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## Coping with a changing world: the UK Open University approach to teaching ICT

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# **COPING WITH A CHANGING WORLD: THE UK OPEN UNIVERSITY APPROACH TO TEACHING ICT**

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## **Abstract**

The rapid pace of change in the ICT field has affected all HE providers, but for the UK Open University (UKOU), used to print-based courses lasting eight years or more, it has been a particular challenge. This paper will present some of the ways the UKOU has been coping with this problem by discussing the design of three courses, the first developed almost a decade ago. All three are distance learning courses that are either core or optional in a variety of bachelors' degrees, including the BSc programmes in: Information and Communication Technology; IT and Computing; and Technology; as well as the BEng (Hons) engineering programme.

The first course, *Information and Communication Technology: people and interactions* is a level 2 (second year undergraduate) course first presented in 2002. It is predominately a print-based course with an eight year lifetime. The second course *Networked Living: exploring information and communication technologies* is a level 1 (first year undergraduate) course first presented some three-and-a-half years later in 2005. It is expected to have a course life of five years, and uses a mix of print-based (60%) and computer-based (40%) material. Both these courses use assignments as key tools for annual updating.

The third course, *Keeping ahead in ICT* is aimed primarily at equipping students with advanced information searching and evaluation skills that will serve them well in professional life, and is presented at level 3 (final year undergraduate). It was first presented in 2007 and has an expected course life of 8 years. It uses much less print than in most OU courses, and has a greater reliance on third-party resources such as newspaper, conference and journal articles, websites, and other electronic resources. Some elements in each block are designed to change from year to year, in order to retain currency.

Finally, the paper will look forward to the development of a new level 2 course with an expected first presentation in 2010, drawing out the lessons learned about course updating, and predicting the approach that the course team may take.

## **Keywords**

ICT, pedagogy, updating, Open University, assessment

## **1. INTRODUCTION**

The Open University (UKOU) of the United Kingdom was established in 1969 with the aim of providing higher education at a distance to all, including those without formal university entrance qualifications. ICT courses are offered by The Faculty of Mathematics, Computing & Technology, one of eight OU academic units offering undergraduate and postgraduate courses. Most courses are of about 9 months duration, offered once or twice a year. Students are normally allocated to a local tutor group, of about 15 to 20 students with one tutor, for limited face-to-face or electronic tutorials. This contact time ranges from around 2 hours per week for certain level 1 (first-year university) courses to as little as 12 hours or less per year at level 3. Tutors mark students' written work, as well as providing them with support and guidance. Course assessment is by a combination of tutor-marked assignments (TMAs), multiple-choice computer-marked assignments (CMAs), and final examination or some other 'end of course assessment' (ECA). Most students work full-time and/or have family commitments, and because of these and other pressures (allied to the open access policy) the completion rates for Open

University courses can be quite low in comparison with full-time courses in many conventional UK universities.

The traditional model of OU course production was a fairly large course team consisting of academics (sometimes as many as 10 to 12, depending on the number of study hours of the course), a course manager, an editor, and AV / broadcasting / software development support. The result was a fairly long development time of two or even three years, and a course with a lifetime of eight years or more in order to amortize the huge investment in the development process. The core course materials were typically high-quality printed and bound texts with little, if any, opportunity for amendments or additions from the second year of presentation onwards, though limited lower-quality supplementary materials could be reprinted annually. This model of course production is no longer sustainable, particularly in areas such as technology where the field is changing rapidly. Additionally, new student support technologies, such as virtual learning environments (VLEs) provide opportunities for change in pedagogic approach, and new social networking tools appear as a driver for potential change in the HE sector [1].

However, exploitation of the new opportunities available and migration to new methods tend to be evolutionary processes, as do the changes in pedagogic approach that accompany the new technologies. Legacy courses still have to be maintained and kept fresh, and new approaches tried and tested in an incremental way. This paper discusses some of the experiences of producing and maintaining three UKOU information and communications technologies (ICT) courses over a period of almost a decade. All these courses are either core or optional in a variety of bachelors' degrees, including the BSc programmes in: Information and Communication Technology; IT and Computing; and Technology; as well as the BEng (Hons) engineering programme. The academics working on the course teams during the production and presentation of these courses have worked closely with each other, some even being members of more than one of the teams. This has enabled them to pass on lessons learned from the earlier courses.

