Quasi Interactive Video Production as a Teaching, Marketing and Retention Tool

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Abstract

The School of Electrical and Computer Engineering (SECE) at the Royal Melbourne Institute of Technology (RMIT) has always had a strong focus on providing a practical "hands on" approach to education, producing graduates who are immediately of value in the workplace and thus attractive to employers. SECE has also focused heavily on making teaching as effective as possible, using a variety of means to deliver the message, thus ensuring that students enjoy the process of learning and develop a life long love of the subject matter.

This paper focuses on what has been determined to be a very effective teaching and learning tool – quasi interactive videos.

In the first half of 2002, fourteen hours of quasi interactive video were produced by the author for a first year electronics course and this material has been used for the last three academic years with great success.

This paper discusses the rationale for production of the videos, how they were produced and the resulting structure. It outlines how the material is accessed online and how it has been used in the first year electronics course. It also discusses the effectiveness of the videos as a teaching tool for all students, but particularly freshmen and the international cohort. The potential for use in distance education and for marketing and retention is also considered. Finally the future direction of video production at RMIT is discussed, which the author passionately believes could transform university education, especially in first and second year.

Introduction

RMIT's Teaching and Learning Strategy sets directions for the development of teaching and learning at RMIT and the Teaching and Learning Group works with schools on course renewal and on developing effective teaching and learning tools. As part of this process, the author was approached in 2002 to produce some material that would capture his particular teaching style while also updating and documenting the content of Electronics 1, a first year course. The Teaching and Learning Group had in mind a written format. However with a strong background in video production, and a vision shared with others such as D.A. Rodgers [1] regarding the ability of video to enhance the learning experience, the author felt that video was an appropriate medium. This was reinforced by previous experience using video material produced by third parties [2] to take students on a virtual tour of silicon foundries and also by producing videos for PSpice instruction.

Many students today are very visual and prefer to view material rather than read it and the intention was that although the new material to be produced could be used for distance learning and other purposes, it was initially to be a supplement to existing course material.

The focus of the author, both at RMIT University and while teaching at institutions in the United States, has always been on good teaching. The author believes that the ability to teach well and thus to excite students about the process of learning and about the subject matter is a critical skill worthy of considerable attention. The author is recognized for this and has won a number of teaching awards, both at RMIT and previous institutions.

The author's teaching style is very interactive and even in large lectures, where the majority of first year courses have in excess of 200 students, an integral part of lecturing is walking about the lecture theatre, posing questions to the students, engaging them in the subject matter, encouraging their questions and answering them. Although PowerPoint slides are very popular and a very valuable teaching aid in many situations, the author's preference is generally to write on a white board when discussing problems, engaging students in the process of finding the correct solution -   thinking the issues through together, keeping the students' minds at the tip of the white board marker.

It is this teaching style that the author wanted to capture in the video productions – the ability to make the students viewing the material feel as engaged in the learning process as students in the lecture theatre. Therefore the videos had to be quasi interactive.

Planning and Production

Considerable time was initially spent thinking about how to make the videos as effective as possible, with the conclusion reached that simply filming the lecture classes would not be appropriate. Many people have filmed/taped their lectures and made them available to students and while there is some benefit in doing this, the material is often too long and boring because it is not focused for the viewing audience.

It is essential that the videos are fit for purpose, produced specifically for and tailored to the intended audience. A good presenter is also essential [3]. In addition, the structure of the video productions is a very important consideration and segmenting the material to be covered into blocks seemed appropriate for a number of reasons discussed later.

Structure
The semester consists of 13 weeks and it was planned to have approximately one hour of video material for each week, which was divided into several blocks or segments, each 15 to 20 minutes long. The format for each segment varies but for new material is generally as follows:

The lecturer (the author)

- introduces the theory for a particular topic;
- works an example problem with the students;
- provides the students with another problem; and

- suggests that the students take a break, discuss the problem with other students and try to work this problem through by themselves.

