TEACHING AND ASSESSING CAD USING ONLINE DEMONSTRATIONS

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ABSTRACT
This study introduces and evaluates a new method for teaching Computer Aided Design (CAD), to complement existing teaching and learning methods. It also introduces a novel method of assessment of CAD knowledge, whereby students themselves generate an online demonstration, talking through their approaches and techniques to develop a CAD model of their own. The rationale was to present a clear means of assessing student understanding, to encourage the students to apply their skills to their own design work and to create a community of learning where students share ideas, tips, and experiences and can learn from each other. Camtasia Studio 5 was used to capture video demonstrations of Rhinoceros 3.0 and Solidworks 2007 3D modelling. This was done by the tutor to complement traditional teaching methods and by students as an assessed activity. Various technical guidelines for the videos were provided for resolution, window size, verbal presentation tips and microphone settings. Recommendations on structure, discursive points, suitable content and alternative approaches were also made. Students responded well to the relaxed nature of the tutor demonstrations, accepting reasonable mistakes and appreciating the ability to be creative in their own work. This helped to overcome the initial fear of a live recording. The communal learning approach also provided a means to improve students' attention to detail and their critical evaluation of different modelling approaches.

Keywords: Computer Aided Design (CAD), Camtasia, video, assessment

1 INTRODUCTION

Students learn in a variety of styles, from activists to reflectors to theorists to active experimenters [1]. As teachers we have a responsibility to accommodate as many of these styles in our delivery and assessment as possible. In some cases only a limited number of these styles are being accommodated. Furthermore, traditional CAD teaching methods can be prescriptive and superficial, with little application in the context of the design process [2].

With the growing trend in use of social networking and online streaming of video content, there is an opportunity to widen the scope of teaching to accommodate a more diverse range of students without a major shift in paradigm. Recent developments in software and hardware open up the possibility for academics to record their teaching material diversifying it to a wider, potentially more demanding audience. Camtasia Studio 5 is a relatively user-friendly software which can capture both lecture material in the form of slideshows and software demonstrations including audio. With relatively

little training traditional teaching material can be turned into re-usable and interactive online learning material which can complement traditional teaching strategies at a relatively low time-cost to academics.

Using video recording software can also be a useful means to assess processes and techniques for students using software. An example of this is asking students to generate online videos demonstrating the use of software to develop CAD models or using particular features in the program. This form of assessment provides teachers with much more detail than a portfolio of finished models which may look polished and complete, but give little insight into the processes involved. The end result allows little opportunity to give feedback on the technique, approach and range of features used. By having a step through demonstration of how models are generated, teachers receive a valuable insight into how students approach the problem and the depth and breadth of their knowledge in CAD techniques and the software used. Furthermore, a database of student demonstrations encourages a community approach in learning CAD, where students can learn from the dead ends, tips, tricks and approaches of their peers.

The aims of this study were as follows:

- To investigate the effectiveness of and student responses to a database of online demonstrations.
- To investigate the value of and student responses to a new form of assessment where students generate and share software demonstrations online.

2 RESEARCH CONTEXT

Traditional approaches to teaching and learning computer aided design (CAD) and particular software packages have made use of a combination of techniques including live demonstrations, printed and online tutorial guides and text book activities. Although effective in small classes, and when students have similar backgrounds these methods tend to be less effective in larger classes, where students may not be able to follow demonstrations on their own and may become isolated or intimidated. They may also be considered too prescriptive. This in turn results in a superficial learning approach and poor ability to apply this knowledge to relevant design contexts. Students "want to obtain knowledge and skills that are most practical and useful to them when they become engineers" [2].

In a survey of industrial practitioners only 8% of participants think that current CAD education is adequate [2]. "Some colleges are still just teaching students simple 2D drawing skills…even though some colleges have switched to 3D packages, the syllabus they present to students is not comprehensive and systematic" [2]. One of the real issues is ensuring that students receive an education in this area, rather than simply training. "Students came out of the class with the knowledge of what buttons to push, but not how to use the CAD software to enhance the design process, and with very little knowledge of how CAD works" [2]. Put simply, they want to learn in context.

As a result of the survey, Ye et al (2004) summarises that the following are important in CAD education [2]:

- The ability to formulate the engineering problems
- The ability to use a computer in solving engineering problems
- A good understanding of the design process and product lifecycle management
- Practice: the most important thing for CAD.

It has also been suggested that CAD training should include exercises in modular design, using CAD within a team environment, project management and on

understanding important generic issues in CAD. “Training should provide more than the picks and clicks of specific software packages” [3]. How true!

