THE POTENTIAL OF DISTANCE E-LEARNING IN THE SPATIAL INFORMATION SCIENCES – AN EVALUATION OF A PILOT PROGRAMME AT THE DUBLIN INSTITUTE OF TECHNOLOGY

Kevin Mooney, Audrey Martin

ABSTRACT

The authors describe a pilot course in 'Co-ordinate and reference systems for spatial information', delivered via the Internet, to staff of the Irish national mapping agency, Ordnance Survey Ireland (OSi). The pilot represented the first course delivered by the Dublin Institute of Technology (DIT) via the medium of its newly installed WebCT® E-Learning system. The aim of the pilot project was to evaluate the suitability of a distance E-Learning environment for the continuing professional development and skills update of personnel in large distributed organisations in the field of spatial information science. The project represented a joint endeavour between DIT and OSi, and relied heavily on feedback from course participants and OSi management. The process, from both the choice of selection criteria and the selection of the pilot group, through course design and implementation, to final evaluation via participant feedback, is described in detail. The pilot course was successful, and points to the potential of E-Learning in scientific subjects as a resource for the continuing professional development of staff of large distributed organisations independent of place or time, and without significant losses in production. However, the development of suitable content is enormously time consuming and requires the support of a dedicated learning technology team. The next phase of the project will concentrate on using the extensive tools of the WebCT® E-Learning system to enhance the learning environment for the participant. The importance of achieving a sense of 'class-group' amongst the participants, some of whom may be the only participant in their workplace, represents a significant challenge. The authors suggest potential solutions to this challenge.

KEYWORDS
E-learning, distance learning; WebCT®, geomatics, spatial information, co-ordinate reference systems

INTRODUCTION

In this, the 21st Century, the traditional role of universities is changing. Learning programmes are becoming more flexible for whole-time students, while additionally responding to the needs of education in the work place and promoting life-long learning for all students. The Dublin Institute of Technology (DIT) is committed to facilitating these changes to ensure accessibility to all students. DIT is keen to evaluate the concept of 'virtual campus' learning environments and, with this in mind, has embraced E-Learning as a new learning and teaching medium, recently adopting WebCT® (Web Course Tools) as the Institute's E-learning platform. To evaluate the potential of this medium a number of diverse E-Learning pilot projects were launched in January 2002. This study describes one such project in the field of spatial information science.

The primary aim of the project was to evaluate the suitability of E-Learning for continuing professional development (CPD) of professionals in industry, and specific objectives were set as follows:

- To gain experience of the E-Learning medium
- To evaluate the potential of E-Learning in CPD and skills updating

- To quantify the time/cost implications of the creation, delivery, and administration of an E-Learning programme
- To compare E-Learning with more traditional mediums of CPD education in terms of knowledge transfer and the learning experience

The project was focussed on the needs of personnel working in a large distributed spatial information organisation who need to update their skills but for whom the traditional university style courses are often impractical. It was designed to include the following elements:

- Liaison with other institutes to share their experience
- The design of a short course in a subject area relevant to spatial information science
- Engagement with a major spatial information organisation which would agree to provide a group of participants willing to undertake the course on a pilot basis, and provide the authors with feedback
- Delivery of the course through the medium of WebCT®
- Organisation of a structured means of obtaining feedback

Agreement was reached with the Irish national mapping agency, Ordnance Survey Ireland (OSi), who provided a group of 'learners' to undertake the course on a distance learning basis via the Internet, and the subject chosen was 'Co-ordinate and reference systems for spatial information'

Many national mapping agencies (NMAs) around the world have redefined their national co-ordinate and reference systems to make them compatible with emerging technologies. As a result, there is now a pressing need for staff in such organisations to upgrade their skills and E-Learning represents a possible means of achieving this end.

In recent years, OSi has implemented considerable change in digital mapping technologies, and now uses global navigation satellite systems (GNSS), digital photogrammetry and Geographical Information Systems (GIS) on a routine basis.

OSi headquarters are situated in Dublin City, and it operates a number of regional offices throughout the country. It has established a permanently operating active GPS (a global navigation satellite system) network and devised and implemented a new national map grid co-ordinate reference system – ITM (Irish Transverse Mercator). Therefore, the subject matter of the pilot course was seen by OSi as being very relevant for its personnel who now manage spatial information in significantly more co-ordinate reference systems than was the case up to quite recently.

