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e-Learning in the Development of Design Skills and Knowledge at the Open University - Georgina Holden and Steve Garner

Key Words: **Electronic resources, DVD, conferencing, web**

The Open University (OU) has a distinguished track record in distance education. This paper examines the teaching methods and learning outcomes of a new introductory course in design at the OU. which uses a combination of paper and ICT based learning resources to support the development of design knowledge and skills by a wide range of students.

The course enables students of all levels of design ability to develop design skills through their studies. This paper argues that the teaching methods used within the course, demonstrate the potential for e-learning in the design curricula.

The core e-learning resources discussed are a purpose made DVD which presents students with a suite of resources; A flexible learning environment that uses a set of related electronic conferences and a course website. The paper draws on student feedback to highlight the effectiveness of e learning for design education.

Introduction

The Department of Design and Innovation at the Open University has been teaching design for over 20 years. In 2004 a new second level, 60 CAT point, design course was launched as successor to the previous generations of design courses. This course is called Design and Designing, though it is most frequently referred to by its code, T211. Along with a third level course, T211 gains students a Diploma in Design and Innovation, which is recognised as a component in a number of different O.U. degree programmes.

In the past the profiles of OU students have been quite different to those of students in conventional institutions in terms of age, qualifications and intentions. OU students are often motivated to take courses as part of a broader career development, but many take courses for interest rather than employment. However, we have found that on this new course there is a significant increase in students aged 18-25 who view this course as the foundation for a career in design.

In 1996/97 only 1 in 8 (12.5%) of all new student registrations at the OU were from those aged under 25. By 2003/04 this had grown to 1 in 5 (20.1%). The student population on T211 reflects this increase in younger students. If this trend continues it is predicted that by 2010, students under 25 could account for more than a quarter of new registrations (27%) [1]. This increase in younger students can be attributed partly to the attraction of part-time study - the notion of *earn while you learn* and the significantly lower cost of this form of study for the student. Feedback from OU student surveys also suggest that younger students do not have the qualifications to enter an increasingly competitive sector of full-time higher education and they are not deterred by distance learning or the increasing role of information and communications technology in distance education.

Today, universities offering product design education face a dual imperative, to provide vocational training that enables graduates to make immediate contributions to design sector employers, whilst at the same time supporting the development of broader transferable skills to widen the employment options of graduates. Given this dual imperative it is not at all clear that a

[1] Swann W., Feb 2005 Internal Senate Paper on Younger Students Strategy, The Open University pp 1 -13

traditional campus based university, offering a full-time, three- or four-year degree course in product design is the best mechanism for addressing the needs of today's students. Although there are a significant number of students whose needs are best met by an intensive degree course in the shortest time possible there is also an increasing community of students who wish to combine study and employment, who do not want to run up huge debts and who want to develop transferable and marketable skills by building their own degree from what they perceive as relevant courses. Flexibility appears to be important for these students, to allow them to pursue emerging career options. Distance learning offers such students the flexibility they seek but creates interesting challenges for design education, which has traditionally been conducted through face-to-face contact, requiring expensive workshop and studio space in which students can develop skills such as the forming and manipulation of materials.

Use of eLearning within a Blended Learning Programme

The Open University course *Design and Designing*, following in the footsteps of its predecessors, has embraced the challenge of design education at a distance and uses blended learning[2], a combination of print and multi-media resources, to enable students to both to learn about the process of design and designing and to develop design skills. Cameron and Macdonald write about blended learning that it allows;

> *'the flexibility to accommodate the varied demands of particular pedagogies, disciplines and levels of course, and also the needs of a diversity of learners"*

Crucial to the blended learning approach is an understanding of the affordances of the media used and role of the tutor, who has a pivotal role in assisting students with the achievement of their learning outcomes, through their teaching comments on assessed work. The design knowledge and experience of students taking the course is mixed. Some are working in ancillary design roles in industry, others have little or no experience of design and designing. Thus the course starts from the premise that the student has little knowledge of product design or its history.