## **2. LEVEL 2: INFORMATION AND COMMUNICATION TECHNOLOGIES**

*Information and Communication Technologies: people and interactions* is a 600 hour level 2 course that has been presented annually since 2002 and is due for its last presentation in 2009, giving it an eight year course life. Over its lifetime to date it has attracted a total approaching 9000 students. The course had a gestation period of almost three years, which meant that the course team first came together to start specifying content and approach as early as 1999.

Aware of the radical changes that were likely to occur in ICTs during the lifetime of the course, the course team took a modular approach. The course is split into 6 separate and independent 100 hour blocks linked only through skills development, which is a key feature of the course. This modular approach meant that each block had the potential to be offered as a 100 hour course, but the key driver was that it would also allow the course to be updated on an incremental basis. The original intention had been to update one or two modules three years after first presentation and possibly rolling rewrites thereafter. In practice this never happened, largely because of a change of emphasis in curriculum that pulled staff away to work on a new level 1 course, and later on a foundation degree in ICT.

Five of the course blocks are taught blocks, each covering a different topic area of ICTs:

- Block 1 *In touch and informed* provides a broad overview of three key technologies – computer technologies, network technologies, wireless technologies – and their role in everyday products, such as mobile telephones and personal digital assistants with internet access.
- Block 2 *Talking with computers* explores the requirements for human–technology interaction, with emphasis on the development of speech recognition systems. The module makes extensive use of audio editing and speech recognition software that will make the development of practical applications possible.

- Block 3 *Network management* covers the design, implementation and management of computer networks for small to medium-sized organizations. Topics include business networking models, local area network (LAN) protocols and design rules, and network management tools. Software supports a wide range of LAN design and simulation activities.
- Block 4 *Cyborg* provides the basis for a group project. Its background is the cyborg concept, which blurs the distinctions amongst technology, life, nature, people and environment. The cyborg concept invites us to see technology and ourselves as inseparable, and to see communication technology as us (cyborgs) reaching out to touch one another through our embodiment as cyborgs.
- Block 5 *Security* considers how people might want to interact with one another using ICTs, and the protocols and procedures required to secure such interactions. It examines the threats people imagine they may be facing and describes some of the successes and failures of the systems that have been proposed to counter these threats. One of the major themes of the module is an introduction to the mathematics underpinning certain encryption systems.

Blocks 1, 2, 3 and 5 are presented to students as printed text, but block 4, which includes a significant proportion of third party papers and book extracts, is provided only in digital media, online via the course website or off-line from a CD-ROM. In theory, the digital presentation of the cyborg block provides greater opportunity for updating, but in practice this is not the case since the majority of the updating overhead comes from the authoring and editing process rather than from the printing process.

The sixth block of the course is a research block where students are required to investigate a specified recent development in ICT and present their findings in the form of a report that they submit for their ECA. The topic is carefully chosen to require supporting foundation knowledge from the taught blocks – predominately blocks 1, 3 and 5, since the technologies they cover underpin many ICT applications - but also giving opportunities for linking with the other two blocks. Other than one or two 'priming' papers, students are expected to find their own information resources using the internet and the electronic journals and research papers available through the University's library. In practice, very few students find appropriate journal or research papers to support their work, probably indicating a need for greater skills development in information literacy.

The ECA, therefore, provides an effective vehicle for keeping the course up-to-date with new developments in ICTs as well as testing a range of foundation knowledge. Similarly, TMA topics are chosen to provide updating for the course. In the earlier blocks, students may be provided with a recent paper or journal article and be asked to explain aspects of the technology it covers. In later blocks students might be expected to seek out supplementary documents as information sources. This approach provides preparation and practice for the more substantial research activity in the ECA.

