

Published: Proc. BCS INSPIRE (International Conference for Process Improvement, Research and Education), Loughborough University, 31<sup>st</sup> March 2015 (UK), "Outlook on Computing Education", eds. M King, R Lock, R Dawson, M Ross, G Staples, J Uhomobhi, ISBN 978-0-9926958-7-3 (2015).

# **Ethical and Professional Issues: Reflections on Course Evolution, Innovation and Student Engagement**

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## **Abstract**

At INSPIRE 2013 we outlined our efforts to develop a core first year undergraduate course entitled 'Computing Technology in Society'. A primary course objective is to demonstrate the potential impact that ever more complex, interconnected digital systems may have on the both the individual and on society in general. This provides the backdrop against which we endeavour to foster an ethos in which students are encouraged to establish a personal ethical position in relation to the application and deployment of digital systems. Here we reflect on further progress in developing this course with particular reference to ongoing curriculum development, student evaluation and, most crucially, student engagement. Additionally, we outline developments relating to our integration of technologies into the educational experience. We draw on our experience with the CTIS course to consider broader ramifications of technology infusion, particularly in relation to increased VLE integration and the streaming/recording of lectures.

## **1.0 Introduction**

In this paper we primarily focus on advances made during the last two years in the delivery of a first year core course entitled Computing Technology in Society (CTIS). This runs biannually as part of a Bachelor of Computer and Information Sciences degree program with ~220 students taking the course in the first term, and ~100 in the second. Many international students enrol for the course, and in general terms classes comprise students with a broad range of abilities/experience. For many, English is not a first language, and there is considerable cultural diversity.

An overarching ambition is to provide the knowledge and critical skills needed for each student to formulate a personal ethical position in relation to the development, manufacture, sale and application of digital systems and associated software. Fundamental to this goal is the need to ensure that students are able to appraise the potential ramifications of new hardware and software systems within the context a rapidly advancing, increasingly complex and highly integrated digital environment.

The current general thrust is summarised in the Course Prescripitor: *'The course provides a wide-ranging, multidisciplinary introduction to the evolution and application of increasingly complex and powerful computer systems (and other forms of digital technology) with particular emphasis on their impact on society.'* The reference to the evolution of computer systems and digital technologies in general is intended to broaden student appreciation of the rapidity of developments in this field and to foster discussion which goes beyond the here and now. In addition, the Prescripitor emphasises the impact of technologies on society, and in this respect the course adopts a strong people-centric thrust. This is a key factor that distinguishes it from other courses in the undergraduate program and can cause technology focused students to *initially* question course relevance.

At INSPIRE 2013 [1], we outlined major changes that had been implemented in the course with particular reference to course objectives, the curriculum, assessment structure and infusion of technologies into the learning process. We now take the opportunity of reviewing further changes that have taken place. These are more incremental in nature and are primarily intended to enhance student engagement and motivation, broaden the course curriculum, and increase the efficacy of the learning process.

In the next section we briefly summarise key facets of the course as reported at the time of our previous presentation. Subsequently in Section 3 we review further areas of development with particular reference to content, the project based assessment exercise, and our incorporation of technology.

The developments made to the CTIS course have moved it from a situation in which it was previously viewed by many staff and students as a marginalised and somewhat irrelevant course, to one in which it is now generally viewed as being at the cutting-

edge of the first year program. Consequently, in Section 4 we pose the question ‘Where to now?’ and consider this from the perspective of course progression, and from the standpoint of technology infusion. In relation to the latter, following a period of adaptation it is evident that students welcome this move (particularly the use of pre-recorded off-campus content, support for mobile devices, the proper integration of the VLE to form a dynamic virtual classroom, and the ability to asynchronously replay lectures). However, this can raise expectations and so has the potential to lead to disappointment when such facilities are found not to be the norm in other courses. With this in mind, in Section 5 we consider factors that can cause reluctance on the part of staff to engage with various technologies in their delivery of courses. We particularly focus on VLE integration and on the use of video facilities in lectures for both streaming and asynchronous replay. Here we draw on informal discussions with overseas colleagues, and in line with other parts of this paper adopt a practitioner’s approach by drawing on experience directly derived from the delivery of the CTIS course.