The development of printed teaching texts is well-trodden territory for academics at the OU. Never the less the creation of the teaching texts for T211 took several person years and involved a highly experienced course team including Prof. Nigel Cross, Prof. Robin Roy and Prof. Chris Earl. Steven Garner, one of the authors of this paper, chairs the Course Team.

The course consists of six printed books, A4 in size, each approximately 120 pages in length. These books adopt a broadly sequential approach taking students from the early stages of design, involving for example, problem definition and writing a brief, through concept design, configuration and component design concluding with detail design and manufacture. The final block takes the form of five case studies of commercial design practice which allow the course team to highlight and reinforce those principles and practices identified and examined in the earlier blocks. Alongside these texts are two modelling workbooks, which set exercises and assist students with the development of design and modelling skills.

The teaching texts are very important as the basis of student learning. However, early on in the development of the course it was realised that elearning could play a significant role in the development of students' understanding and skills. Georgina Holden, one of the authors of this paper took the lead in the development of a DVD to support the Design and Designing course and potentially support other courses offered by the Department of Design and Innovation.

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[2] S.Cameron and J.Macdonald 2003 "The Good Practice Backlash; A review of the literature on blended learning"..SOLACE report no. 1 The Open University Knowledge Network.

An extensive evaluation of existing software and models of multimedia products was carried out to inform and shape the DVD development. Many people were involved in the development of the DVD, however, the majority of work was done by the lead author and lead programmer in consultation with the authors of the course material and an independent video producer. The decision was taken to create a mainly resource based learning environment which would bring information and teaching to the student desktop.

The resulting DVD uses a simple html interface and is structured around the themes of the teaching texts. There are six main themes, Design and Designing, (which includes an introduction to drawing and modelling), User Requirements and the Design Brief, Creativity and Concept Design, Configuration and Component Design, Detailed Design and Manufacture and Design Case Studies.

Fig 1 The Main Menu page showing the main themes of the course and DVD. This menu enables the student to access all areas of the DVD. The navigation has been kept as simple and straightforward as possible and, for usability reasons roll overs and image maps have been avoided.

Each theme has its own menu listing the resources for that particular block of study. These resources are a rich mix of video assets, interactive elements, bought in software and web archives. Use of these resources builds up during the course and becomes increasingly interactive[3]. This strategy enables students both to familiarise themselves with use of the medium and to develop their understanding of design processes before using the full range of electronic resources provided for their design project work.

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[3] **The Impact of Interaction and Integration in Computer Mediated Higher Education**
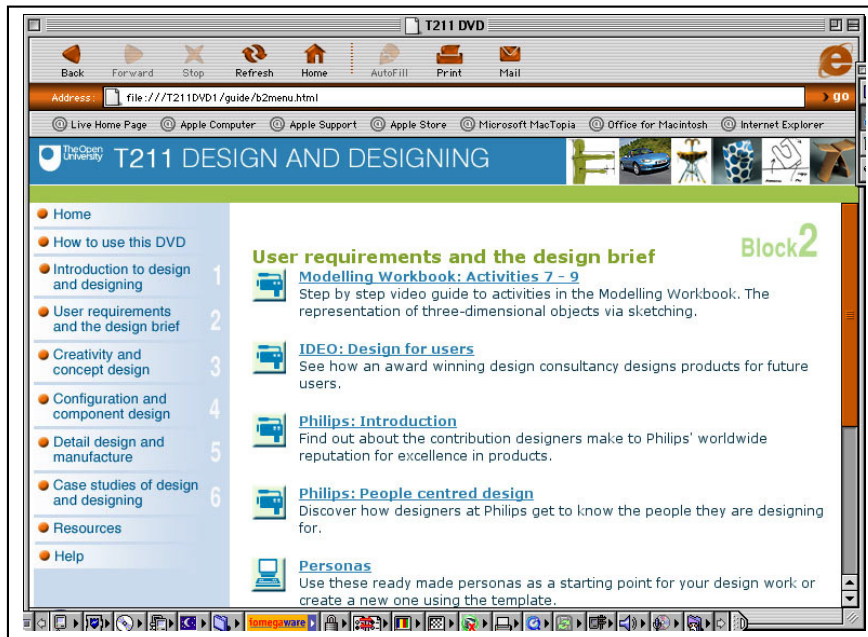
Fig 2 The secondary layer menu for one of the themes. Access to all areas of the DVD is offered in the side bar. Each resource has an icon denoting its nature e.g video, interactive exercise, web archive.

