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Networked Living: a new approach to teaching introductory ICT

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Networked Living: a new approach to teaching introductory ICT

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Abstract

The course T175 *Networked Living* is a 300 hour, multiple media, distance learning course offered by the UK Open University. The first presentation of the course, in 2005, attracted over 1600 students. T175 introduces students to general concepts of information and communication technology in a range of contexts, including: communication and identity; entertainment and information; and health, transport and government. It is an introductory (level 1) course for a variety of bachelors' degrees, including the BSc programmes in: *Information and Communication Technology*; *IT and Computing*; and *Technology*; as well as the BEng engineering programme. The course was designed with a focus on retention of students and preparing them for further study. Student workload and pacing was carefully planned and there is a significant study skills component. The course uses a range of media, including: text, audio, computer animation and other software, and a website. Active learning is encouraged by means of activities, online quizzes, animations, spreadsheets and a learning journal. Continuous assessment is carried out via a mix of multiple-choice assignments (to test factual and numerical skills) and written assignments (which include elementary research into new topics). The course culminates with a written end-of-course assessment. This includes a major reflective component, as well as more traditional questions designed to test knowledge and understanding.

Keywords: ICT, distance learning, active learning, learning journal, student retention

1.   INTRODUCTION

The Open University (OU) 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. The Faculty of Technology is currently one of nine 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 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.

Until October 2005 the level 1 course in ICT offered by the OU was T171 *You, your computer and the net*. Although extremely successful in its day, this course was beginning to date, and student numbers were dropping. In addition, it did not deliver all the skills required for higher-level study, particularly in the numeracy area. The course had also suffered from comparatively low completion rates [1]. It was agreed to replace this course with a new one with a wider remit. The new course was to be designed explicitly to improve retention rates, and to ensure that the workload for students was not excessive. Furthermore, the course had to be appropriate both for those who intended to study for a full degree and for those who, under the OU's modular structure, wished to take it simply as a course in ICT to be combined with another field of study. The new course is T175 *Networked living: exploring information and communication technologies.* (For a 'taster' of the course material, see http://students.open.ac.uk/technology/courses/t175/taster/html/). It has two presentations a year: October - May;

and February - September. The October 2005 presentation attracted over 1600 students, and the February 2006 presentation about 1400.

2. T175 COURSE STRUCTURE

To provide the broad appeal believed to be necessary, the course team decided to present ICT 'in context', addressing social, ethical, and political issues as well as the technologies involved. The course is divided into four blocks, with Block 1 half the length of the others.

Block 1 *Living in a networked world* provides an introduction to ICT systems and to the course. Students are introduced to some of the concepts they will study in more depth later. The block also begins to develop learning, communication and numeracy skills. Such skills are an extremely important element in OU level 1 courses.

Block 2 *Communication and identity* looks at how networks connect people, information and devices. It also considers the role of identity in communication – identities of both people and devices. So students learn, for example, about online 'personas' as well as IP addressing. Most of this block is delivered online, in order to give students experience of using the internet, and to develop their information literacy skills.

Block 3 *Entertainment and information* considers how ICTs have transformed entertainment and news broadcasting. Using the context of digital images, film, computer games, news gathering and broadcasting, it teaches basic ideas about digitization, data compression, the role of standards, elementary communication engineering, and issues of trustworthiness and authority in the media. There is a strong element of numeracy in the block, with students being taught to carry out numerical calculations, simple algebraic manipulation, and spreadsheet construction.

Block 4 *Health, transport and government* explores three contexts in which ICTs are becoming increasingly important. The block includes discussion of e-government, health information and communication systems, telesurgery, ICT in traffic management, and issues related to identity checking using databases. This block has the strongest element of social, political and ethical aspects – but students also learn the rudiments of databases and biometric identification, as well as applying ideas about communication from earlier in the course to systems such as telesurgery and road management.