Other mechanisms for updating were built into the course design. The course has its own website that includes pages for updates to each block. The updates typically represent no more than two hours study time and have no student activities, but generally include underpinning knowledge for the associated TMA. As examples, when Block 1 was written, the move from GSM (Global System for Mobile Communications) to GPRS (General Packet Radio Service) was comparatively recent, and the third-generation UMTS (Universal Mobile Telecommunications Service) was not available in the UK. The Block 1 web updates have enabled the course team to introduce emerging technologies in mobile telephony as well as the social trends that have driven or accompanied them. For Block 4, the third-party papers and extracts (many of them seminal texts) have remained unchanged since the start of the course, but updating for this block is done by providing links to appropriate up-to-date web resources via the course web site.

Because of the UKOU's quality and administrative systems, providing updates via the course web pages is not as instant as might be expected. Typically there is a delay of some six to eight weeks between course teams writing the block updates and the material appearing on the course website. This is to allow for the scheduling of editing and web support staff. A more rapid mechanism for updating is through the use of computer conferencing, which provides a 'quick and dirty' route for course teams to make resources directly available to students, as well as enabling distance learners to carry out collaborative activities and build a sense of community [2]. The updating that the course

team has provided through computer conferencing has tended to be for bringing students' attention to particular news items or relevant broadcasts.

Inevitably, now in its seventh year of presentation this course is starting to look a little dated, not only in content but also in approach. The course has always made significant use of computer conferencing, but hasn't incorporated the more recent additions to the social networking toolkit such as blogs, wikis, social bookmarking, and newsfeeds. Though it would not be impossible to do so, the overhead of the design changes needed could not be justified so close to course's end-of-life. Similarly, the increased educational emphasis on ethical issues is absent in this course. Nevertheless, the course team believes that the updating mechanisms built in to the course design have been helpful and could have been used even more effectively with a greater allocation of staff time for course presentation.

### 3. LEVEL 1: NETWORKED LIVING

*Networked Living: exploring information and communication technologies* is a 300 hour Level 1 course on Information and Communication Technologies (ICT). The course introduces students to ICT concepts, systems and issues within a range of contexts, such as entertainment, health and government [3, 4]. As well as teaching students about ICT, the course aims to help students develop a range of generic skills. These include numeracy skills (including work with spreadsheets), communication skills (including computer-communication), information literacy (including skills in finding and using online resources) and study skills. The development for *Networked Living* started in late 2003 and its first presentation was in October 2005. The course is presented twice a year, starting in October and February, with each presentation attracting around 1500 students. It is expected to have its last presentation in 2010.

The course uses a blended approach and consists of 4 blocks of study, as follows:

- Block 1 *Living in a networked world* introduces the course, and discusses the elements and processes of ICT systems. It also begins students' skills development.
- Block 2 *Communication and Identity* teaches students about networks, in particular the internet. There is a focus on skills in finding and using information, for example from the web.
- Block 3 *Entertainment and information* teaches ICT concepts and technologies in the contexts of entertainment and news broadcasting. This block also introduces basic mathematical skills and skills with spreadsheets.
- Block 4 *Health, transport and government* discusses ICT in societal contexts, using the examples of health, transport and government. The block brings together the skills which students have developed throughout the course.

Although the greater part of the course materials (60%) is presented as traditional printed texts, some parts of each block require online work. This is most significant in Block 2 where approximately 67% of its content involves on-line working. In this block students learn to search for and evaluate Web information and are encouraged to use sites like Wikipedia ([www.wikipedia.org](http://www.wikipedia.org)) and HowStuffWorks ([www.howstuffworks.com](http://www.howstuffworks.com)). As well as helping them to develop as independent learners, this approach helps to build the skills necessary for students to keep updated in their subject.

The course website uses a different model for the one used on the Level 2 course discussed previously. Two features of this model particularly relevant to content updating are a news area and a resources area, both under the control of the course team. This means that any lengthy editing or administrative process can be avoided.