3 PUBLISHING ONLINE DEMONSTRATIONS

Recent attention to re-usable learning objects (RLO’s), online access to teaching material (e.g. Blackboard), shared networks (e.g. You-Tube) and readily available screen capture software (e.g. Camtasia Studio) lends itself to a complementary method of teaching CAD. This method involves recorded demonstrations with voiceovers that are easily accessible online for students who miss lectures or may miss detail in lectures, who may require extra support with their learning. Software companies are trying this approach to develop online demonstrations that are by no means comprehensive. Most of the material that is available through social network sites (e.g. You-Tube) and company Websites is at best superficial and piecemeal. A new user to the software will gain little from these sites apart from an appreciation for the capacity for the software, with a limited coverage of instructional methods or critical awareness of the software and limitations.

Teaching material that is recorded live in a lesson and uploaded to an online database fundamentally gives flexibility and freedom to students such that they have access to taught material in their own time and from remote locations. If students feel that this complements rather than supplements such delivery methods then this is a good thing.

This approach can also save teachers time. As with any software, students develop skills and understand tools or features differently and often need reinforcing or a repeated demonstration. This online database allows teachers to be more strategic in how they spend their contact time with students. This study was concerned with using the Camtasia software to generate a database of online demonstrations based on live experiences in a first year module called Communications 1, a compulsory year-long module for students within the product design portfolio at the University of Brighton. In the 2007-08 academic year there were 35 students in this module. Half of the module is not CAD, while the other is entirely CAD based and these halves are run in parallel throughout the year. A series of demonstrations were recorded at the beginning of the module to introduce the students to Rhinoceros 3.0 software. Examples of these include a recorded lecture introducing the package, creating a basic castle with general introduction, creating a flashlight using basic solid and surface features and calculating volume and surface area of a model.

4 ASSESSING STUDENTS WITH ONLINE DEMONSTRATIONS

In previous years, this half of the Communications 1 module only involved two types of assessment: the group presentation/report and the individual portfolio of CAD work. In 2007-08 however, students were also required to produce an online demonstration of a Rhinoceros model and a Solidworks model. The rationale for this was based on the limited information that could be gathered from a CAD portfolio: how was it created? was this approach correct? could it be created more efficiently? was it even the work of that student? Although most of these issues could be addressed by getting the student to state their approach and by working closely with the students on their CAD work, much more detailed information could be gathered by getting students to produce their own online demonstration. Furthermore, it was reasoned that if students were able to share and discuss their demonstrations, then they would be able to learn from each other as well as the teacher. Students were shown how to use the software and were introduced to the online tutorials provided by the software developers. Students were required to

submit their demonstrations to the online discussion board on Studentcentral (Blackboard). Guidelines were given (similar to the ones used by the teacher above) for preparing (planning, rehearsing), editing (mistakes are acceptable but no swearing) and producing (file type, size, resolution, frame rate) the videos. This facility allowed students to comment on each others work and staff were able to provide feedback and grade the work.

After a slow response students engaged with the assessment well and produced some informative demonstrations. In fact, the demonstrations gave such an insight into the approaches, tools used and limitations to the students work that it was valuable opportunity to provide feedback. It was often the case that students were able to demonstrate a new feature that proved useful to them but hadn't been covered in class. They were pleased to be promoting the use of these to their peers, and this provided an obvious sense of satisfaction. The assessment was particularly timely for students, since they were in the process of developing their portfolios and this feedback could be directly implemented in their modelling, and also since they could gauge where other students were at in their understanding of the package. They were then ultimately exposed to a variety of new techniques, tools and approaches and information on these could be accessed at any time. A rich variety of student work included a glossy finish to a fully packaged frisbee with labels, a set of lit traffic lights, a toy robot and the application of light types. The criteria for this assessment included 1) clarity and coherence of voiceover, 2) clarity of presentation structure, and 3) level of detail in demonstration. These were chosen to ensure students paid attention to how they communicated themselves and their work and how they structured and prepared their presentation. It also placed an emphasis on their critical awareness of the package, in terms of options available, alternative approaches and limitations of various tools.

5 FEEDBACK FROM STUDENTS

A questionnaire was given in class after the assessment of student demonstrations where 27 students were present. This was designed to gain an insight into how students perceived the role of the online demonstrations alongside the written tutorials, the live demonstrations in class by the tutor and those uploaded by other students. 96% of students rated the online demonstrations by the tutor in the top 3 (of 4) most helpful for learning Rhinoceros, while 74% of students rated the online demonstrations by other students in the top 3 (of 4) most helpful for learning Rhinoceros. When prompted for an explanation, the following comments provide a cross section of responses:

- "Although the written tutorials are good, it's better to be talked through it"
- "Written tutorials are good to start but demonstrations are better later on"
- "Written tutorials were difficult to follow, unlike live demonstrations as you can ask questions"

When asked whether the online demonstrations (by the tutor) should complement or replace the written tutorials, students voted:

- Complement: 85%
- Replace: 15%.