It could be argued that the large number of existing Internet sites dedicated to the subject of co-ordinate reference systems for spatial information could be used by NMA staff to update their skills in a specific area. These sites range from simple well-structure lecture notes (Dana, 1995) to expensive online courses by individual software vendors (ESRI, 2002). However, they are often so subject-specific that they do not address the varying needs of NMA staff. Furthermore, as the majority of online courses are vendor driven they usually do not provide recognised CPD programmes and are therefore of limited use to the geomatics professional.

Most professional institutions, such as the Society of Chartered Surveyors (SCS) and the Royal Institution of Chartered Surveyors (RICS) require members to complete a mandatory number of CPD hours to retain membership (RICS, 2002; SCS, 2002). However, the CPD on offer by these professional bodies is generally unsuited to the vast number of members as it takes the form of evening lectures and/or one-day seminars which are based in one geographic centre. Thus, maintaining professional and corporate membership of such organisations can become a problem. The International Federation of Surveyors (FIG), which represents Geomatics disciplines in over one hundred countries, is currently promoting E-Learning and Virtual Academies as a resource, which may provide a solution to the CPD requirements of their members (FIG, 2002).

In the past, the Department of Geomatics at DIT has provided CPD programmes in the spatial information sciences for large organisations on a request basis. Such programmes were generally undertaken on a whole-time short-duration basis (e.g. intensive one-week sessions), whereby participants were granted leave from their organisation for the duration of the programme. However, it was found that this method of updating skills was not sustainable for the majority of organisations, as it required professionals to attend classes during the working week when they are normally occupied in the office. Furthermore, as classes were concentrated in one geographic location, usually Dublin, access was difficult for people from other locations.

The authors felt for some time that the Internet offered realistic possibilities for facilitating the CPD of industry personnel that heretofore could avail of only limited opportunities due to the dual constraints of time and location. However, it was recognised that, whereas the Internet would provide a means of making CPD resources available, it was important to identify constraints and limitations pertaining to the medium. The Department of Geomatics at DIT has a long established working relationship with OSi and has designed the pilot E-learning course in a manner tailored to suit both the OSi needs and CPD requirements.

The pilot course, which is intended to facilitate learning on a part-time basis without the need to leave the working environment, comprised the main part of the current E-Learning project, and was followed by a post-pilot feedback workshop to evaluate its performance.
Section 2 of this paper describes the methodology of the project; Section 3 discusses the performance of the project, drawing particularly on feedback received from the participants; and Section 4 draws conclusions and makes recommendations for future E-Learning courses in the spatial information sciences.

METHODOLOGY

In September 2001, DIT invited applications from interested Institute staff for funding (in January 2002) for innovative projects aimed at evaluating E-Learning as an educational resource. Interestingly, the current project, which was successful in attracting funding, was one of only two from a total of nine successful projects dealing with CPD for industry – the other seven successful projects evaluated the use of E-Learning at undergraduate level. In each case, E-Learning was used to augment existing taught programmes, and to encourage more self-learning on the part of undergraduate students.

The current project was designed to include the following elements:
- A short course entitled 'Co-ordinate and reference systems for spatial information'
- Engagement with the Irish national mapping agency, OSi, who agreed to provide a group of participants willing to undertake the course on a pilot basis, and provide the authors with feedback
- Delivery of the course, as a pilot, through the medium of WebCT$^®$
- Organisation of a structured means of obtaining feedback

The Learning Technology Team
In addition to the provision of funding for research projects, DIT further underpinned its commitment to E-Learning through the establishment of a dedicated learning technology team (LTT), whose principal function was to support the development and provision of E-Learning programmes by the Institute.

During the current project, members of the LTT carried out the following tasks:
- Design of the course homepage and interface
- Creation of a User ID and password list
- Authoring of Javascript$^®$ for interactive control of the illustrations
- Encoding of multi-choice questions (MCQs) provided by the authors
- Technical support, including regular course back-up

The Pilot Course

Objectives of the Pilot Course

The objective of the pilot course was to evaluate the experiences of a group of personnel from OSi to permit:

- a value judgement on the effectiveness of E-Learning
- the identification of shortcomings in the content offered
- an assessment of the quality of the learning experience for the individual participant.

