A Research-Led Curriculum in Multimedia: Learning about Convergence

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ABSTRACT

Traditional teaching methods have acknowledged limitations. Lectures may be used to transmit information efficiently, but often fail to motivate students to engage with the subject. Coursework assessments and examinations may lack authenticity and thus fail to help students develop 'real world' skills even though they ensure technical competence.

This paper presents a teaching innovation motivated from a social constructivist perspective whereby undergraduates researched, reviewed, and presented their papers at a one day conference, by way of preparing for a written examination.

The paper presents theory supporting this change, our experiences from running the course, and improvements in learning we observed. We identify the value of undergraduate conferences beyond serving as a vehicle for communication skills. We identify an approach which engages learners and realizes higher level learning objectives by using authentic activities. The process has identified a 'research-led' approach which clarifies the similarity between research processes and effective independent learning strategies and is valued by students, faculty and stakeholders alike.

Categories and Subject Descriptors

K.3.2 [**Computer and Information Science Education**]: Computer science education – Curriculum.

General Terms

Human Factors.

Keywords

Research-led teaching, Student Engagement, Multimedia

1. INTRODUCTION

Electronics and Computer Science (ECS) at the University of Southampton is a leading UK school in this area. It has particular strengths in Multimedia research, evidenced by the IAM (Intelligence Agents Multimedia) research group which at last count consisted of about 150 researchers. We believe Multimedia in the undergraduate curriculum should clearly articulate the similarity between research processes and effective learning. It should also be inspiring for the students, enabling them to develop and demonstrate high order skills.

This paper tracks the evolution of our third-year one-semester elective course in Multimedia Systems from one focused on content and recall towards one which incorporates authentic learning and a pedagogy of engagement. The possible strengths of an undergraduate conference as a means of developing communications skills [1-4] have been noted. It was our intention to extend this approach to develop the students' capacity for independent learning in the subject domain.

The course is currently in its fourth incarnation. In the late 1980's the first version largely studied Multimedia Authoring, associated tools and technologies.

The next version had a more technical perspective, focusing on storage, networking and compression; emerging technologies and an investigation of what might be possible in an evolving world. This version was popular with students as they felt they learned a lot. However, faculty believed that, although it was leading edge, it did not correspond to our research strengths or the breadth of topics appropriate to a Multimedia curriculum.

The third version addressed perceived weaknesses, providing a series of 'guest lectures' delivered by our researchers and any visiting luminaries. It was knitted together by the course leader who also set a small authoring coursework and a final examination. Students were less happy with this version. Their feedback indicated an unclear understanding of the syllabus and belief that the course teaching had not prepared them for the examination. Since the examination was used as the primary means by which students demonstrated their acquisition of higher level skills the course team agreed that some revision of the approach might to be appropriate.

The authors became responsible for Multimedia Systems in 2000, and decided to radically revise its structure. We agreed with the previous course leaders' views that a research-led approach was important. Our understanding of 'research-led' was being refined and The Boyer Report's observation that courses such as this "should be the culmination of the inquiry-based learning of earlier course work, broadening, deepening, and integrating the total experience of the major" [5] p28 ideally matched our thinking. We also believed that the syllabus should reflect the breadth of the subject as researched at Southampton and elsewhere.

Analysis of teaching and assessment methods of our CS degree had suggested it might be appropriate to make changes in some of

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our educational approaches; a recent survey had suggested that a significant percentage of coursework assessments could be characterized by *'I have taught you a concept – now write me a program to demonstrate that you understand this concept'*. We had become concerned that whilst we were graduating excellent technical computer scientists, some had less well developed 'real world' skills. This was not surprising given the observation that learners' understanding of the curriculum can be largely derived from their experience of the assessment [6]. The importance of developing and integrating academic, technical and intellectual skills and the imperative to incorporate them into the broader CS curriculum is well understood [7-9], and the authors, having some responsibility for the overall curriculum as well as for the design of this course, wished to make changes to address this wider goal.

In summary our objectives were to reduce the emphasis on the 'content' of the syllabus and emphasize the value of the processes of learning as undertaken by researchers. We began from the premise that the content of multimedia is largely determined by the convergence of existing technologies. Our students come to our Multimedia Systems course after two years of intensive study of existing technologies and are therefore already well-equipped to understand the content of Multimedia Systems.

Our faculty who contribute to this course as lecturers are all successful researchers and we were inviting our undergraduate students to perform tasks which reflected the ways in which researchers go about learning. In changing the tasks and assessments we were inviting students to model their learning on the common behaviors of successful academics.