Video as an integral part of the elearning environment

The DVD includes four and a half hours of video footage. Students watch and hear about design practice from IDEO, Dyson, Mark Sanders. There is also footage of students from a conventional design institution talking about their design projects and a short piece introducing ideas of symmetry in housing design. The DVD also includes a Channel 4 video, "Better by Design" from the series showing Seymour and Powell re-designing everyday objects.

In addition to this footage there are two significant new pieces of video. The first of these is an instructional video, which has 50 minutes of drawing and modelling tuition. Steven Garner demonstrates 19 modelling activities which the students have encountered in the printed materials. This enables students to observe techniques being used and helps to overcome some of the potential ambiguity of the printed word. Students who are new to drawing and modelling have found this tuition particularly useful.

The second of these new video pieces is a case study of Philips Design which students encounter in four parts at different points of the course and revisit in its entirety towards the end of the course. This video case study offers students an insight into contemporary design practice and thinking. Philips Design who collaborated with the author to make this video have subsequently allowed the filming further footage which will be used in the third level Design course.

The OU is well known for its video materials but use of the DVD medium opened up new possibilities. The main narrative videos for each block of study are supported by extra in-depth footage and Course Team Comments which are easily accessed from the video interface. Some video pieces also have attached extras such as a PDF of a brochure from Philips Design or pages from IDEO's book "Masters of Innovation".

The DVD format enables the same piece of video to be looked at from different perspectives, for example, a small video case study of IDEO is discussed first from the perspective of user centered design and is later viewed again looking at the creative process. The strength of this approach is that it demonstrates to students how multiple lessons and meanings can be drawn out from the same piece of source material.

To assist students the DVD can also be played on a television using a DVD player using a simplified text interface.

Fig 3   The video interface showing a tree menu that appears when one of the buttons in the side bar is selected, in this case " Course Team Comments."

Diana Laurillard[4] writing about the use of interactive media says:

> *Interaction between the learner and the world is a vital part of the learning process because it is this that situates academic knowledge in our experience of the world. If we are to understand the world, …, if our academic knowledge remains abstract and formal without any meaningful interpretation, then it is useless: it does not enable more effective action in the world, which is the primary value of academic knowledge. The world the learner interacts with is necessarily a teacher-constructed part of the world …. It is the teacher's task to construct the conditions of the learner's interaction such that their experience enables them to learn …. On the basis of that particular experience the teacher can then begin to build general, abstracted descriptions. **The interactive media, i.e. computer-based media, can support the learner in what is otherwise only possible through real-world experience.***

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[4] Laurillard D. 1998 Multimedia and the Learners Experience of Narrative in Computers and Education 31 Pergamon pp 229-42

The use of video as part of the elearning environment enables students to gain insights and understanding into the "world" of contemporary design practice through a consistent and repeatable experience. The design of the interface and the interactivity afforded by the DVD video interface enables students to learn through the exploration of themes that interest them. From a practical viewpoint this part of the elearning environment allows students to replay clips to strengthen and reinforce their learning. The video exercises on drawing and modelling are particularly useful as a way of transmitting 'know-how' in a direct and unambiguous way. The 'print transcript' facility enables students to select appropriate quotes from designers to incorporate into their course work.