3. SELECTION OF MEDIA

Course developers need to choose appropriate media for different aspects of a course [2]. Among the options available to the T175 course team were: traditional printed text; Web delivery; DVD (for video, audio, animations, software); and computer conferencing (including chat / instant messaging). These choices affect students and their learning. There are questions of flexibility of time and place; the availability of computers, networks, and software; and the need to cater for different student learning styles. Some media can encourage learning through activities, interaction, and dialogue – others are less appropriate for interactive or collaborative learning. It is also important to address the need to develop skills, experience, and confidence amongst students.

The course team adopted what has recently come to be termed a blended approach. All the above media were used where appropriate. About 60% of material is print-based – teaching text written by the course team, together with carefully selected articles from journals, newspapers and magazines. About 20% is web-based – again a combination of OU designed web sites (incorporating links to other web sites), but also requiring students to do a certain amount of searching for themselves. The course DVD contains animations with audio, interactive simulation and graphics software. Finally, the computer-mediated communication (CMC) system used by the OU (entitled *FirstClass*) is used for tutor group conferences, whole-cohort conferences, online tutorials, live chat and individual email. The use of such systems needs to be planned carefully to ensure high rates of participation and to avoid student overload [3, 4].

The precise use of the multiple media varies from block to block. Block 1 aims to get students started with a range of media, and is a roughly equal mix of print-based and online work. Block 2 is predominantly online, as befits material that aims to teach students to become informed users of the internet. Learning to search the Web and make reasoned judgments about information found are important aspects of this block. The online parts of the block also include animations – for example, to teach ideas about the TCP/IP protocols. Block 3 has a small online component, but about one third of the study time is devoted to offline computer activities. In this block students learn to use spreadsheets to model growth in the context of ICT systems, and they carry out basic digital image processing, as reinforcement of ideas about digitization and data compression. They also view an animation about computer generated images as used in cinema and computer games. Block 4 again has a

considerable text component, but also asks students to access a variety of websites and download data into a spreadsheet for analysis. The block also includes a number of computer-assisted learning components. One example, illustrated in Figure 1, is a simulation designed to teach ideas about queuing, using the context of road traffic. Students can experiment with different arrival and service rates and patterns.
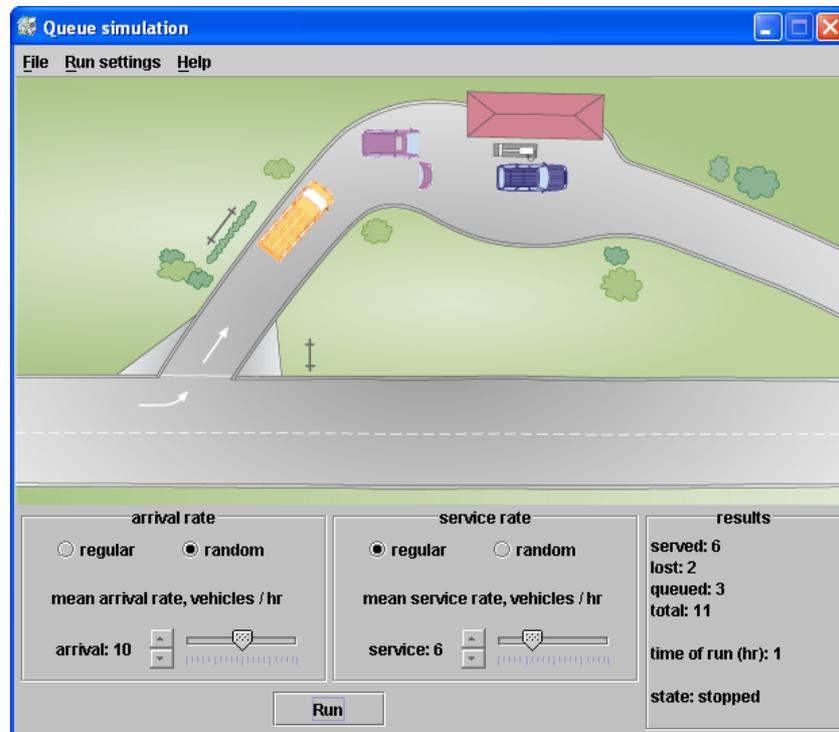