When asked whether online demonstrations (by the tutor) should complement or supplement the live demonstrations (by the tutor), 100% of the respondents voted for complement. When asked whether or not the shared online demonstrations promoted a

community of learning, 85% of students agreed or strongly agreed with this statement. On this issue students made comments such as:

- "It allowed us to see what others have done and then use that information to enhance your work"
- "It's good to see something done from other people's perspectives and their methods"
- "There was a sense of trying to reach the same level as other students"

When asked *What do you feel you've learned by generating an online demonstration?* Students responded with:

- "How to help others in a structured, inventive, friendly process"
- "How to use Rhino more effectively and quickly"
- "A more efficient way of submitting work"
- "Presentation (public speaking) skills"
- "There is still so much to learn"

When asked if the online demonstrations by the tutor are necessary, 85% of students said that they were, while 15% said that they were not.
Explanations for this included:

- "Because some people don't get it during the lecture and they can go through the online lecture as much as they want until they do understand"
- "Because they help you to progress"
- "Not necessary, but helpful"

And finally, when asked what could be improved in the module, the majority of responses indicated that more online demonstrations would be helpful.

6 DISCUSSION

It has been suggested that education driven research often leads to new insights, as well as to improved teaching [4, 5]. The fundamental premise for this study was to introduce and evaluate the use of online demonstrations in teaching and assessing student CAD work with the aim of improving the student learning experience. It is believed that overall students responded well to both online demonstrations and that this enabled them to develop skills more efficiently and more interactively with other students and with the teacher. A positive outcome from the questionnaire was that none of these students felt that online demonstrations should supplement the live equivalent, and reasons for this were mostly that they were able to ask questions. Whether or not students will respond in the same way should the online demonstrations be more interactive or should the novelty of this exercise wear off remains to be seen. It is doubtful, however that this would be the case, especially for first year students and since the classes themselves were interactive with student activities rather than being delivered as a straight lecture. Having easily accessible and hence easily sharable material available to students can potentially leave teachers vulnerable to intense scrutiny and may be shared outside of the context of the institution leading to intellectual property issues. However, with careful planning of material and since students themselves are developing online demonstrations, it is thought that they may take more responsibility and ownership with how they respond to this activity. Students who for reasons of illness, disability or a difficultly in learning CAD progress slower than others in the group may become isolated as a result of such an activity. This was

highlighted by a number of comments which may have been flippant or intentional but they did highlight that students may feel more despondent as a result of this activity. Regardless, it is an issue worth addressing by teaching in a responsive and supporting manner, working closely with students.

7 CONCLUSIONS

Clearly in this instance the online demonstrations were a novelty for students and they responded well to those made available online by the teacher and other students. It was generally felt that these demonstrations added value to the traditional teaching methods of live demonstrations and written tutorials and possibly enhanced the students' learning experience since they were able to gauge their progress against that of others and could learn something in doing so. It is believed the teacher and peer demonstrations also allowed the students to progress faster and with more insight into approaches, techniques and tools available in these packages. One danger to beware of is the isolation of students who for one reason or another fail to progress at the same rate as others. Further work in this area includes the development of the database to include further demonstrations that are specific for features, tools, software limitations and troubleshooting. Interactive demonstrations with prompted questions and feedback are also planned for the CAD software. A formal peer assessment process is suggested rather than the informal method currently in use. This will allow students to provide more detailed feedback to their peers, rather than simply patting them on the back.

REFERENCES

[1] Kolb, D. *Experiential Learning.* (N.J., Prentice-Hall., 1984).

[2] Ye, X., Peng, W., Chen, Z. and Cai, Y. Today's students, tomorrow's engineers: an industrial perspective on CAD education. *Computer-Aided Design*, 2004, 36, 1451-1460.

[3] Field, D. Education and training for CAD in the auto industry. *Computer-Aided Design*, 2004, 36, 1431-1437.

[4] Sapidis, N. and Kim, M. Editorial to special issues: CAD education. *Computer-Aided Design*, 2004, 36, 1429-1430.

[5] Rossignac, J. Education-driven research in CAD. *Computer-Aided Design*, 2004, 36, 1461-1469.

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