Participants in the Pilot Course

The authors worked closely with OSi in selecting the participants for the pilot course. In all, fifteen participants were chosen. It was felt that a greater number than this might cause difficulties in achieving adequate learner/teacher interaction. Participants were chosen by OSi with the following criteria in mind:

- A number should be based in the regional offices
- At least one of the participants should be the sole participant from his/her particular location
- At least two participants should be chosen from the same regional office
- A group of more than four participants would be chosen from one location.

These criteria were set in order to evaluate the influence of peer support, peer distraction, and group work during a distance learning programme. OSi agreed to set aside three hours per week for each participant in the pilot to follow the course on-line from his/her work place.

Each participant was issued with a WebCT® User ID and password by the LTT one week prior to commencement of the pilot, and was invited to attempt to log on to the DIT WebCT® server. During this period, it became evident that OSi personnel were blocked by their network security restrictions from accessing the DIT WebCT® server. The OSi IT department provided the necessary access when requested, but it is worth noting that such a problem is typical of any large IT network, and should be considered during the lead-in period to an E-Learning programme.

All participants then attended a one-day pre-pilot workshop in DIT where they were

- provided with course materials, comprising technical papers and course notes
- introduced to the WebCT® environment
- given instruction in the requirements of the pilot in relation to assignments, self-tests etc.

The Learning Medium

Within WebCT®, content is organised as a series of hierarchically numbered html pages, which function as they would directly in an Internet browser. WebCT®, however, automatically adds an 'Action Menu' to each page, which can be customised to a certain extent by the course designer (Figure 1), and which permits the learner to quickly become accustomed to navigating through the content pages of a particular theme of the course.

A further, higher level, customisable menu is available to the designer on the left side of the screen, and was used in the pilot course for navigation between themes and to the homepage, discussion board, mailroom, and assignment pages.

Module 4. From local to global co-ordinate reference systems

4.2 Geodetic datums

A geodetic datum establishes the relationship between a co-ordinate reference system and planet Earth. The terms 'co-ordinate reference system' and 'geodetic datum' are sometimes used to describe the same thing. Whereas, however, a co-ordinate reference system establishes the means by which position will be described (e.g. three-dimensional Cartesian co-ordinates), a geodetic datum ties the system to planet Earth by defining the origin and orientation of the reference system to the real world.

Figure 1. A typical content page of the DIT E-Learning pilot course 'Co-ordinate and reference systems for spatial information' showing the Action menu

Content

The content of the pilot course 'Co-ordinate and reference systems for spatial information' was divided into six themes, and each theme was revealed to the participants on a phased basis, together with assignments. One week was allotted to each theme, and the number of hours spent by participant per theme and per page was logged by the authors, using the 'Track Student' function of WebCT®. The total and average on-line times spent by each participant in accessing course content is summarised in Table 3.

Table 1 illustrates the theme structure of the course. Themes 1 to 5 of the six-theme course are general in nature, and were designed in order to fit into a distance learning programme delivered internationally, while Theme 6 relates to the co-ordinate reference systems in use in a particular country.

Table 1. The six themes of the DIT E-Learning pilot course 'Co-ordinate and reference systems for spatial information

Theme	Title
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

Theme content consisted of html pages, each of which followed a standard format. Navigation was not included in the html content created by the authors, as navigation is available in all pages through WebCT's® 'Action Menu'.

The authors used Macromedia® Dreamweaver® v2.0 to create 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® by the LTT. 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.

Assessment

WebCT® offers a number of tools for the assessment of the progress of a course participant. In the pilot course, the authors used two of these tools, namely 'Self-Test' and 'Assignments'.

Self-tests consist of multi-choice questions (MCQs) and represent a very useful aid to the learner in confirming understanding of a topic. An immediate response is automatically generated as to whether the answer is correct or incorrect. MCQs need to be well designed and ideally each potential answer should be equally plausible. Examples of MCQs used, together with the correct and alternative answers, are shown in Table 2.

