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GeoLearn – EXPLOITING NEW EDUCATIONAL TOOLS IN THE SPATIAL INFORMATION SCIENCES

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Abstract

GeoLearn is an educational research group within the Department of Spatial Information Sciences (DSIS) in the Dublin Institute of Technology (DIT). Its aim is to promote, develop and evaluate emerging learning methods and resources, such as E-Learning and other innovative educational techniques in the Geomatics discipline.

The GeoLearn group has conducted a number of pilot studies of E-Learning for Continuing Professional Development (CPD) with International groups and the evaluation of the feedback from participants is presented. The group has also participated in the education service of the European spatial data research organisation (EuroSDR) delivering and evaluating its courses to multi-national participants. At undergraduate level the group has pioneered the use of problem-based learning (PBL) as a replacement for the traditional classroom-delivered approach and written examination. The experience of the first three years of PBL is reported, including students' own reflective experiences.

In recent years there has been a paradigm shift in education in DIT whereby the focus is now more learner-centred and it is recognised that current and future learners will increasingly have diverse background experiences, motivations and learning preferences. In addition, focus has shifted from teacher performance and outputs to the quality of the learning outcomes. To support this paradigm shift DIT put a number of systems in place including: pedagogical support from the Learning and Teaching Centre (LTC); learning technology support from the Learning Technology Team (LTT) and Heads of Learning Development (HoLD) positions in each Faculty.

With these structures in place the GeoLearn group has helped to successfully address a number of issues such as weaknesses in the Geomatics Degree Programme including poor integration of subject areas; lack of independent and innovative thought; unfamiliarity with the role of team player; poor presentation skills and lack of self belief as significant contributors and innovators.

To date one ECTS accredited E-Learning module in Co-ordinate Reference Systems has been marketed and delivered. Two further modules in the area of Global Navigation Satellite Systems (GNSS) are in production and a number of modules on laser scanning are in the planning stage. The aim is to have a suite of modular online courses that can be accessed as the need arises. The GeoLearn team was also awarded a Teaching Excellence award in 2006 from DIT for its use of PBL at undergraduate level. The introduction of PBL at all stages of the Geomatics undergraduate programmes has been strongly recommended by various accreditation and validation bodies engaged by DIT.

The GeoLearn group aims to disseminate its experience to the wider spatial sciences and to learn from the experiences of similar groups in related fields.

Keywords

E-Learning, Problem Based Learning, CPD, Geomatics

INTRODUCTION

GeoLearn was established as an educational research group and learning development centre within the Department of Spatial Information Sciences (DSIS) in 2005. Its inception arose out of a number of interrelated learning and teaching initiatives that were underway within the DSIS at that time, these initiatives will be discussed and evaluated in the following sections.

The aim of GeoLearn is to promote, develop and evaluate emerging learning methods and resources in the Geomatics discipline, with a primary objective of disseminating learning outcomes to the broader scientific and education community through international links. Much of work carried out by GeoLearn has been facilitated through implementation of the learning and teaching structures of the Dublin Institute of Technology's' (DIT) Strategic Plan.

DIT is the largest educational institution in Ireland, with more than 21 000 students engaged in programs ranging from craft training to post-doctoral research. It is committed through its strategic plan to the excellence of the learning experiences and outcomes for all students through the creation of a multi-level learner centred environment. This multi-level structure incorporates a number of flexible learning models, which enable students to participate in education at different stages of their careers on either a part-time or full-time basis.

In recent years DIT has invested significantly into the pedagogical services offered to academic staff and a dedicated Learning and Teaching Centre (LTC) has been established. The LTC aids development of flexible learning models and developing new curricula and delivery modes. In addition, the Learning Technology Team (LTT) was established in 2002 to implement new learning technologies in support of the change to a learner-centred paradigm [1]. At this time the institute adopted WebCT[®] (Web Course Tools) as its E-Learning platform.

These support mechanisms have already been used to good effect by the DSIS and GeoLearn, in both servicing the Continuing Professional Development (CPD) requirements of the spatial information industry and in the undergraduate Honours degree (BSc) program in Geomatics and MSc programmes.

EDUCATIONAL TOOLS

E-Learning for CPD

CPD needs in the technical area of mapping and geographic information are traditionally met through dedicated seminars and workshops delivered either on site or in academic institutions. Courses at a basic level can be generic in nature or in advanced circumstances tailored to meet the requirements of specific user groups such as local authorities and government departments. However, due to busy working environments and for reasons of time and location, a more flexible training model better services the needs of industry [2].

The first distance E-Learning CPD module in 'Co-ordinate Reference Systems for Spatial Information' was developed by GeoLearn in 2002 with significant technological and pedagogical support provided by the LTT under the auspices of developing DITs' virtual campus. The development of this module has previously been reported [2], [3] and will only be briefly summarized here.

As a first step in developing a suite of E-Learning modules aimed both at industry and the student population, the module developers were keen to use best academic practice and have due relevance to National Mapping Agencies (NMAs). Therefore consultation with European academics already involved in E-Learning, in particular the University at Aalborg in Denmark was undertaken and close collaboration with industry in the lead-in period to the pilot was carried out.

Accreditation for the module was attained academically, through DITs' internal validation procedure, and 5 ECTS (European Credit Transfer System) credits were awarded to all course participants who successfully completed the module. Professional recognition was also attained from the Society of Chartered Surveyors and the Institution of Surveyors of Ireland.