Feedback on the video element is very positive. On the previous second level design course satisfaction with video resources was high, 87% of students found the video accompanying that course to be very helpful (43.1%) or fairly helpful. (44.2%). A direct comparison with how students regarded the video on T211 is not possible, but satisfaction with the Design and Designing DVD as a whole is extremely high, 96.2% of students perceiving the DVD as very helpful (70.5%) or fairly helpful (25.7%)[5]. In an informal qualitative survey students made comments as follows.

> "Very helpful - sound and pictures really help me remember the info"

> " … to hear the designers, to get visual as well as audio commentary, provides a needed link. I may not always agree, but at least I am being stimulated to think! "[6]

Interactive Exercises for the development of designerly ways of thinking

To facilitate the development of designerly thinking and design skills a number of interactive exercises have been developed in-house. In the section entitled "User requirements in Design" students can choose from a number of developed personas to inform their design work or they can develop their own persona using a template. They are also given a template to create a user notebook like one which they are shown in a related video piece on Philips Design.

In the section "Creativity and Concept Design" the course team have developed a number of interactive exercises to help students to learn a number of creativity techniques. Each exercise takes students through the technique step by step requiring them to fill in their responses and ideas and building up to generate an idea on a the exemplar topic. The exercises can also be used blank for any topic of the student's choice. Each page of the exercise has audio as well as text instructions and there are more detailed guidelines in a "help" section. This approach assists both visual and auditory learners to gain from the material.

Exercises used in the section on "Configuration and Component Design" allow students to experiment with symmetries and tiling and there is also an exercise introducing the concept of shape grammar in which students choose from a menu of rules and generate patterns based on repetition of a given shape.

Though each of these exercises is relatively simple their value lies in the engagement of the student through interaction. The motivation to complete the exercises comes from the development of ideas or patterns, which can be saved as tangible outcomes of the effort invested.

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[5] Student Statistics 2004 Institute of Educational Technology, The Open University
[6] Holden G., 2004, Making a DVD: The design and designing experience, unpublished seminar paper The Open University Knowledge Network
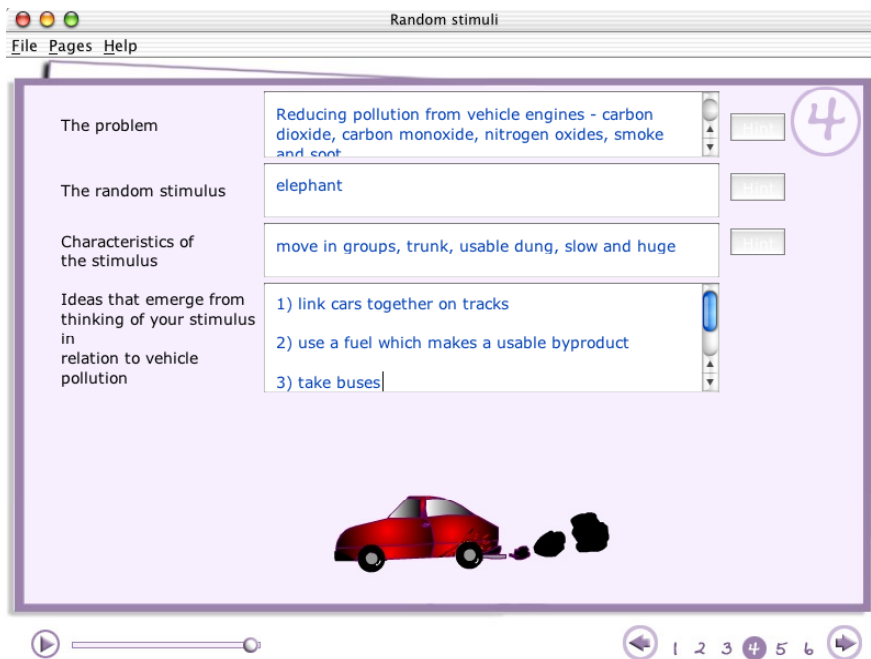
Fig 4   A screen from an interactive exercise on random stimuli. Some of the text is generated from responses to earlier questions, some is added in response to questions on this page. In some exercises course team responses and ideas are shown for comparison.