FIGURE 1. Interactive queue simulation software used in Block 4
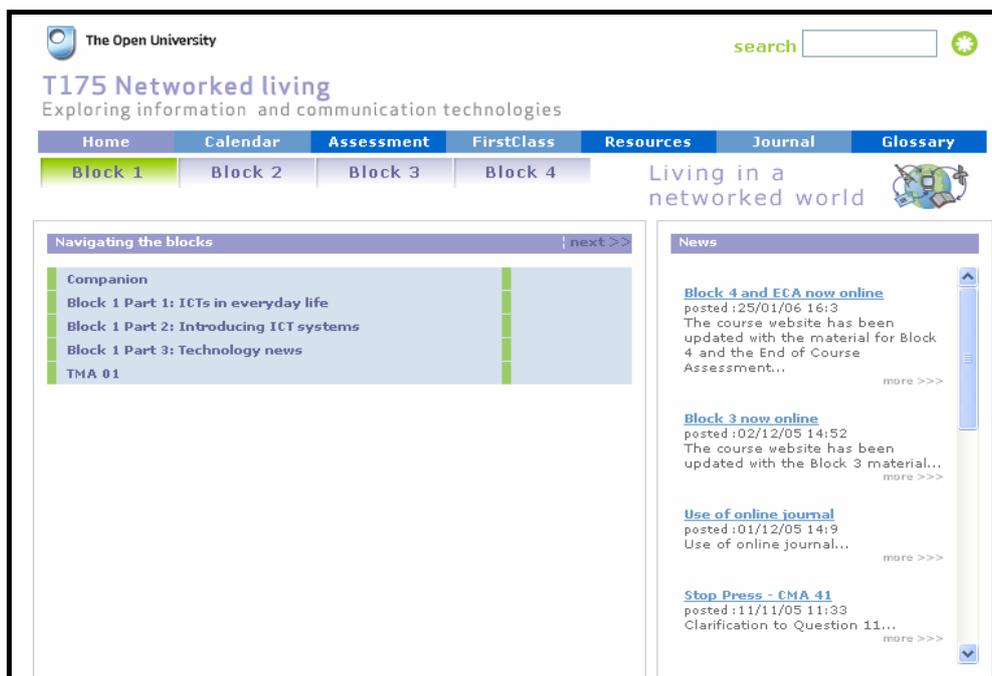
FIGURE 2. The T175 course home page

The course has a comprehensive web site, whose home page is shown in Figure 2. The 'navigating the blocks' area gives access to online course material in html or pdf format, while the upper menu consists of links to other course components, some of which are discussed further below. The regularly updated 'news' area informs students of matters such as the appearance of new online components, corrections and clarifications to course materials, and so on. All the printed components of the course are made available in pdf format, via the course website, for students' convenience and to provide screen reading for visually impaired students. Text descriptions of all figures and animations are also available.