Table 2. A selection of multiple-choice questions (MCQs) together with possible answers from Theme 1 of the DIT E-Learning pilot course 'Co-ordinate and reference systems for spatial information'

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

The assignment associated with Theme 2 was designed as a group assignment, and each course participant was paired with a participant at another location. They were required to consult on the assignment brief; divide the work between them; undertake the task; exchange responses; and compile and submit one joint document. To this end, they made use of WebCT's® internal mail and discussion board tools. Each of these tools is intuitive to learn and permits the attaching of files in the normal way. Communication between participants and the course designers used a mixture of the discussion board and E-Mail tools.

The participants, on an individual basis, completed each theme of the course with the submission of a written assignment. The submission of each assignment was facilitated through the WebCT® 'Assignments' tool and proved problem free. The course designers then graded the assignments off-line and posted the grade with comments, individually in each learner's personal user area.

Post-Pilot Workshop

On completion of the pilot course, a post-pilot workshop was convened at DIT. Course participants were invited to meet with the course designers and the LTT and provide DIT with their evaluation of the performance of the pilot course. This stage of the project was designed to identify shortcomings in the pilot course, and highlight those areas where improvements could be made. Feedback from the participants would comprise the main data from which the authors could ascertain whether the objectives of the project, as outlined in Section 1, had been achieved. The substance of the participant feedback and the main issues raised are summarised in Section 3.

RESULTS

In order to ascertain if the project objectives had been achieved, the authors applied both quantitative and qualitative analysis of the performance of the pilot course. WebCT® offers a number of tools

through which the on-line time used by a course participant may be tracked. These tools were used for the quantitative analysis of the performance of the pilot course.

Quantitative Analysis of the Performance of the Pilot Course
From a total of fifteen learners, only seven submitted all assignments. This had been anticipated, as the assignments were not graded for the purpose of attaining an accredited qualification, and the grade given to each participant was for the purpose of familiarising the course designers with the WebCT® grading process. All but one participant, however, followed the on-line material for all themes.

Table 3 summarises the number of hours spent on-line by participants, amounting to 171.5 hours in total, and the number of hours required by the course designers for content generation, amounting to 335 hours in total.

Table 3. Details of hours spent by designers (preparation time) and participants in the case of the DIT E-Learning pilot course 'Co-ordinate and reference systems for spatial information'

Theme	Preparation Time (hours)*	Total hours student access	Number of students	Hours accessed per student	Ratio (Preparation/Access)
1	106	81	15	5,4	19,6
2	68	45	14	3,2	21,3
3	44	15,5	14	1,1	40,0
4	44	16	14	1,1	40,0
5	43	10	14	0,7	61,4
6	30	4	14	0,3	100,0
Total	335	171,5	14	11,8	28,4

*Including an estimated thirty hours for the incorporation of additional tools in the planned second pilot course

An examination of Table 3 leads to the following observations:
- Content preparation requires a significant time commitment on the part of course designers.
- The number of hours per theme spent on-line by course participants decreased as the course progressed. On the one hand, this was due to the nature of the subject matter covered in each theme, and on the other hand, an increase in familiarity on the part of the participant with the learning environment. It is also the case that many participants printed the on-line content for off-line study, particularly in the case of the second and subsequent themes.
- The ratio of preparation hours to on-line study hours was calculated to be 28.4. It must be said, however, that the authors had considerable prior experience with web authoring and graphics illustration tools. In addition, the LTT were proficient in developing interactive applets, which allowed the efficient creation of the animation control panel used throughout the course. In order to maintain this ratio at an approximate value of 30, comprehensive training in web and graphics authoring tools, together with the back-up of a dedicated learning technology team represent essential pre-requisites to the economic design of successful E-Learning programmes.

Qualitative analysis
Qualitative analysis was addressed in the form of a post-pilot workshop, during which, course participants were asked to complete an anonymous questionnaire, designed by the course designers and the LTT, and to engage in a free discussion covering any subject matter which they regarded as relevant to their participation in the pilot.

Course Content
Course content was considered by the participants to be satisfactory, even though it did presume a basic knowledge base, which might have been lacking in some participants.