The next segment in respect of new material would then consist of the lecturer working through the new problem with the students and it is this overall format that in part helps to provide the impression of interactivity between lecturer and students. This is also fostered by the style of lecturing - the fact that the lecturer is addressing the students on the video as if they were in the same room.

The Electronics course covered the following material:

Diodes - diode characteristics, diode circuits, half and full wave rectifiers, clipper and clamper circuits, Zener diodes and LEDs;

Bipolar Transistors - transistor characteristics, DC analysis and biasing circuits, AC analysis of various amplifying circuits, calculation of Voltage Gain, Current Gain, Input Resistance;

Operational Amplifiers - open loop characteristics and applications, closed loop amplifier configurations including inverting, non-inverting, voltage followers, summation amps, subtracting amplifiers, multistage amplifiers, differential amplifiers, and Schmitt Triggers;

Digital Design - number systems, logic functions, Boolean algebra, Kmaps, combinational circuits and sequential circuits with a major focus on the design of state machines.

Producing the footage
In the actual filming process careful consideration had to be given to camera position, lighting and backdrops and the author set up a dedicated area for the filming process. Each video was scripted but it was important that a natural and interactive feel to the presentation was achieved. Consequently each presentation had to be rehearsed, modified and re-rehearsed to produce a workable format. Cue cards were used where appropriate but always out of view of the camera. It took approximately two days to produce what would ultimately be one hour of video.

The videos were taped using a Sony single CCD digital video camera in DV format, loaded onto a PC in DV format and then compressed to MPEG1 so that they could reside on the University's streaming server. New videos are currently being produced using a Sony PDX10 professional video camera.

Camera Position
Several different camera positions were used to create interest and variety. Head and shoulders shots of the author were utilized in introducing a topic, close up shots were used for practical demonstrations and a document mode was employed when filming problems being worked.

Lighting

Lighting is a very important consideration in video production, as outlined by Long and Schenk [4], especially in relation to the writing. White boards are not effective as there is too much reflection and when using paper it is important to remove as much of the shadow of the hand as possible so as to clearly see what is being written.

Lighting was also used to give a three dimensional effect, three different lights being used to achieve this:
- Key Light is the strong dominant light;
- Fill Light is used to fill in the strong shadows created by the key light; and.
- Back light helps to separate the background from the subject.

Backdrops /Location scenes

A variety of backdrops were used for inside shots to provide variety and add interest and to create the impression of a roving as opposed to static position lecturer.

Location scenes were also used to create interest and to introduce real world examples for the students to relate to. A Melbourne electric train scene was used as the introduction to state machines, with a view to considering how to design an automatic train. A car scene was used to introduce operational amplifiers in terms of controlling electric cooling fans and also to introduce digital design in terms of designing car alarms.

Editing

Editing allows for a more professional production via the insertion of titles and transitions. It also means that the material does not necessarily need to be filmed in sequence and permits the addition and deletion of sections as needed to provide a smooth and coherent flow of information to the audience.

The first videos produced were filmed in sequence without benefit of editing, but subsequent work is being edited using various professional non linear editing packages. Future work will also utilize Pinnacle Studio 9 Plus software.

Access and use in Electronics 1

Electronics 1 is typically a very large first year class with a relatively high proportion of international students. The transition from high school to university can be overwhelming and new tertiary students often face many difficulties. High schools in Australia typically prepare students for tertiary education with widely divergent degrees of success and the relative freedom of the university environment is often not balanced by the realization of the importance of and the ability on the part of students to study independently. Hence a number of students typically drop out of this and other first year classes, partly because they are unable to follow all aspects of a lecture and are thus ill prepared for the next one, which quickly has a cumulative effect. International students can face the additional problems of adjusting to a new culture and in many cases to a non-native language, which can significantly compound their difficulties, making it harder to keep up.

The author believes that the videos as described in this paper are a significant help to overcoming many of the difficulties outlined. By using the videos as a supplement to lectures and tutorials, those students who may be experiencing difficulties with any aspect of the subject, for any number of reasons, can go over the material between lectures as many times as required to gain a full understanding of it and thus be well prepared for the next lecture.