4.   THE ACTIVE STUDENT

Open University students have always been encouraged to be active learners, with printed materials from the earliest days including 'self assessment questions' and various practical activities. T175 has built on this tradition, using current ICT tools. The course uses a great variety of activities to encourage active learning. In both the printed texts and the web pages, exploratory and self-assessment activities are used to help students to engage actively with the material. These activities are often combined with interactive online tasks. One type of the latter invites students to insert their own comments into the body of the teaching web pages, as illustrated in Figure 3. Other students can then view these and add their own responses to each comment.
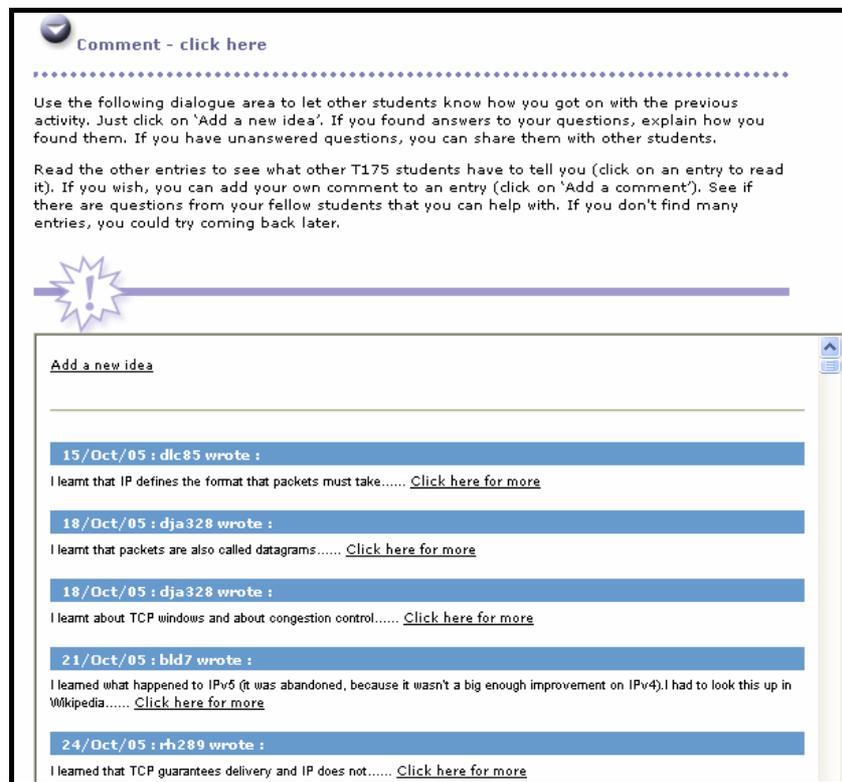
FIGURE 3. An example of active learning: a comment section from T175's online teaching

Another interactive activity within the web pages asks students to complete a quiz on what they have just been studying; Figure 4 shows the first activity of this type, polling students for their general attitude towards technology. After completing such a quiz, students can be given the results of other students' responses so far.

FIGURE 4. An online quiz

Another important component of active learning is the use of spreadsheets, which are employed to support the teaching of numeracy. Students undertake a carefully graded set of activities taking them from first principles to the point where they can construct a spreadsheet of growth and use a logarithmic chart to consider whether the growth is exponential. There is evidence to suggest that students who find conventional mathematical symbolism difficult to understand can cope more easily with the equivalent representation in spreadsheet form [5].

A novel aspect of active learning in T175 is the online learning journal (for a general discussion of learning journals, see [6]). Students are encouraged to reflect upon their learning throughout the course, and to keep records. They can do this in any way they wish – from a handwritten log to a computer-based form. But they are also provided with a purpose-designed tool – the online journal – via the course website. Figure 5 shows the form for creating an online journal entry. Using the journal facility students can record their thoughts on their studies and attach work they have carried out for course activities. They can also choose to share their journal entries with their tutor and other students in their tutor-group. The response of students to the journal facility has been mixed. Some students post detailed information, even – in one or two cases – including their answers and responses to the various activities in the course material. Some students post only a few entries and then stop using the system, while others choose not to use it at all. These interim findings are consistent with experience of a paper-based learning journal in an earlier OU Technology course [7]. Further evaluation is needed to investigate whether having an online version of a journal results in increased student use.

Your Online Learning Journal   Close Journal

Entries | New entry | Selected entries | View shared | Help

New journal entry

Date	04/03/06
Block/Part	Block 2	Part 1
Topic	My first Journal entry for Block 2
Notes	Arial	3 (12 pt)	**B** *I*
	I have now completed Block 1, and have just started Block 2.

Block 1 was a mixture of material in print and on the web, which made it quite varied. I managed to keep up, and submit the assignment on time, so I'm hoping that my mark for the TMA will be OK.

Block 2 is different - the first two parts are all online. Just as well we now have broadband!