## **2.0 General Course Overview**

The reshaping of the CTIS course in 2012 resulted in the following broad changes (also see [1]):

1. Development of wide-ranging research inspired curriculum content. Exemplar topics are summarised in Figure 1.
2. Inclusion of contemporary case studies and topical examples.
3. Inclusion of historic content – the evolution of digital technologies (from Babbage to current) with applications that included the use of punched card systems to facilitate many aspects of the Holocaust.
4. Elimination of a multiple summative assignment based assessment scheme and its replacement by a major group project and end of term exam. Both components were weighted at 50%, with the requirement that in order to pass the course as a whole at least 35% of the available marks must be gained from each component.
5. Transition from traditional course delivery which made it necessary to separately deliver each lecture at both the main and satellite campuses, to the use of Mediasite for lecture streaming. Importantly, this also enables recording of lectures for asynchronous replay via the course VLE.
6. Transition from simply using the course VLE as a materials depository to one in which it is more fully integrated into the teaching process.
7. Development of pre-recorded lecture content (where appropriate) made at topic relevant locations. Also see [2].
8. Regular use of mini-content video recordings to address FAQ’s and to reinforce particular lecture/tutorial content.
9. Emphasis on the use of rapid communication techniques enabling fast response to student questions (including mobile devices, Skype and Google+ Hangout).

10. Support for student group project work using both the VLE and a class community established via Google+.
11. Support for project group formation – each group typically comprising six members with one person designated ‘Group Coordinator’.
12. Introduction of a project assessment scheme comprising an interview and poster presentation together with the creation of a ‘group video’ (uploaded to Youtube), in which students provide a more detailed insight into the work undertaken.

These changes provided a sound framework for course advancement, increased course relevance, and most importantly enhanced student engagement. The impact on student achievement justified the scale of the effort that was applied to redesigning the course.

#### Exemplar CTIS Topics

- The evolution of digital technologies – from Babbage to today’s ubiquitous systems.
- The publishing revolution – signaling the end of physical books?
- The use and misuse of digital systems.
- Digital shadows - is personal privacy an outdated concept?
- Empowering digital technologies – fully automated systems (including law enforcement applications)
- Social networking.
- Predictive modeling.
- The ethical application of digital systems.
- Information retrieval and visualization – from paper records to fully integrated systems.
- Surveillance in the physical and digital worlds.
- Database search engines.
- Biometrics.
- Computer manufacture, operation and disposal – the environmental cost.
- Long term data archiving.
- *Ownership of personal data.*
- *Censorship and the Internet.*
- *The use and ramifications of 3D printing technologies.*
- *Fully automated systems (particularly a focus on motor vehicles).*
- **Case study:** The use of early digital systems with emphasis on their application in facilitating the Holocaust.
- **Case study:** The operation and application of radio frequency identification devices – from Identify Friend or Foe (IFF) systems to microchip implantation.
- **Case Study:** Technology in teaching – enhancing the educational experience? To what extent do blended learning techniques really work for you?

### **3.0 Areas of Development**

Since our previous presentation at INSPIRE 2013, further efforts have been made to enhance key aspects of the CTIS course. These have particularly impacted on the curriculum, on the scope of the group project work and on our use of technology. In this section we briefly review each of these areas.

#### **3.1 Formal Course Content and Delivery**

Student feedback gained via formative assessments/quizzes and through informal surveys revealed greater diversity in prior knowledge/understanding than had originally been anticipated. It became evident that ~50% of students had little, if any, prior knowledge/interest in current events relating to the use and misuse digital systems and (beyond iPhone technologies) ~30% were surprisingly limited in their general hands-on ability to use computers/applications. An even greater proportion had no significant prior knowledge of the evolution of digital technologies.

Thus it has proved necessary to adjust the course curriculum to incorporate basic foundations and great effort has been directed towards assisting weaker students to develop the study and time-management skills needed for successful tertiary study, and for nurturing student engagement. In parallel we have recognised the vital need to ensure that mid- to high-achieving students are fully supported. In this respect greater use has been made of research inspired content, with students being encouraged to study research publications, topical video content and the like which directly relates to current aspects of ethical issues arising in science and technology. Additionally, subject experts (in key areas such as digital forensics) have been regularly invited to participate in lecture delivery.

The curriculum has been extended to include significant coverage of 3D printing technologies. This rapidly advancing area provides a stimulating backdrop for discussion on the ways in which more advanced printing technologies may ultimately impact on society, and in turn provides opportunities to consider ethical implications.

Course content relating to the use of digital systems to facilitate the Holocaust - especially considered in terms of instrumental rationalization, the ability of technologies to divorce people from the ramifications of their actions (depersonalization), potential use/misuse of personal data, potential ramifications of depersonalized data, and the overarching theme of personal professional accountability - continues to be an important and highly engaging part of the CTIS course and its people centric focus. Although high achieving technology focused students frequently initially question the relevance of this historic subject matter, it has been found that during content delivery and discussion this position invariably changes, and their interest in both the course and ethics related case studies is considerably enhanced.