We wanted a course which would be motivational and good fun, since we understood that our computer science students might be uncomfortable with collaboration, discussion, writing, and peer review, and that workloads and pressure to achieve high marks in the final year can be intense. Study activities were to be more interactive than is common across the rest of our degree, students would be given a structured introduction to the processes of research through an entire life cycle of identifying, researching and writing, reviewing, revising and presenting. It was important that the tasks should be 'authentic' [10] and 'situated' [11] in contexts that students might recognize in their future work or educational careers.

We realize that few students could conduct real research in such a limited timescale. However their tasks reflected the processes which researchers undertake and would be sufficient to demonstrate attainment of Bloom's [12] higher level skills of design, evaluation and synthesis. From the perspective of Biggs' SOLO Taxonomy the curriculum objectives fall into the qualitative range of relational and extended abstract and the outcome from a both the students' and the teachers' perspectives was intended to be what Biggs would describe as an 'aligned curriculum' [13]. The coursework component of the course would be changed; three courseworks would be introduced, evaluating stages in the research paper life cycle. An open booklet examination would be used to evaluate learning, with the change in mode designed to defuse anxiety generated by the change of focus from content to process.

2. THE INTERVENTION

In this section we describe the course process in some detail, as summarized in Table 1, Section three discusses and evaluates the results of our intervention and in the conclusions we examine the extent to which our objectives have been met.

Since 2000, student participation in the Multimedia Systems has been preparation for participation in a one day student research conference. Undergraduate conferences are not new although there are only a few examples in which all students on a given course prepare for a full conference. It is common practice in CS to assess capstone courses by poster sessions see for example [14]. As noted above, conferences have been used in the CS curriculum to address communication skills.

Our model differs in that learning is also assessed via an open booklet examination which covers the whole spectrum of multimedia topics. The conference is held one week before the examinations begin. Students work independently preparing for the conference and also for their final examination.

The course is one semester long and weighted as one twelfth of an annual student workload. It has two timetabled lectures each week, and since it is also studied by part-time students, lectures occur consecutively on the same day. We are aware that 'talking at' students for almost two hours does not support student attention, concentration or learning, so we incorporated a variety of tasks and activities into our course design.

In the first week of term the students are given an overview of the breath of multimedia within the confines of this course. They are given examples of good paper titles and abstracts written by previous students. Small group work enables students to explore possible topic areas. They have two weeks to choose a subject area and to select the sort of paper they will write. They are encouraged work collaboratively on early research, and to submit information of topics and sources to our student wiki. However it is emphasized that the final paper must be all their own work. Suggested paper types include

- Review (explain the requirements and specifications of a recent technology (e.g. Bluetooth) and evaluate current implementations);
- Experiences (e.g. using leading edge software, equipment, protocols etc);
- Research issues (e.g. what research issues are being addressed by the e-learning community?);
- Overview (review and evaluate current and emerging technologies and research (e.g. in Medical Imaging);
- Comparison (e.g. Compare DivX with WMV);
- Social Implications (e.g. How does the literature suggest the world will change as computers become pervasive).

They are given support to produce their proposals. There is an emphasis on producing proposals that will enable them to write papers demonstrating evaluative and analytic skills rather than producing (or re-producing) factual technical reports. Students receive immediate feedback on the suitability of their proposals, maybe suggesting changes that will help them to produce better papers.

They have four weeks to research and produce their first draft. During this period we split our lectures into two streams – the first lecture/activity will be (just in time) about process– how to research for a paper, how to write a paper, how to review a paper etc., and the second is a seminar series given by guest lectures, and

the titles of the guest lectures in the most recent course can be seen in Table 1.

At the same time as this we invite the students to form a Conference Committee who will hold regular meetings to organize the conference day and the programme, as well as seeking sponsorship and outside participation.

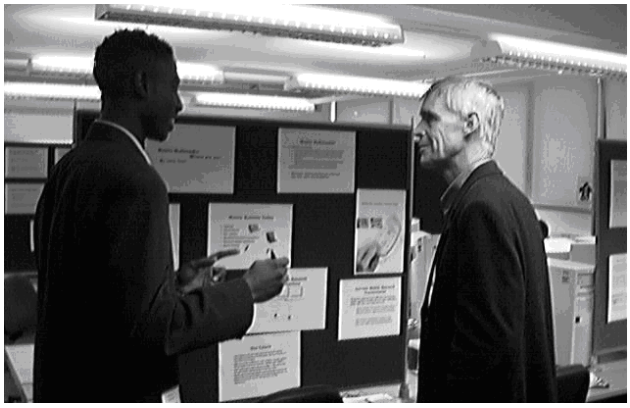

Figure 1: A Student Explains his Poster to a Visitor

Once the papers have to be received they are immediately allocated anonymously to reviewers (each paper gets five reviews and each student carries out five reviews). Authors can indicate whether they would wish to present their paper as a 'full paper', as a poster or as a poster/demo at the conference. Two weeks later the students have completed their reviews, and the conference committee uses the information to organize a program, allocating parallel presentation sessions and identifying those they would like to see as posters and demos.

