THE POTENTIAL OF eLEARNING IN THE SPATIAL INFORMATION SCIENCES
A RESOURCE FOR CONTINUING PROFESSIONAL DEVELOPMENT

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ABSTRACT:

National mapping agencies have at their disposal a number of resources for the continuing professional development of their staff. These range from attendance at full-time University programmes to short in-house tutorials and workshops.
The Dublin Institute of Technology has recently developed an eLearning course in 'Co-ordinate reference systems for spatial information' and piloted it with staff of Ordnance Survey Ireland and the Department of Lands and Surveys, Nicosia, Cyprus.

This paper evaluates the performance of eLearning in the delivery of the pilot courses pointing to its weaknesses and its strengths. The need for considered and careful use of interactive tools such as discussion boards and chat rooms is emphasised as are issues affecting assessment and accreditation. The authors provide an analysis of the time commitment required in the preparation and delivery of eLearning courses in the spatial information sciences and make recommendations as to the choice of appropriate course topics.

1. INTRODUCTION

The Department of Geomatics at the Dublin Institute of Technology (DIT) has developed a distance eLearning course in 'Co-ordinate Reference Systems for Spatial Information' as part of its suite of learning resources for the continuing professional development (CPD) of staff of geographical information (GI) organisations.

The course comprises six themes:

Theme 1 Describing position with co-ordinates
Theme 2 Defining and realising co-ordinate reference systems
Theme 3 Calculation in a two-dimensional Cartesian co-ordinate reference system
Theme 4 From local to global co-ordinate reference systems
Theme 5 Manipulating co-ordinates
Theme 6 Position in Ireland (Customisable)

Theme 6 is customisable to specific reference systems pertaining to a particular country or group of participants.

In order to evaluate the suitability of eLearning as a CPD resource the course was piloted with two groups of participants from the Irish national mapping agency (NMA), Ordnance Survey Ireland (OS*i*). The experience gained from these two pilots (Martin et. al., 2003) was used to modify the course prior to a final pilot with staff of the Department of Lands and Surveys, Nicosia, Cyprus at the beginning of 2004.

2. COURSE CONTENT

Participants had the option of following the course either on- or off-line as all content was reproduced in a CD-ROM and printed as hardcopy, both of which were provided to participants at a one-day pre-course workshop. All participants were brought together with the course tutors at this workshop for the purpose of:

- meeting other participants and tutors

- receiving off-line content material
- receiving the course guide and handbook
- obtaining login and password codes
- familiarisation with the on-line course environment (in the case of DIT eLearning courses – WebCT).

Course content was created using Macromedia® Dreamweaver® v2.0 for the html content off-line. Multiple html files were then compressed using standard zip tools and uploaded to WebCT® using its 'File Management' interface, which also included an 'unzip' function to extract the html files, once uploaded.
In total 82 html files were used, the majority of which included an animated graphic, which consisted of a series of sequenced frames (GIF images), which could be navigated via an animation control applet developed in Javascript®. The animation control allowed the learner to view the animation at his/her own pace and as often as required. The GIF images (930 in total) were generated using a combination of Adobe® Illustrator® v9.0, and Macromedia® Fireworks®v2.0.

The frames of the animation were, however, in two dimensions. Feedback from the pilot participants, pointed to the need for comprehensive three-dimensional animations as opposed to a series of two-dimensional frames. Co-ordinate reference systems are essentially three-dimensional concepts, particularly in the case of global datums. In order to attain a thorough understanding of their principles participants felt that they would benefit from a facility to manipulate a three-dimensional model dynamically.

The textual content was interlaced with hyperlinks to a glossary of technical terms and definitions. This feature was welcomed by participants but some felt that the explanations were not sufficiently fundamental and that a knowledge of even the most elementary concept should not be presumed.

It is the experience of the authors, therefore, that content relating to complex definitions of principles should be fundamental and elementary in nature. Through the imaginative

use of a glossary the main text can be maintained at a level to suit participants familiar with fundamental concepts while allowing the less experienced participants to explore such concepts through pop-up glossary content.

Graphic illustrations work best when three-dimensional in nature and where the user can manipulate the illustrations through appropriate navigational controls to explore the concept thoroughly.

3. INTERACTION

Students and course tutors interact within WebCT through:

- Discussion board postings
- E-Mail
- Chat Room
- Calendar

In each pilot course the discussion board and e-mail were used extensively, particularly for course announcements and the dissemination of additional reference material by way of attachments to messages. Such tools function well and are easy to use.

Pilot course participants followed the course over a six-week period covering one theme per week. They checked discussion postings and mailings on a daily basis. Course tutors gave an undertaking to respond to messages within twenty-four hours. This proved difficult to sustain particularly in the case of pilots coinciding with a busy domestic workload.

Students of eLearning courses, particularly distance courses, require and expect effective feedback to problems and queries. Designers of eLearning courses, therefore, must factor sufficient time per theme for monitoring and responding to student queries – in the authors' experience this amounted to two to three hours per theme.

The effective use of the chat room for interaction between students and tutors is more demanding than the discussion board and e-mail tools. In the case of the three pilot groups, very few participants had used a chat room previously. In the initial two pilots the chat rooms were offered as an open discussion forum without structure. This proved to be unsuccessful. Participants who logged into the chat rooms did not have access to chat content up to that point in time and thus were faced with an empty room. This, coupled with a natural reluctance to use the tool, usually resulted in their logging out of the room.