I think I should get on OK with the first two parts of this block because I've used the internet quite a bit already. The third part (in print) is about other kinds of networks, so most of that will be new to me. Learning about Wifi will be good. But what's RFID?

I've attached a file to this entry with my work for Activity 1. |
| Action points / Lessons for the future | Must remember that there is an online tutorial for this block. That will be a bit different to the face to face one for Block 1! |

FIGURE 5. The online journal entry page

Active learning can also take place through collaboration [8]. In a distance learning course such as T175 collaboration usually needs to be mediated by technology, and this is where the Open University's computer conferencing system *FirstClass* comes into its own. Each tutor-group, of around 15 students with one tutor, has its own computer conference. This provides a space for students to work together on course activities, discuss ideas from the course, and help each other with any problems. Based on experience from the predecessor course T171 [9], T175 uses the tutor group conferences to host two 'online tutorials': one associated with Block 2 and one with Block 4. The Block 2 tutorial has two elements: an asynchronous discussion of one of the articles used in the block teaching material; and a synchronous 'chat' exploring the pros and cons of real-time communication compared to asynchronous conferencing. The Block 4 tutorial requires each student to evaluate a web site on a health-related topic. Students post their evaluations in the group conference, and use these to carry out a comparative assessment of the various websites. In the assignments for each of Blocks 2 and 4 there is a question related to the online tutorial. This encourages students to take an active part, so that all can benefit from the collaborative work. (See [10] for further discussion of the role of assessment in online collaborative learning).

The preceding paragraphs have attempted to give a flavour of the range of active learning elements in T175. There is ample evidence, via informal feedback from students to tutors, and students' comments in the course computer conferences, that students appreciate the rich mix of active learning in the course. Here is a selection of student reactions.

- Student 1, on an online, resource-based activity dealing with the TCP/IP protocols:

   "Full marks to the Course Team for making this potentially 'dry' topic so interesting. The animations are fun but make the processes clear in a memorable way, as the two computers chat to each other across a virtual network!

   Activity 7 was a simple but inspired twist – not 'read this & make a note of what you learn from it' but 'read this & make a note of what you *don't* learn'! Then go & find out the answers to your **own** questions – not some that the Course Team has thought up for you. Constructivist learning at its best!

   Sharing the outcome of this learning semi-anonymously via the course website's interactive area is a great touch too... invites short on-the-spot contributions, whereas a vague exhortation to go & discuss this in the Tutor Group probably wouldn't have much effect.

   I learned as much about online learning as about TCP/IP here."

- Student 2, on the quizzes:

    "I enjoyed the quizzes etc online in Block 2, and found the safari activities [a generic tutorial on information literacy, developed by the OU Library] both informative and easy to follow. The quiz questions are quite a 'light' way of revising the topic(s) covered and are not very time-consuming (which is always a bonus!)"

- Students 3 and 4, on the online journal:

    "Regarding the journal - I used the online journal quite a lot near the beginning of the course and found it particularly useful for making notes when working online. However, with Block 3 I made most of my notes on paper – it's what I've been used to I guess, but also just as the online journal is convenient when working online, I find the pen and paper most convenient when working from the text books. Either way, I have tried to make notes and have kept my responses to the activities throughout the course."

    "I use the Journal very frequently, as a note taking aid and a place where I can complete the activities. I find it a useful tool as I can look back at the previous study session as a refresher. [...]"

5. SKILLS DEVELOPMENT

Many students coming to study T175 will have been out of the education system for a long time, and they may find it difficult to come to terms with studying again. They need to be supported in developing a range of skills to help them study the course effectively and move on with increased confidence to further courses. Study skills, such as planning their time and reviewing their own learning, are thus an important component of the course. Students are referred to two Open University books - the *Good Study Guide* [11] and the *Sciences Good Study Guide* [12] for further support on a range of aspects of skills development.

Communication skills, in particular, have long been identified as a vital – and often lacking – element in engineering education [13]. Students need to be supported in developing their writing skills and also in using techniques for active reading of different kinds of material. They also need to gain skills in communicating with other people. Increasingly this communication takes place electronically, for example via email, discussion forums or instant messaging. Development of communication skills is embedded throughout the course and explicitly assessed in the course assignments.