Meanwhile the anonymous reviews are returned to the authors who have one week in which to make any final revisions before the paper (now with their name) is placed on the conference web site in time for the Christmas Vacation. The conference, held on the first Saturday of the new term, is opened and closed by invited keynote speakers. Two parallel sessions of paper presentations are broken by poster/demo sessions. A typical programme can be seen by visiting:
http://mms.ecs.soton.ac.uk/mms2002/.

The Conference Committee run the day, inviting volunteers from the second year to help with the organization of registration, meals etc. The day finishes with a sponsored best paper/poster prizegiving at a drinks and snacks reception.

Figure 2: Brian Holloway from IBM Presenting the Best Paper Prize

The examination period begins shortly after the conference. We work hard to communicate to the students how we expect them to learn from the conference, and the first question in the examination is a structured trip report. Students are allowed to take a short set of notes into the examination. Overall marks for the course are derived 50% from the examination, 30% from our marks for the paper, 10% from their contribution to the reviewing process and 10% from their paper presentation at the conference

Clearly the process is highly time sensitive. Students must submit on time and staff must organize allocations and feedback on time if the system is to work. There is no room in this timetable for slippage and in cases where students have genuine reasons for lateness staff may need to organize special reviews in order to get them back on schedule.

Table 1: Semester Timetable for the Multimedia Systems course

Week	Deadlines	Feedback	Lecture 1 (Process)	Lecture 2 (Guest)
1			Overview of the Multimedia Domain	How to write a Proposal
2			Proposal surgery (Wiki and Hand-in)	1st Conference Committee meeting
3	Submit Proposal	Proposal Feedback	What is a conference?	"Ubiquitous Computing"
4			Researching and Critical Writing	"Digital Audio Broadcasting"
5			How to Write a Paper	"Information Triage"
6			Paper surgery	"Augmented and Virtual Reality"
7	Submit Paper	Review Allocation	How to Review a Paper	"Learning Technologies"
8			Making revisions/Marking guidelines	"Multimedia and Networking"
9	Submit Paper Reviews	Return reviews	*No Lecture*	*No Lecture*
10	Submit final version of Paper for End of Term	Committee decisions made public	How to Present at a Conference	"Content-Based Retrieval"
	-------	Xmas Vacation	-------	
11	Saturday: Conference		Reflections Session – Exam Prep.	Poster and Presentation Surgery
12			Reflections Session– Exam Prep.	
13/14	Examination Weeks			

3. THE RESULT AND EVALUATION

In general the course has achieved its objectives. The students achieve high standards and have been pleased by their learning, the staff are satisfied that we assess a wider range of skills than previously, and generally the university and employers are positive about this instantiation of research-led learning. Finally the conference has resulted in a constructive experience for everyone involved.

Along the way we have learned a number of lessons, and seen a diverse range of reactions to the course. In this section we examine these experiences from the perspectives of all involved. .

3.1 The Student Perspective

We have conducted the usual post course student surveys, and averages are very much in line with those of other courses the authors have run, but it is interesting is that the standard deviation is wider. Many students were delighted with the course, but a small number were very unhappy. Things that please the students about the course include:

- The experience of the conference itself (mentioned by the majority of students);
- The self guided, open ended nature of the research;
- The feeling that their learning was authentic;
- The teaching they receive on how to research, write papers, review papers, present etc. Although they receive other guidance on these things, the teaching is perfectly situated, answering their needs at the time that they identify them;
- The opportunity to do an extremely good literature survey for their final year individual project;
- The involvement of outsiders in the conference.

On the other hand most students comment on the very high workload on this course (on average they estimate that they dedicate about 40% more time to this module than others), and this workload is at a time when they have some other very important deadlines. Many students feel that the workload would be more reasonable if there was no final examination. We have resisted this change so far, as we do believe that it is the act of preparing for the examination that gives students the motivation they need to focus on learning from the conference and to integrate the diverse skills they are acquiring through the course.