Most participants were of the opinion that the content would have benefited by adding pop-up glossary definitions of all technical terms. The course designers had identified this issue during the design phase. However due to time constraints it was not addressed during the pilot study, but a glossary of pop-up definitions will be included in future courses.

Furthermore, participants felt that worked examples of all calculations were essential. They also felt that the learning methodology could be enhanced by introducing online demonstrations of related technology, such as, for example, a video link of the operation of a GPS receiver or a photogrammetric workstation, concentrating on the role of co-ordinate reference systems in their operation.

In general, the interactive graphic animations were well received, although, in some cases, more text would have been preferred. Participants indicated, however, that the graphics illustrations presented in this manner were successful in imparting complex concepts that would otherwise have been difficult or impossible to convey.

Although an outline of the course structure was provided to participants in advance of the pilot course, a major limitation identified at this stage was the lack of course content in either hardcopy or CD-ROM form. It had been the intention of the course designers to provide a CD-ROM version of the course content at the pre-pilot workshop. However, due to an underestimation of the time required generating the on-line content (see Table 3), the participants received the CD-ROM and reference material on completion of the pilot course. Participants of future courses will receive this material prior to course commencement.

Almost all participants felt that this would have greatly enhanced the learning experience, allowing off-line study at the work place or at home to augment the on-line interaction and assessment. Many participants printed the course content pages to serve as reference material for off-line study when necessary.

The E-Learning Experience
The pre-course workshop was generally perceived as a good introduction to WebCT® and E-Learning as a study environment. Participants felt that they had been provided with sufficient information to login from their remote work places, and had become familiar with the nature of the graphics and textual elements of the pilot course.

The workshop also facilitated an introduction to the course designers and other course participants. This was anticipated to be valuable, as once the course began participants could feel isolated in following the course from their workplace. The course organisation was considered to be satisfactory by all participants. However, an unforeseen break of three weeks in the middle of the course led to difficulties for some participants in remaining engaged with the subject matter. Many found it difficult to reapply themselves after the break.

Online interaction amongst participants was generally good during group assignments and general discussions. It was found, however, that the internal E-mailing system of OSi was used more frequently than the discussion board in WebCT® because participants were more familiar and comfortable with this mode of interaction. What was of significance here is that participants did not resort to exchanging telephone numbers. The contact remained computer based thus further indicating that IT communication for the purpose of learning can be considered a successful medium.

Some participants would have liked more feedback relating to their assignments with a critical analysis of the work done. This level of feedback was not intended in the first pilot course, but will constitute a fundamental element of a second pilot course due to commence in February 2003. Participants felt that the use of MCQs was beneficial to their learning, although it is interesting to note that the most difficult aspect of designing MCQs often proved to be designing appropriate incorrect answers.

Participants were critical of the amount of interaction between participants and course designers, which they felt was inadequate for such a technical subject. It was felt that a mid-term tutorial/workshop to augment the on-line study would be of benefit. It is, indeed, the case that this communication between participants and course designers was poorly structured in the first pilot. A posting from a learner might not raise a response from the course designer until a day or two had elapsed due to the pressure of normal day to day commitments.

This unsatisfactory situation will be remedied in future courses by designating a specific period during the life of each theme when the course designers will be available for immediate response to queries.
The authors feel that this will encourage more learner/learner interaction via the discussion board, as all participants will be on-line at the same time. Indeed future courses are seen by the authors as consisting of content which will be studied largely off-line using a CD-ROM and hardcopy, and interaction with other learners and teachers in concentrated on-line sessions.

For the purpose of this pilot the basic structure and design of the WebCT® software interface remained, for the most part, unchanged (some small alterations were made to put a geomatics stamp on the interface), and from the learner point of view, it proved to be intuitive and easy to master without undue time required gaining proficiency. From a course designer point of view, WebCT® proved easy to learn and use, although procedures for loading and organising content were cumbersome and would benefit from the use of 'drag and drop' technology. Although the course was not graded, assignments were completed in the allotted time by most participants. However, it was felt that time constraints in the work place, and the fact that some assignments were found to be more onerous than others, made the submission of all assignments difficult. Facilities in the OSi regional offices were generally considered by the participants to be satisfactory in terms of hardware and Internet access. However, the main problems experienced related to the finding of time to work online during a busy work schedule.