The mathematical skills of many British undergraduate students – not only OU students – also require a great deal of remedial attention [14]. This aspect is particularly important if students are to progress to higher level courses. T175 supports students in developing their numeracy skills, and aims to advance them to the point where they can understand and manipulate simple equations.

Finally, as befits a course in ICT, T175 also teaches information literacy skills. This is carried out via a mix of course-specific activities and more generic online resources developed by the Open University to support all its students (see, for example, http://ltssolweb1.open.ac.uk/safari_guests/homeframe.htm). The aim is to develop students as independent learners, who can use online as well as printed material to keep up-to-date in their subject.

6. ASSESSMENT: ACTION AND REFLECTION

Each block of T175 has a tutor-marked assignment (TMA). The TMAs test conceptual knowledge and understanding of the course materials, and often involve students in actively researching a new topic for themselves. In addition the TMAs include questions that require students to reflect on their learning and to comment on some aspect of this. All TMAs are submitted electronically, using a web-based in-house system. Each of Blocks 2, 3 and 4 also has a computer marked assignment (CMA). CMAs are used primarily to assess factual knowledge, numerical work, algebraic manipulation, and spreadsheet interpretation. The TMAs and CMAs together make up the continuous assessment component of the course, with the TMAs accounting for 85% of this component and the CMAs for 15%.

The end-of-course-assessment (ECA) provides the other assessment component, which is equally weighted with the continuous assessment. The ECA requires students to: comment on their work, and the feedback they received, on one of the TMAs; answer questions and carry out investigative activities to demonstrate the knowledge and skills they have developed; work with a published article about an ICT topic; provide evidence from their work on course activities that they have achieved specific course learning outcomes.

7.   WORKLOAD MANAGEMENT

Distance learners have many commitments beyond their studies, and this can cause difficulties keeping up with a course. They may also be studying other courses at the same time, which will add to these difficulties. Problems are more likely to arise in a level 1 course, which may be a student's first experience of university study, and of distance learning. If students fall behind, the quality of their work is likely to suffer, together with their satisfaction level, and they may drop out of the course altogether.

T175 is a 30 UK credit point course, which means that it should take about 300 hours to study. There is a temptation to fill these hours with material for students to read and activities to carry out. It is easy to neglect other aspects students need to spend time on, such as familiarising themselves with the course and attending tutorials. Open University guidelines now suggest that in a 300-hour course at least 60 hours should be available to students for background activities and general 'thinking time'. This leaves 240 hours for the structured learning activities of the course and the course assessment. T175 lasts just over 30 weeks, so structured study time was planned on the basis of an 8-hour study week.

Study Week	Media	Study Session	Content	Link to assessment
1		Companion and 1	**Part 1: ICTs in everyday life** The network society	TMA Q1
		2	Your networked life	
		3	Online activities	
		4	Organising your resources	
2		1	**Part 2: Introducing ICT systems** Describing an ICT system	TMA Q2
		2	Computers	
		3	Computers and communication systems working together	
		4	Presenting information	
3		1	**Part 3: Technology news** Take note	TMA Q3 and TMA Q4
		2	News from the Web	
		3	Learning to learn	
		4	Working with others online	
4			Complete your TMA	

Print   Web   First Class

FIGURE 5. Block 1 study schedule

Block 1 of T175 is half the size of the later three blocks. This is to give students an opportunity to gain early feedback on an assignment. Early assignments have been found to reduce drop-out at the beginning of a course. Block 1 lasts for four weeks, with three weeks allocated for studying the block materials and the final week devoted to completing the assignment, as shown in Figure 5. Blocks 2, 3 and 4 each last 8 weeks, but only the first 6 weeks of each are allocated to studying course material. The remaining two weeks of each block allow students time to review their work and complete the block assignments. T175 culminates in an "End of Course

Assessment" (ECA), rather than an examination, and time is allocated for students to prepare for and complete this assessment.