Each of the blocks is assessed via a written assignment, and the course culminates in a written 'end-of-course assessment', rather than an examination. This tests students' understanding and application of the concepts taught in the course, and provides an opportunity for students to draw together the different ideas. Like the level 2 course previously discussed, the course uses assessment as an important element in updating. For example, students have been set assignments on such topics as

the Blu-Ray / HD-DVD controversy; wikis and blogs; developments in removable storage; and Internet TV – none of which are covered in the course material itself. These assignments typically involve students carrying out elementary research and critically reading published papers and websites. Until the introduction of the UKOU's new Moodle-based VLE, it was not possible to support students' use of social networking tools, such as blogs, wikis and instant messaging, in a protected environment. However, the rollout of the VLE during 2007 and 2008 means that the course will soon be able to migrate from the bespoke website to the VLE. In 2007 a pilot study was set up to enable a subset of tutors to use the new tools in their work of supporting students. When the study is complete and the results evaluated, the study will inform the revision of the course during the transition. Though the use of the new social networking tools does not in itself provide an obvious vehicle for keeping course content updated, it does enable an updating of approach.

During the development phase, the course team gave considerable thought to the choice of themes for Block 4, attempting to select those that were emergent and likely to stay current for a substantial period. Their choice of health, transport and government has been generally successful. Though the general interest in E-government in the UK has waned, interest in the government's national identity system has remained a hot topic, and interest in ICTs in health and transport remain current.

#### **4. LEVEL 3: KEEPING AHEAD IN ICT**

*Keeping ahead in ICT* is another example of a distance learning course with a high resource-based component, this time as a means of keeping the course up-to-date, as well as delivering certain important generic skills necessary in engineering graduates. More details can be found in [5].

*Keeping ahead in ICT* is a 300 hour, level 3 (final year undergraduate), distance learning course offered by the UKOU for the first time in February 2007. It has an expected lifetime of 8 years. It is aimed primarily at equipping students with advanced information searching and evaluation skills that will serve them well in professional life. Because ICTs are changing so fast, a traditional UKOU course with a great deal of printed material would be bound to date quickly. So there is much less print than in most OU courses, and a greater reliance on third-party resources. The nature of the course means that development time was cut to just over one year.

The course consists of three, 100 hour blocks of study, increasingly relying on materials not written specially by the OU, such as newspaper, conference and journal articles, websites, and other electronic resources. The individual blocks focus on: general principles of wireless technologies; wireless sensor networks; and ICT in a social context. Some elements in each block are designed to change from year to year, in order to retain currency. All blocks include an electronic 'companion', posted on the Moodle-based virtual learning environment (VLE), which contains advice on study patterns, and so on. In common with many other courses the VLE is also used to post electronic versions of almost all print items, links to library resources, up-to-date news items, audio downloads, and any errata that may be necessary as the course proceeds. The VLE also acts as a host to national and local electronic forums for discussion of course materials both with tutors and other students. Student 'self help' has always been considered a vital part of Open University study, and clear guidelines are given to students about the difference between valid self-help and inadmissible collusion or plagiarism.

It is generally agreed that SET graduates must be sophisticated independent learners, able to locate and evaluate information for themselves. *Keeping ahead in ICT* includes an interactive tutorial (developed jointly with the Open University Library, and available both online and in a downloadable executable version via the VLE), which teaches the elements of the effective use of search engines, including such topics as the use of Boolean operators and specialist engines such as Google Scholar. Access to many commercial databases is provided via a Library portal, which obviates the need for additional passwords for databases to which the University subscribes. An important part of the tutorial is to compare the results returned by a generic search engine for a technical query with those supplied by a specialised database such as IEEE Xplore. All in all, UKOU students have electronic library facilities that compare favourably with the best of the UK conventional universities.

Other sources of information that are used, discussed and considered critically for ICT information searches include LexisNexis; electronic books; major national library catalogues such as those of the

British Library and the US Library of Congress; commercial publishers' catalogues; and citation indexes. In each case the peculiarities and advantages and disadvantages of these sources are explained. Students are also introduced to the basic principles of copyright law and the *digital object identifier* (DOI) system for electronic resources.