This part of the curriculum has now been extended to include a brief, but much broader, review of the Nazi regime's extensive use of mass data collection and analysis techniques in areas such as population health. *'We are recording the individual characteristics of every single member of the nation onto a little card... We are proud to be able to contribute to such a task, a task that makes available to the physician ... the material for his examination, so that our physician can determine whether, from the standpoint of the health of the nation, the results calculated in this manner stand in a harmonious, healthy relation to one another, or whether unhealthy conditions must be cured by corrective interventions... We have firm trust in our physician and will follow his orders blindly, because we know that he will lead our nation toward a great future.'* Willy Heidinger, Dehomag (Deutsche Hollerith Maschinen Gesellschaft).

Coverage in this general area is also linked to more recent events and provides an opportunity for students to gain an insight into ways in which fundamentally valid survey objectives can ultimately be distorted by manipulation and/or by method of presentation.

A further key addition to the curriculum relates to the ethics of Internet censorship. With the passage of time, case studies relating to the Nazi period and other historic subject matter can be presented and discussed within a clearly structured and largely non-controversial framework. However, in the case of other content, it is clearly necessary to select and present principles, concepts and exemplar content in a highly sensitive way – especially when, as in the case of the CTIS course, classes comprise students with wide-ranging cultural beliefs and who come from countries with a range of political systems. Thus although Internet censorship has proved to be of great interest to students and engages vibrant discussion, it has proved to be one of the more problematic topics and has necessitated scrupulous preparation. Interestingly in the most recent rendition of the CTIS course, immediately prior to coverage of this topic an informal survey of 55 students revealed that 45 believed that the Internet should be completely free from censorship. When surveyed after topic coverage (and despite efforts to present a well balanced overview) this figure had fallen to 5 students.

### **3.2 Group Project**

The simple assessment structure employed in the CTIS course is intended to alleviate the need for students to complete multiple assignments and meet corresponding due dates. This 'assignment treadmill', which invariably forms a significant part of a student's first year experience, can negatively impact on engagement and can reinforce the notion that the learning experience associated with tertiary education is a secondary consideration – in which case if a topic is not examinable then it is often perceived as being of little, if any, interest.

Primary functions of the group project are to enable students to focus on either a practical activity or mini-research topic relating to relevant ethical issues. Additionally, project work is intended to stimulate engagement and subject interest. Recently, students have been allowed to undertake project work in the area of 3D design (using SolidEdge) and 3D printing, with emphasis on the ethical issues that may ultimately arise with this form of technology and/or ethical issues relating to the entities that are created. This has proved to be a particularly popular part of the course with many students working on project areas that directly relate to formal course content.

### **3.3 Use of Technology**

Mediasite continues to play a central role in course delivery and provides the platform for lecture streaming and asynchronous lecture relay. Since Mediasite supports only unidirectional communication, Skype is used for the uplink from the satellite campus and supports student interaction using one or more iPad's. When used for this type of interactive application, however, Mediasite's inbuilt transmission latency of ~20 seconds is non-optimal.

Key advances in the mediatization [3,4] of the CTIS course have centred on ensuring streaming reliability coupled with rapid set-up times in order to permit timely commencement of lectures (see below).

In order to facilitate online project group interaction each student was initially provided with a gmail account and encouraged to make use of the established Google+ class community (including Hangout). This proved to be a popular and highly effective method of facilitating group communication, and provided the opportunity to monitor progress and proffer timely assistance when necessary. Despite this success, general use of this approach has been curtailed because in the event logistics proved to be too time-consuming. Instead students are encouraged to fully participate in interactive discussion via the course VLE and, in addition, a popular course Facebook page is employed. Based on multiple renditions of the CTIS course, it is evident from both student feedback and the extent of interactive discussion that many students prefer to participate using social media platforms rather than via the more formal (and perhaps more daunting) VLE discussion board environment.

### **4. Current Status: Where to Now?**

As indicated previously, the CTIS course has moved from its previously marginalized position to one at the forefront of the first year experience. It is therefore natural to consider ways in which it is possible (in principle) to build on this apparent success, and pose the question: 'Where to now?'

In terms of primary academic objectives, the CTIS course provides students with a basic insight into ethical issues that can emerge in relation to the diverse applications of

digital technologies. In addition the course adopts strategies that captivate student interest in the area. However, this falls short of what is clearly a much more demanding, overarching, and important undertaking – specifically, motivating and enabling each student to develop (and adopt) a personal ethical position in relation to the development, application, and deployment of digital systems.