The first two videos were produced by the 26th of July 2002 and were made available to students in the Electronics 1 course, which the author was teaching in second semester. As new videos were produced they were made available to the class, thus providing an opportunity for valuable feedback which could be quickly incorporated into subsequent productions.

Blackboard, which is a networked learning environment and part of RMIT's Learning Hub, provides access to the University's streaming server.   It is a tool used for on-line teaching and providing access to course material, including lecture notes, problem sets incorporating worked problems, laboratory assignments and learning guides.   Any student or lecturer can view instructional content, collaborate with other educators, evaluate academic performance and access learning resources, via this tool.

The video material produced is divided up on a weekly basis and an example is shown below:

Week 5 Material

Video 5 – Operational Amplifiers
This video introduces Operational Amplifiers. It is divided into five parts. Review a   part, then take a break and discuss with other students and/or your tutor. When you are ready move to the next part.

Part 1
Introduction to Op-Amps – Open loop mode

Part 2
Car cooling fan example. Closed loop non inverting amp

Part 3
Inverting amp, summation amp, voltage follower, input resistance

Part 4
Amplifier problem

Part 5
Amplifier problems continued

Effectiveness as a Teaching Tool

Feedback from the Teaching and Learning Group was very positive even though video was not initially their medium of choice. Comments from colleagues both at RMIT and other Australian institutions were also extremely positive about the value of this material as a teaching tool and about its potential for use in other arenas. Dr. Peter O'Shea at the Queens University of Technology is also producing video material with very positive results and had access, via Blackboard, to the author's material for sharing and evaluation purposes.

Although feedback from colleagues is very important, the author considers student feedback to be the most important. After the first complete academic year of using the video material in Electronics 1 a survey was undertaken of all students enrolled in the subject. 87% of students rated the videos as being effective as a teaching tool, with 62% of this number considering them to be very effective. In response to a question about the use of videos in other courses, 98% of students were in favor of this. In the most recent survey, 94% of students enrolled indicated that the videos were effective in explaining the subject matter with 70% of this number considering them to be very effective. 92% of students surveyed wanted to see videos introduced into other courses. Students' comments throughout each academic year had also been very encouraging but it was valuable to have this confirmed by survey results.

The only real negative comment received from students about this work related to the difficulties they experienced from time to time in accessing the material via Blackboard and the fact that the videos could not be viewed from home without Broadband. There were a number of hurdles to overcome in making the video material available in alternative formats but in response to student concerns, the videos are now available on CD.

In terms of student grades, there are many variables which make it hard to actually quantify but overall performance in Electronics 1 has improved over the last three course offerings, with over 50% of students achieving a grade of A or B in 2004 as compared to 35% - 40% achieving the same grades prior to the introduction of the videos. Other institutions have shown a significant improvement in academic performance from using video instruction, as outlined by Canelos and Catchen [5].

In terms of retention, there are no accurate statistics available and this is difficult to measure because students drop courses for a variety of reasons and there are a number of required first year foundation courses. However, the drop rate in Electronics 1 is lower than previously and lower than that in equivalent first year subjects which are not supplemented by video production.

Potential for other Uses

As previously discussed, the video material for Electronics 1 was produced primarily as a supplement to the existing course format, with the intention of assisting the transition of first year students and increasing retention rates as well as developing in students a greater love of the subject matter through a deeper understanding. There are, however, a number of other opportunities for utilizing video production, including distance education, off shore delivery,

production and sale of short courses to industry and others, and the potential for this material to be shared with other institutions, particularly since it is modularized.

As Australian universities move into an environment of decreased government funding, there is a need for institutions to differentiate themselves and to generate increased external income. The ability to attract international students and full fee paying domestic students is critical to success in this environment, as is the ability to generate income from short courses, grants and other sources. The production of good quality quasi interactive videos material has the potential to significantly contribute to marketing strategies in these targeted areas.