Most participants experienced some distractions during their study time and tried to accommodate learning during short time slots when they were 'not busy'. In the case of a number of participants who were the sole representatives of their particular work locations in following the pilot course, distractions often proved significant. If consistent on-line learning is to take place it is imperative that a dedicated 'learning' time slot can be set aside during the normal work schedule. One participant in a regional office had the use of a training room with Internet access and found this to be invaluable in terms of continuity of learning.

The Potential of E-Learning for Skills Update and CPD
In general, participants believed that the E-Learning medium suited the spatial information sciences, and that the principles of Co-ordinate and Reference Systems were well presented in WebCT®. A number of participants from regional offices pointed to the fact that they had been unable, in the past, to avail of CPD courses due to their remoteness from course venues. They were strongly of the opinion, that distance E-Learning represented a CPD resource that had proved its worth in the current pilot, and one that they would enthusiastically utilise in the future.

Time and Resource Implications of E-Learning programme Development
In the opinion of the authors, the generation of suitable on-line course content required the bulk of the time needed to bring the DIT E-Learning pilot course 'Co-ordinate and reference systems for spatial information' to pilot stage. A number of changes will be made to the content based on the feedback received from the pilot course participants. The bulk of the content will, however, remain unchanged and, therefore, the same time commitment will not be required for second and subsequent deliveries of the course.

It is the intention of the authors, however, to build more extensive interaction features into the second pilot course, and to design all assignments for group working. In addition, concentrated learner/teacher interaction sessions will be scheduled in a structured manner during each theme of the course. It is anticipated that such developments will require an increased time commitment from the course

designers during the lifetime of the course, and this commitment will be evaluated on completion of the second pilot to be delivered to a further group of OSi personnel in February 2003. The LTT played a fundamental role in the design and delivery of the first pilot course and, in the opinion of the authors, such a team is an essential component in the implementation, by a large institute of education, of a successful E-Learning resource.

CONCLUSIONS

The DIT pilot E-Learning course, 'Co-ordinate and reference systems for spatial information', has confirmed that distance E-Learning is an appropriate and potentially effective medium for the continuing professional development of professionals in the spatial information sciences. However, the preparation of course material proved to be enormously time consuming and required approximately thirty hours preparation for each one hour of on-line student time. In addition, course preparation and delivery requires the continuous support of a dedicated learning technology team.

Future E-Learning courses for CPD should consist of off-line study of pre-supplied course materials with concentrated sessions of learner/teacher and learner/learner interaction. Assessment should be based on a mixture of methods such as MCQs, quizzes, and course work assignments. Group based course work should be exploited to encourage as much learner/learner communication as possible, thereby helping to generate a sense of 'class community' leading, hopefully, to an enhanced learning experience for all participants.

REFERENCES

Dana, P., (1995). Coordinate Systems Overview. The Geographer's Craft Project, Department of Geography, The University of Colorado at Boulder.
[http://www.colorado.edu/geography/gcraft/notes/coordsys/coordsys.html - accessed on 10th December 2002]

ESRI, (2002). ESRI Virtual Campus - GIS Education and Training on the Web. [http://campus.esri.com - accessed on 10th December 2002]

FIG, (2002). Virtual Academy - distance learning 1998 - 2002. Web site of the Commission 2 Working Group 2.2. [http://www.fig.net/figtree/commission2/wgroups/wg2_1.htm - accessed on 10th December 2002]

RICS, (2002). The Royal Institution of Chartered Surveyors. [http://www.rics.org/careers/cpd/ - accessed on 10th December 2002]

SCS, (2002). The Society of Chartered Surveyors.
[http://www.scs.ie/html/publicpages/educationcpdindex.html - accessed on 10th December 2002]

Kevin Mooney, M.Sc., Audrey Martin, Ph.D.
Department of Geomatics,
The Dublin Institute of Technology,
Bolton Street,
Dublin 1.
Ireland
Email: kevin.mooney@dit.ie, audrey.martin@dit.ie