Thus on the basis of the current CTIS course (and from other ethics and professional issues related courses delivered by the author (BGB) in the UK and US) it is apparent that a single course does not suffice. Indeed, once student interest has been catalysed and momentum builds, it is important to capitalize on this by offering appropriate course progression and hence the opportunity to study material at a more advanced level (e.g. via a second year course coupled with ethics related projects in the final year).

A second important consideration concerns the infusion of technologies into the learning experience. Certainly students appreciate the technologies that have been incorporated into the CTIS course – and in many institutions such approaches are the norm. However in the case that these developments occur in an isolated first year course, there is the risk of raising, but not sustaining, student expectations. This perhaps suggests that technology infusion should be undertaken as part of an integrated plan embracing all courses in a degree program. However, to do so would necessitate the cooperation/commitment of all staff and an increase in individual workload. With this in mind, in the next section we briefly draw on experiences primarily gained from the CTIS course and consider broader issues relating to the infusion of technologies into course delivery – with particular emphasis being given to the impact on the lecturer.

## **5. Integration of Technologies: Broader Issues**

Although ever-increasing use is being made of video technologies for lecture streaming and asynchronous replay, many academic staff remain reluctant to engage with this development. An informal survey of overseas colleagues (involved in the delivery of Computer Science and Engineering courses) revealed that whilst potential benefits are acknowledged, there is also uncertainty about the ultimate ramifications of the increased transparency associated with the presence of the camera in the lecture room and with more active VLE usage. Particular concern was expressed about the impact of the camera on the lecture delivery process, and in relation to future secondary use of video and VLE content as a required component in staff assessment and promotion exercises.

### **5.1 Impact on the Lecture Delivery**

As class sizes increase many students are, unfortunately, reluctant to engage in interactive discussion, and relatively few institutions are widely equipped with the

resources needed to support electronic interaction in the lecture theatre. Consequently traditional lecturing styles are commonplace and without doubt the video recording process makes ill prepared and poorly delivered lectures uncomfortable viewing. It is therefore possible to suppose that when the integration of video techniques becomes common practice this will drive improvements in the teaching process [5]. Contrariwise, it is apparent that for some staff the presence of the camera can be unnerving and so can negatively impact on course presentation. Unfortunately when lectures are streamed, it is not possible to simply 'forget' about the camera's presence. This has been clearly demonstrated in the CTIS course where we sought to maximise integration of students located at the satellite campus. In this situation, there is a need to continually switch attention between the immediate and remote audiences – and in the case of the latter this necessitates regularly looking at, and talking to, the camera. Thus the lecturer must be continually aware of the camera's presence.

When video facilities are used to support asynchronous replay, it is possible to edit footage before making it available for viewing. In contrast, this is obviously not possible when content is streamed. Experience with the CTIS course has demonstrated that this has at least two important potential ramifications:

1. **Viewing audience:** In the case of Mediasite, synchronous access is obtained via a URL. This is selected prior to a lecture taking place and is primarily intended for use in the lecture room at the remote campus and is shared with any students who are not able to attend for reasons such as illness. However, the lecturer is not necessarily involved in the distribution of the link and hence may not know that it has also been shared with other staff who may have only peripheral/general interest in the proceedings. In short, from a practical perspective there is no certitude as to who may be looking on.
2. **Student cooperation:** Without doubt, lecture streaming places additional pressures on the lecturer, and performance can be impaired by any loss of focus. Common sources of distraction include students who arrive late or leave early (particularly if, as a consequence, this involves others having to physically make way for them), and students who are in other ways disruptive. Whilst the immediate student audience will be aware of sources of distraction, this is unlikely to be the case for the remote audience. Further, any break in content delivery that is required in order to exercise classroom control has a very negative impact when viewed on video. Thus student cooperation is an essential ingredient to success and can be more problematic as the size of the immediate class increases. Consequently, when video facilities are used, it is especially crucial that in transitioning to the tertiary experience students quickly learn to appreciate that the educational experience represents an active partnership in which they are co-creators of the learning environment.

The incorporation of ever more complex technologies into the course delivery process can increase set-up times and raises the likelihood of delays caused by technical issues. Thus even before a streamed lecture begins, the lecturer (and support staff) are under considerable pressure to quickly resolve problems so that the lecture will commence on time (which is particularly important given the expectation that students will do their best to arrive promptly). Although larger lecture rooms are increasingly equipped with video streaming and recording facilities, this is often not the case and considerable set-up work has to be carried out very quickly. Unfortunately, the scheduled ten minute gap that is usually placed between lectures is frequently significantly eroded by lecture overrun. Thus in practice it is not possible to assume that there will be more than a 4-5 minute window in which to set up equipment, and establish the communication channel with the satellite classroom(s). In the case of the CTIS course, lecture rooms equipped with video facilities were not available and so within this brief window the camera/audio equipment and Mediasite hardware had to be put in place and the link with the satellite campus established. In the most recent rendition of the CTIS course, this was typically achieved in four (generally intense) minutes.