Each block of the course consists of three parts. This results in a very simple course structure, which fits clearly into a week-by-week study schedule. For Block 1, a week is allocated to each of the three parts of the block, and for later blocks, 2 weeks are allocated. The study schedule for each block is described to students in the Block Companions (study guides), illustrated with diagrams similar to Figure 5.

For Blocks 1 and 2, the study material for each of the three parts is further broken down into 'study sessions'. These are chunks of work which should take a typical student about two hours. Each part of Block 1 therefore consists of four study sessions, and each part of Block 2 consists of eight study sessions. The intention is to give students a clear idea of the amount of work they need to do, and to help pace them through it. Another advantage of chunking the material in this way is that course developers can more easily envisage how much material to allocate to a 2-hour session. This guards against unknowingly overloading the course.

For Blocks 3 and 4 the material is not divided into study sessions. In these later blocks, students are given some guidance on study times, but are expected to plan their detailed study of the block themselves. This is because they need to become used to working with more standard Open University materials, which are not divided into study sessions, so that they can move on confidently to later courses. In Block 3, where there is a considerable amount of computer work, two alternative study routes are suggested, and students can decide whether one or other of these will suit their purposes . Block 4 returns to a more familiar sequential structure.

Throughout the course, students are encouraged to spend time planning and reviewing their study, and Blocks 1 and 2 provide explicit guidance on this. In Block 1 students are asked to plan their study schedule for a typical week, and to take into account anything that may affect this over the period of the course. Block 2 develops these activities further. The assignments for Blocks 1 and 2 require students to comment on their study planning and say what lessons they have learned for the future.

A study is underway to evaluate the success or otherwise of student workload management in T175. For the evaluation of Block 1, 33 students volunteered to complete an email questionnaire, and 26 responses were received (79% response rate). 85% of respondents had carried out the study planning activity, and 68% of them found it useful. The average study times students reported for each week of the block are given in Table 1.

Week	Study task	Average hours spent
1	Studying Part 1	6.7
2	Studying Part 2	8.0
3	Studying Part 3	7.8
4	Completing the assignment	8.0

TABLE 1. Reported study times for Block 1.

It appears that students found the advised eight hours per week study time adequate for completing Block 1. In a typical week about 85% of respondents completed all or most of the study activities. 80% of respondents reported that the workload for Block 1 was as expected or less than expected, and 90% were on schedule or ahead of schedule at the end of the block. All respondents found it useful to have week 4 dedicated to completing the block assignment, with 85% saying that this was very useful. Of the 1675 students who were registered on the course, 1495 (89%) submitted the assignment.

8.   CONCLUSION

Although T175 *Networked Living* is only in its second presentation, it appears that a number of the course team's ambitions have been realised. The 'blended' approach, using an appropriate mix of printed and computer-based material, together with both face-to-face and online tuition, seems to be successful. Anecdotal evidence indicates high student satisfaction, and feedback from tutors (nearly all experienced OU part-time staff) has also been positive.

Potential student retention, as measured by the submission rates of early TMAs, is high. The results of the workload evaluation so far also indicate that the approach to managing student workload is succeeding. Students do not appear to be overloaded by the materials, and they are keeping up with their studies.

Students also seem to be comfortable with the integration of skills development and technical content. This is particularly important in an introductory course such as T175, which needs to prepare students to move on successfully to higher level learning.

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Curricula

Chris Bissell has recently celebrated twenty five years at the UK Open University – first as Course Manager, then Lecturer and, since 1999, as Professor of Telematics. He has written course materials on signal processing, control engineering, telecommunications, ICT, and media studies. His research has concentrated on the history and social context of technology.

Karen Kear is a Lecturer in at the UK Open University. After studying physics at Cambridge University, she worked as a theoretical physicist and subsequently as a software developer. She has contributed to a number of distance learning courses in ICT. Her research interest is computer-mediated communications and she is currently undertaking a part-time PhD in this area.