In the third pilot, however, participants received a discussion board posting two days prior to the chat session, in which the topic to be discussed was introduced. This system proved to be very successful and, provided a set of rules were established to regulate the flow of the many contributions from participants and tutors, effective discussions were enabled.

The chat room tool was also used to conduct an on-line tutorial in two-dimensional co-ordinate transformations. It was used in conjunction with a previously available set of lecture notes in the form of PowerPoint lecture slides (pdf format) and an interactive whiteboard tool on which both tutor and learner could create and annotate illustrations.

To properly conduct such a tutorial, however, it was necessary to prepare thoroughly in advance to ensure that all participants had access to the necessary material and to clearly design a logical sequence through it. It is, though, the experience of the authors that effective tutorials can be delivered in this way and that significant value is added to a distance learning course by so doing.

4. EVALUATION AND ASSESSMENT

A series of self-tests was incorporated in each theme of the pilot courses in the form of multiple choice questions (MCQs).

Participants reported mixed reactions to this feature. Some found them useful while most, however, felt that they were unnecessary and did not use them concentrating instead on the preparation and submission of assignments. From a course designer point of view MCQs are limited by the difficulty in composing sufficient non-trivial incorrect answers to adequately test the student.

Question	Possible answer	Possible answer	Possible answer
Geodetic co-ordinates and astronomical co-ordinates are examples of geographical co-ordinate reference systems. Which of the systems requires the choice and location of a reference figure?			
	astronomical co-ordinate reference system	geodetic co-ordinate reference system	
In the case of a geocentric Cartesian co-ordinate reference system based on planet Earth, the origin will be located at			
	the implied centre of mass of planet Earth	a convenient local reference point	the centre of the best-fit reference figure
In the case of a geocentric Cartesian co-ordinate reference system based on planet Earth, the Z-axis will be aligned			
	vertically	with the direction of North	parallel with an agreed axis of Earth rotation

Table 1. A selection of multiple-choice questions (MCQs) together with possible answers from Theme 1 of the DIT eLearning pilot course 'Co-ordinate reference systems for spatial information'.

At the end of each theme participants were required to download, complete and submit a written assignment. Two of the assignments were designed as group assignments for the purpose of bringing participants together online using the various interactive and communication tools available. In addition to these tools, participants also used their own e-mail and telephone communication facilities.

Feedback from course participants indicated that, where assignments lead to an awarded grade, they would prefer to work individually. In this way they have more control of their grades and are not as susceptible to problems of breakdowns in communications or an imbalance in the contributions of individual group members.

Participant feedback also indicated a degree of surprise at the standard expected of them in assignment submissions. They initially expected assignments to be solely based on content

covered in a particular theme. However, the assignments set required extra research and it was felt that insufficient time was available for adequate submissions. In the experience of the authors, therefore, assignments should be carefully designed and a single assignment submission at the end of the module would yield a fairer assessment of a participant's understanding rather than weekly submissions, which tend to be rushed and limited in quality.

It is essential that feedback is given to students as soon as possible following submission of assignments and this in the authors' experience, is not possible where a submission is received at the end of each theme.

Of course it is not necessary to include assessment of assignments in distance eLearning courses. Indeed the authors envisage a regime whereby participants could choose from a range of options: from merely following a course without assessment to completing and submitting assignments which could then lead to an accredited award such as a credit allocation from the European Credit Transfer Scheme (ECTS). This latter option will allow staff of GI organisations to accumulate credits from a number of courses, which might ultimately lead to a higher educational award.

5. GENERAL EXPERIENCE OF DISTANCE eLEARNING

The generation of content suitable for the efficient learning of complex concepts is time consuming. In the authors' estimation, approximately thirty hours preparation is required for one hour of student on-line study (Mooney et. al., 2003).

Material must, therefore, be re-usable in other courses or educational resource. Courses should have a long 'shelf-life' in order that they can be used over a period long enough to recover some or all of the creation costs.

Participants of the pilot courses felt that distance eLearning represented a very effective means of updating their knowledge and continuing their professional development, particularly where no other form of CPD resource existed or was convenient.

They felt the learning experience was a good one provided that feedback was forthcoming from course tutors in a timely manner.

Tutorials covering complex concepts are possible through the use of communication tools provided they are well prepared and structured.

Assessments should lead to an accredited award and students should be given sufficient time to prepare submissions. Group based assignments are difficult to realise and the gain to the learning experience is marginal while grades accruing can be affected by factors other than a student's knowledge.

6. CONCLUSIONS

It is the experience of the Department of Geomatics at DIT that distance eLearning represents a valuable resource for the CPD of staff in GI organisations. The range of technology developments and changing user requirements, however, require educational resources to be available in a spread of GI topics.

Collaborative development of eLearning resources between competent educational establishments through a co-ordinated approach will offer the most effective means of providing these resources economically and as required.

The authors look forward to such developments and welcome the continuing efforts of Commission 6 of ISPRS, Commission 2 of FIG and the EduServ series of EuroSDR.

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