Given the crucial importance of guaranteeing lecture delivery at the satellite campus, the possibility of technical failure cannot be ignored and so back-up plans have always been put in place. In the case of CTIS this has usually involved the overhead of having pre-recorded lecture content available ready for use should it be needed. In practice such back-up plans have seldom been needed because scrupulous attention has been paid to testing equipment well in advance.

## **5.2 Secondary Use of VLE and Video Content**

The proper integration of the VLE into the educational process provides great scope for increasing student engagement, and for the promotion of a synergistic interactive learning experience. However, on occasion administrative/management staff view the VLE as simply a resource repository (which is indeed an all too common reality), and do not necessarily appreciate that when used effectively it represents a virtual extension to the physical classroom. As a result, traditional protocols that are usually applied to the latter are not necessarily transferred across to the VLE. Thus whilst a staff member who wishes to attend a physical lecture will invariably make both their presence and purpose known, this courtesy does not necessarily happen in the case of the VLE (particularly as access rights are usually established by one or more administrative staff).

In parallel, when lecture content is made available for asynchronous replay there is no way of knowing the ultimate audience. This may include staff who have only a vague peripheral interest, and in the case of the CTIS course students regularly share interesting material with friends and family members. Again, this increases the onus on

the lecturer to ensure polished delivery and avoidance of classroom management issues.

## 6. Discussion

Student surveys coupled with informal discussion clearly demonstrate that the CTIS course has a positive impact on many students by raising their awareness of, and interest in, the potential ramifications of inadvisably applying, integrating and empowering digital systems. It is also evident that given the scope, profundity and interdisciplinary nature of this subject a single course can do little more than provide a general introduction, and that further more advanced courses are needed to build on these foundations. This is an area in which the BCS can play an important role by encouraging more extensive integration of ethics and professional issues courses/projects into undergraduate CS and IT programs. In addition, the BCS is in a strong position to facilitate the creation of appropriate support materials including video content, and most importantly appropriately focused and engaging course books (which at present are unfortunately lacking in this area).

The fundamental motivation for introducing the video camera into the lecture room should centre on enhancement of the educational experience, and indeed support for asynchronous replay has positive benefits with respect to content understanding, content assimilation, and by offering greater support for flexible learning (also see [6] and references therein). This is confirmed by student feedback, which particularly highlights the value placed on:

1. The opportunity to replay particularly challenging content.
2. The provision of better support for students for whom English is not a first language.
3. Greater opportunities for flexible learning.
4. The opportunity to replay all or parts of lectures in the lead up to course exams (this use is strongly confirmed by data taken from the CTIS VLE across multiple renditions of the course).

In addition, the presence of the camera enhances transparency of process such that its routine use in lectures has the *potential* to motivate higher teaching standards. However, it is crucial that effective protocols are adopted such that staff are encouraged (rather than forced) to engage with such technologies. In practice, there can be little doubt that student expectations and institution requirements will ultimately lead to a situation where full VLE integration and the video recording of lectures

become the norm. In this case, it is difficult to imagine that staff performance in these areas will not become an integral part of staff evaluation exercises. This could significantly detract from the educational process by promoting the need to produce ‘slick’ lectures in which undue attention is paid to ‘working the camera’, and could also result in a more homogenized style of teaching and hence a most regrettable loss of diversity.

A further question arises in relation to content ownership/control. Rather than an institution claiming outright control of content use, it would be preferable to see more equitable arrangements where the lecturer retains some rights and has a stake in relation to secondary usage. Thus, for example, should an institution decide to use content for advertising purposes or as a saleable commodity, then it is important that appropriate protocols are in place and that staff agreement is sought beforehand. Additionally, content should be stored in a manner which makes it accessible to the lecturer for off campus personal use, thus enabling the efforts made in its development to contribute to the advancement of the lecturer’s portfolio.

These are also areas in which the BCS is ideally placed to offer leadership - particularly through the development and dissemination of a much needed best practice framework able to accommodate the often diverse interests of fee-paying students, lecturers, technical support staff, and administrators/managers.

## **Acknowledgements**

The authors would like to express their gratitude to staff at the Centre for Learning and Teaching at AUT. Particular thanks to Reza Mohammad Yari without whose dedication and camera skills the CTIS course would have indeed been impoverished. Thanks also to Soheila Mohammad Yari.

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