Distance Design Studio

A significant part of the Resources included on the DVD is the provision of three pieces of software which has been bought in to bring information and capabilities to the student desktop. The main software is a Materials Database, a 3D solid modelling package, and a life-cycle assessment package. There is also a small piece of commercial software, which is designed to stimulate creative thinking. These software tools are used by students for design work, towards the end of the course though they are provided at the outset to enable keen students to familiarise themselves with the programmes early on. To assist students with learning these packages the course team provides printed instructions even though each package has built in tutorials and help facilities. The provision of printed instruction assists the less technically confident.

The CES Materials Database, authored by Mike Ashby from Cambridge University, provides students with a large amount of information to inform materials selection, including some information on the environmental impacts of materials. The interface is reasonably self explanatory but printed instructions are provided to support students. The database contains images and is written in an accessible way which encourages students use.

The SolidThinking 3 D modelling package developed by Evoque is provided to enable students to try out computer aided design. The programme is a fully functioning demo copy which expires at the end of the academic year. A number of tutorials are provided in print, as well as though which come as part of the package. SolidThinking was chosen as it can run on both Windows and Mac platforms and the company were willing to co-operate with the Open University.

Eco-It, developed by a Dutch company Pre, is a life-cycle assessment package which is included to show a worked example of how such software can be used in design. Students can use the

software in their design work on this course and subsequent courses but it demands some time to learn to package so this is optional.

Resources and examples

The DVD also contains two web archives, a selection of Design Council Case Studies and the Helen Hamlyn Centre for Inclusive Design site. The decision to capture web-pages rather than send students to the live site is a pragmatic one, having cloned sites on the DVD ensures consistency of access and enables course materials to be developed around the information. Students are encouraged to look at current versions of sites but the course team can rely on them having base line information and particular product histories.

In addition to all of the above the DVD includes a gallery of designed objects where those products can be turned and examined in virtual 3D. The gallery provides some information about the objects. This is included as a potential source of material for tutor group discussions as well as background information for pieces of assessment.

Integration of materials

As discussed above the course team has adopted a blended learning, rather than pure elearning, approach to teaching design. The electronic resources provided could be used independently of the printed text as an environment in which students can learn and experiment., but the blended learning approach allows greater integration and reinforcement of the ideas and skills taught in the course. The printed text provides an important grounding of design practice in the epistemology of design knowledge in complement to the more experiential approach of the DVD. The context setting and in-depth discussion of the text support the lessons learned through the DVD, whilst the elearning environment of the DVD supports student understanding of the text, bringing it to life. 97. 4% of students rated the printed course materials as helpful, with 83.3% rating the texts as very helpful.

Online elements in the blended learning mix.

In addition to the DVD the course has two online components. The first of these is a website where students can download electronic versions of course materials, and receive news and updates. The ebook facility is considered by many students (78.6 %) to be helpful or very helpful. The ebook is an interesting component. Unlike web pages the PDF of a typeset book is considered to have added value. There are approximately 144 pages in each block of the course, but the ebook facility enables students to search the text and select and copy text and pictures. Students report using this facility to download portions of the text to study when travelling or at work. The perceived value of ebooks points to the use of this approach, rather than lengthy web-pages as a way to deliver large amounts of text online.

The second online element is an asynchronous, on-line, course conference that provides a forum for students to discuss their work and develop an on-line community. The authors' experience is that these on-line environments, are being used increasingly by students, to access and discuss course materials.78.6 % of students surveyed found the course website helpful, and
The course conference, (which uses well established software called "FirstClass"), was rated as helpful by 70.2% of students surveyed, a figure which reflects that some students participate and use this environment extensively whilst others do not venture into it at all. Perhaps the most important role of the on-line environment in the creation of a sense of student community that motivates students to maintain their engagement with the course even when they are struggling

personally or academically[7]. The relationship between perceived usefulness and individual student contributions to the conference is a strong one, students who regularly communicate using this medium see it of much greater value than those who 'lurk' or do not use the medium at all. A parallel situation is seen in the tutor conference for the course where a proportion of tutors use the conference on a regular basis to post and exchange ideas whilst others contribute rarely if at all.