Looking at the comments of the small but important number of students who score this course badly, we see that the main cause is that the students do not believe in or engage with this method of learning; recurring comments showed:

- A belief that the course team were being lazy or abandoning our duty by not presenting content laden lectures;
- A view that we were wasting their time by giving them guest lectures from leading researchers when it was not clear that the content was examinable;
- A belief that they would not learn anything useful by this method; “This is not really learning”;
- A worry about the examination. Without a formal tick list syllabus of content to learn, how could they prepare themselves for the examination?
- A worry about peer evaluation. In spite of the fact that we assure the students that we actually mark their final papers ourselves, some students were unhappy about the value or appropriateness of the peer evaluation of their initial papers.
- Although we do everything we can to diffuse such thinking, and to help them understand the value of different forms of learning, there are always some who disagree.

3.2 The Course Team Perspective

We have observed that there are two aspects of this course that our students often find difficult.

First, we ask the students to propose to write a paper that will demonstrate analysis and critical evaluation. Their initial understanding of the leading edge of research in Multimedia may be fairly limited, so we spend a lot of effort trying to guide them away from looking at magazine reviews of technologies and steering them towards suitable research publications. Until they have read some papers they are not clear how they will demonstrate analysis and critical evaluation. This is hard for them because it differs from their usual experience of being asked to write a program or a factual technical report; the students hear what we are asking them but are not sure how to do it. As a result they tend to gravitate towards proposals for ‘Social Issues’ papers. We use individual feedback on proposals to guide the majority towards more technically analytical approaches to their research. Happily, once involved in research most students understand what is required. A small number of students do not read the suggested literature or choose not to revise their papers after peer review; we always end up with a few papers where critical evaluation is not based on any evidence or references to the literature, typically characterized by ungrounded assertions “What I think is…”.

A second difficulty for many students is how to constructively and critically reviewing their peers’ papers. Peer-review is an important part of our teaching process. Other authors e.g. [15] have commented on the importance of peer-review in helping students to understand and improve the shortcomings in their own work. We dedicate time to show what is expected and give examples of useful reviews, but in spite of this guidance some students find that, having written a good précis of the paper they have read, they are unable to articulate any objective evaluation beyond “this paper is good/bad/boring”. Making constructive criticism is indeed a very high level skill, so it is not surprising that the students find it difficult, but this is all the more reason to persevere with attempting to help them to learn this skill. Having said that, the quality of some of the reviews we see is outstanding.

From the teaching team’s point of view this course was a significant extra effort, and a particular difficulty for us is to find ways of expressing exam questions which will enable students to demonstrate what they have learned from the course and the conference; questions which are too specific may be unfair on students who have concentrated their effort elsewhere, whereas questions that are too open-ended may solicit wooly, unstructured answers. We believe we have improved on this each year, but do not yet have the perfect solution.

3.3 The Stakeholder Perspective

Industry and potential employers have been very supportive, regularly providing both sponsorship money and people to spend their Saturdays engaging with our students’ work. Business and industrial sponsors have often commented on the value they place non technical lead to this course and how pleased they are to help us make this course successful. Students have observed that participation, particularly if they have been part of the conference committee, has been a plus point on their CVs. Maybe co-

incidentally we noted that one sponsor offered employment to the entire conference committee the first year we ran the course! Invited external educationalists who gathered qualitative data commented on the level of engagement which was evidenced during the conference.

From the point of view of our CS degree, we regret that this course is an elective, and as such is attended by less than half the cohort. The School now uses the model of this course for a unit on research methods for students who continue their studies to Master's level, where it has been very successful.

4. CONCLUSIONS

In this paper we have described our conference approach to research-led teaching. We have examined some lessons learned from taking this approach and we have discussed some of the pro's and con's from the viewpoint of the different participants.

The purpose of this educational intervention was to improve the student learning, so we should conclude by summarizing our understanding of this area. Evaluation of the quality of the students' final examination scripts showed in depth understanding of technical issues that was commensurate with students work from previous years. But the learning was clearly different. The students and the stakeholders were clear that the process part of the course was the most valuable. Students had received timely and appropriate advice on how to do those things that they had come to understand were important, namely research, write and present work, and to critically evaluate the work of others. Along the way they had started to cross that divide between the inevitably artificial world of education into the real world, in which their work has a bearing; the act of presenting their work in the conference and discussing it with outsiders from industry and business had helped them understand that this was more than just an academic exercise. Their years of study of a range of technologies converge in this course, as they learn to synthesize their understanding, and move away from a world of passive learning into a space where they learn by constructing knowledge and understanding by interaction with others.

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