By its very nature, the course requires students to carry out a significant number of on-line activities, so a broadband connection is advisable (although not strictly required). As part of these activities they evaluate electronic newsletters, blogs and wikis, as well as more conventional sources of information. An important feature of the teaching is to suggest structured ways in which students can make notes of information sources, including information (where available) about editorial policy, intended audience, possible bias, and so on.

Following the teaching of searching for information sources, students are introduced to techniques that can be applied to a detailed critique of what has been found, based on the detailed study of three articles on the topic of wireless sensor networks (WSNs). Students practise extracting information from texts, but are also asked to think about the provenance of the materials, the background of the authors (including a Web search of their academic and other activities), and are asked to make judgments on the authority of texts. The emphasis in the teaching is to develop strategies for coping with new, complex ideas without panicking – and also to learn to make judgments about when it is appropriate to move on without having fully understood all the pre-existing text. This is a subtle and complex skill, and students often find it worrying. A number of examples are therefore included to illustrate how meaningful information can be gleaned from highly technical papers – particularly figures and diagrams – without necessarily fully understanding the complete mathematical derivation. This, in turn, raises questions of trust and authority, which are again problematic. A novel feature is the use of audio commentaries to guide students through their study of complex figures.

In addition to these generic skills, students also develop an advanced understanding of wireless techniques in current ICT systems in general, not only in the context of WSNs. They also look at a number of important issues in ICT, such as system failure and ICTs in the developing world.

## 5. LOOKING AHEAD

In 2010 the UKOU plans to present a new level 2 course that will take the place of the retiring course *Information and Communication Technologies* when it finishes in 2009. The planned course life has yet to be specified but it is unlikely to be anything less than six years (and probably more) because of the high development costs.

The new course is planned to have a similar structure to its predecessor. That is, it will be a 600 hour course, split into 6 blocks of 100 hours each. There will be no new content introduced in the final block, the 100 hours of student activity being devoted entirely to the ECA and development of the knowledge required to address it. Again it is intended that the ECA will feature a new technology development not specifically covered in the course. Thus an ECA will again provide a significant element in the updating of the course.

The other five blocks of the course are likely to be as follows:

- Block 1 *Storing and sharing* will discuss how individuals and organisations share information using wired and wireless networks.
- Block 2 *Exploring and enquiring* will discuss how people communicate on the move using mobile telephony and explore the opportunities these mobile technologies offer.
- Block 3 *Creating and collaborating* will develop students' skills in group work and web skills through project work
- Block 4 *Protecting and prying* will discuss technology and issues connected with monitoring, surveillance and communication security
- Block 5 *Entertaining and educating* will investigate the growth of computer games and their use in education and technology. The block will teach the key concepts of audio and video editing and will include an individual student project.

Drawing on the experience of producing and presenting the three earlier courses discussed, it is expected that this new course will continue the trend of increased use of third party materials and dynamic updating through constant renewal of these resources. This inevitably places a greater overhead in staff resources onto course presentation but can be balanced by a reduction in production overheads.

## 6. CONCLUSION

The need to keep Open University students up to date in ICT has resulted in significant changes to the course development and presentation processes over the last decade or so. Predominantly print-based courses, with a long lead-time and a long, static, lifetime, have been replaced by courses characterised by more rapid development and considerable change over their lifetime. The result has been a significant shift of course team effort from development to presentation. These phenomena have been illustrated in this paper by courses at all three undergraduate levels of the UKOU ICT curriculum: an 'elderly', print-based, level 2 course; a more recent level 1 course with a 60/40 split between print and other media; and a new (2007) level 3 course with perhaps a third of the traditional quantity of print and a much greater reliance on third-party material.

There has been a corresponding shift in the nature of the learning outcomes of ICT courses, with an increasing emphasis on the generic skills of learning to learn and the ability to carry out personal updating, rather than on a relatively unchanging body of knowledge. In all the courses described in this paper the assessment – both during and at the end of the course – is an important element in keeping both the courses and their students up to date.

The historical trends described here seem set to continue with a new level two course to replace the 'elderly' one described in more detail. Although not considered in this paper, other courses currently under development at the UKOU, covering such topics as e-business and digital media, are also exhibiting similar characteristics.

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