Implications for conventional design teaching

In 2001 Nigel Cross[8] proposed that there was a need for a new model of design education, one suited to a post-industrial design culture. In his paper he suggested that this new model should make design education more accessible, ubiquitous, continuous and explicit. In short it should be more 'open'. The Design and Designing course (T211) has attempted to address this. This course has allowed a wide range of students to develop a sound foundation of *knowing about* design and some valuable participation in the *doing* of designing. The development of this course has been supported by the infrastructure of the Open University and the resources available for video production, software development and web design as well print publishing resources. The financial investment in this course, in particular the elearning components, is large, but the resources and structure created are expected to be robust enough to be used by students for eight years which is the life of an OU course. With around 500 students a year taking the course there are some economies of scale.

The important message for other design institutions is that not all design knowledge needs to be developed in a face-to-face setting. The blended learning approach using printed materials, digital resources and computer mediated communication alongside experiential learning in the studio or even, as like Open University students, in the student's own home, can facilitate the development of both design knowledge and skills. The challenge is to use the media appropriately and to present the student with opportunities to integrate the knowledge and skills acquired in each medium to give them the overall sense of a coherent narrative.

A study conducted by Lawless and Freake in 2001 found that students with a meaning orientation (deep approach) to studying showed more favourable attitudes to multimedia activities than those with a reproducing orientation (surface approach). One of the conclusions of that study was : "..for effective learning it is not just a question of using technology to provide multimedia learning sequences, it is important to develop appropriate ways of studying them." [9] This is a challenge that all institutions face whether teaching at a distance or face-to-face.

A user-centred design approach is crucial for the successful development of an elearning, or blended learning environment. The development of the Design and Designing materials drew on the knowledge and experience of course team members, associate lecturers and, informally, on the views of Open University students. The development of the course meant the acquisition of new ways of thinking about teaching and learning and for some, the acquisition of new skills. There are training implications both for core course staff and part time associate lecturers which

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[7] Kukulska-Hulme *A., 2003* Online and Web-Based Learning: Linking Key Issues to Experience and Research *Research for the National College of School Leadership* by the Open University Institute of Educational Technology

[8] Cross N., 2001 Post-Industrial Design Education, Proceedings of International Congress of Societies of Industrial Design (ICSID), Seoul, Korea pp1-7
[9] Lawless C. and Freake S., 2001 Students' use of multimedia activities in an Open University introductory science course, Journal of Educational Media, Vol 26, no.2, pp117 -141

need to be addressed and new ways of communicating have to be adopted. However our experience shows that the pay-off is an improvement in the quality of student work and more peer learning as students assist each other in the on-line community.

Perhaps one of the most persuasive arguments for using elearning in Design teaching is that remote communication and information delivery are increasingly used in the design profession. On-line collaboration across continents is commonplace and the use of elearning develops not only design knowledge and skills but also skills such as communication and information searching which are useful preparation for the workplace. In the third level design course currently in development it is hoped to take student collaboration one stage further to allow on-line group project work.

Conclusion

The experience of the Design and Designing course team has shown that elearning can be an effective way of teaching large numbers of students about design processes and practices and can also be used successfully to aid skills development. Though it is not a substitute for the personal feedback and guidance given by tutors to individual students it can assist the learning process by enabling rehearsal, repetition and the development of understanding in a way which may not be achieved through printed text and activities alone. To develop successful elearning materials it is important to identify student learning needs and look at the most appropriate ways of meeting these within the time and budget available.

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