Distance Education
The vastness of Australia as compared to its sparse population makes the concept of distance education a very necessary and valid one and if material is available which offers the long distance student a majority of the advantages available to students actually attending a university, this is an obvious plus. The quasi interactive nature of these videos makes them attractive for this purpose and provides an opportunity to extend the boundaries of knowledge beyond the walls of tertiary institutions.

Off Shore Delivery
RMIT University currently has a campus in Vietnam and is building another campus there to increase its educational offerings and presence in that country. RMIT also has partnership arrangements in a number of other countries whereby courses are taught and RMIT degrees are awarded. Quasi interactive video material has an obvious advantage in such situations, providing equal educational access to off shore students, perhaps under the guidance of a local teacher who can provide the cultural context and respond to issues arising.

Short Courses to Industry
The author is currently producing video footage of a short course designed specifically for sale to third parties and this is an obvious opportunity for the University to generate funds in what has become a very financially constrained environment. The Head of School, who is lecturing in this course is very excited about the medium of video and sees considerable potential in exploiting this opportunity.

Sharing the Resource
The fact that this video material is modularized means that another institution may be able to benefit from some of this work, while not needing the complete package. Modules on diodes, for example or Boolean algebra may fit well into another institution's program, whereas other modules might be of limited value. The opportunity to share resources in financially constrained times, or to generate income from this work is an attractive opportunity.

The Future of Video Production at RMIT University

The 14 hours of video for Electronics 1was both taught and filmed by the author. There are therefore opportunities for other courses taught by the author to be made available to students in a video format.

In 2006 a new program structure will be introduced, which will involve moving the analog material in Electronics 1 from first to second year and expanding it. The digital material will be retained in first year with modifications. Since the existing video material is modularized, much of it can still be used in these two separate courses. There will, however, be the need for supplementary video material to be produced. DC Circuits, which will continue to be taught in first year, will also be made available on video for 2006.

Another project to be undertaken in 2005 for use in 2006 is the development of video for laboratory classes in DC Circuits, Digital and Electronics 1. Labs traditionally have suffered from tremendous variability of instruction because the tutors are usually graduate students. The proposed videos will not only assist students but will also be very valuable for preparing the lab tutors and thus enabling a consistent quality of teaching in the labs. [6] [7]

There are also numerous opportunities for courses taught by others to be captured on tape and some work of this type has already begun. One issue becomes immediately apparent, however, when attempting to video other lecturers and this is the fact that not all presenters are equally good in front of a camera. Although good lecturing technique is always important, a live presentation to a class of students can absorb far more errors in delivery than can a video taped presentation. A certain amount of experience is required to deliver a good video taped presentation and huge amounts of time can be consumed in providing direction and in takes and retakes, sometimes with the conclusion that a particular presenter should only focus on live delivery.

All videos to date have been made available in MPEG 1 format to conserve space on the University's streaming server. However, the intention is that future work will be made available in MPEG 2 format on DVDs.

The use of videos as a marketing tool has tremendous potential and the intention is to promote the School's programs on the basis that some courses are available on video and therefore if a lecture is missed, if the student does not completely understand the material, if there are language difficulties or any other impediments to learning, good quality, quasi interactive video material is available to assist the students.

Conclusion

The realization of the synergies between two passions, that of teaching and that of video production has presented an exciting opportunity for the author. It also presents an exciting opportunity for the School of Electrical and Computer Engineering at RMIT both in terms of attracting students, particularly full fee paying students, to the program and retaining them and in terms of enhancing its reputation by doing so and by producing graduates who are confident, capable and not only pass but pass well.

A good presenter is critical, as is the experience and ability to produce a quality product, but given these, the potential for quasi interactive video production in the educational arena is, in the author's opinion, almost limitless.

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Biographical Information

Peter C. M. Burton is Senior Lecturer in the School of Electrical and Computer Engineering at RMIT. He has also taught extensively and worked in the microelectronics industry in the United States. A background and strong interest in video production, coupled with an appreciation of difficulties faced by some first year tertiary students has been the impetus for this current work.