The module was subsequently successfully piloted three times, twice at national level in 2003 with the NMA the Ordnance Survey of Ireland (OSi), and once internationally with the Cypriot NMA in 2004. In each case, module participants followed the module over a six-week period covering one theme per week. Each of the six themes were revealed to the participants on a phased basis, together with assignments. All OSi participants attended two workshops; a one-day pre-pilot and, a one day post-pilot workshop in DIT. The Cypriot NMA module participants also attended a pre-pilot workshop held in the University in Nicosia. The post pilot workshop was carried out using DIT's tele-conferencing facilities.

The function of the post-pilot workshop was to provide constructive criticism and identify shortcomings of the module so improvements could be made. Thus an effective evaluation of the performance of the pilot module was undertaken. Access to such detailed feedback was hugely beneficial to the module designers as time limitations usually restrict this type of module analysis.

Evaluation of E-Learning

E-Learning has been shown to be highly effective means of providing necessary CPD without disrupting the workplace. Such CPD also provides a unique opportunity for participants to gain direct access to experts in their field of work. However, the needs of CPD module participants will differ significantly to undergraduate students both in their time available to undertake research and assignments, and their expected module outcomes. Cognisance should be made of these extra demands and by ensuring course assignments are very closely related to desired learning outcomes, learning times can be maximised. Successful online delivery of complex concepts can be achieved by using advanced communication tools, however to be effective, these must be well prepared and structured. In addition, the group dynamic, favoured by many learning methodologies, can be difficult to engender using distance based E-Learning and may not be essential to the learning experience of the CPD module participant [5].

Ideally CPD modules should have a long 'shelf-life' as the generation of content suitable for the efficient learning of complex concepts is time consuming. It has been found that approximately thirty hours preparation is required for one hour of student on-line study [4]. Material must, therefore, be re-usable in other courses or as an educational resource. Successful completion of E-Learning modules should lead to an internationally accredited award, preferably one which is related to the ECTS credits. Such accreditation will provide added value and act as a retention mechanism for course participants.

Maximizing the CPD potential of E-Learning

Having successfully piloted the Coordinate and Reference module three times and taking onboard the lessons learned, this E-Learning module was subsequently offered to the wider international professional surveying community. To date it has been commercially run 3 times, twice from within the educational service of EuroSDR (European Spatial Data Research): EduServ3 (2004) and EduServ4 (2005) and most recently from within DIT (2006). Participants, which have been as diverse as surveying professionals from South Korea, the Sudan and NMA employees in Ireland and Cyprus, have all successfully completed the module. In addition the module material has been made available to the undergraduate students in the DSIS on an annual basis in support of lecture materials. Thus the initial investment for this module has been recouped in full.

The template for this module now forms the basis for a suite of E-Learning CPD modules currently under production by GeoLearn. This template addresses the following issues: course structure, length, degree of difficulty, nature of assignments and type of interaction. In

addition assessment criteria and formats which comply with the ECTS norms have been established. The next two CPD modules from GeoLearn will deal with the satellite surveying technology more commonly known as Global Positioning Systems (GPS), these are due for release in 2007.

E-Learning for Undergraduates

Flexibility of choice for undergraduate students is accommodated by the modular structure currently being implemented by DIT whereby degrees will eventually be tailor made by selecting the appropriate modules. Increasingly also, the focus is shifting to a learning rather than teaching environment paradigm forcing the individual to take ownership of their own learning. Thus the pressure on staff to produce comprehensive and pedagogical sound online modules which cater for the needs of a more diverse audience is increasing.

In the undergraduate Geomatics degree E-Learning modules are made available on each of its eight semesters through the WebCT server. However, these modules are used as sources of information and a repository of course material rather than for self learning. This is reflected in all DIT undergraduate programmes as students remain more comfortable with the traditional classroom learning environment. Despite the fact that both staff and students are growing more confident in the online environment and more reliant on WebCT, the vision of independent online learners operating in a constructivist manner is some years away [1].

Problem Based Learning

In recent years there has been a philosophical change in teaching in DIT to a more learner centred environment and in particular Problem Based Learning (PBL) has been advocated by the LTC. PBL emphasises the importance of social interaction between the students (learner to learner) and establishes more mature learner to lecturer (learner to facilitator) interaction.

GeoLearn has pioneered this constructivist approach to education in the DSIS. In semester one of the final year of the Geomatics degree programme the passive instructivist methodologies (classroom-delivered lecturers; tutorials, and written examinations) have been replaced by PBL in two modules [6]. Initially, in 2004, one 5 ECTS module – Geodetic Surveying – was chosen to implement PBL. Geodetic Surveying was chosen for a number of reasons including the lack of subject coherency for the student group which was caused by granularity of the module content. Subsequently in 2005 and 2006, PBL was expanded to incorporate a further subject area – Photogrammetry and Remote Sensing – and was allocated 10 ECTS. This was seen as a positive means of linking related subject areas and was deemed necessary due to the increased time and effort spent by the students on the subject area.

In advance of implementing the PBL process and in recognition of the cultural change for both academics (facilitators) and students (learners) the facilitators attended a number of LTC specifically designed PBL workshops and training seminars. Learners also attended induction seminars and undertook a personality test to establish effective PBL teams based on personality strengths and weaknesses. In subsequent reflective analyses of PBL, individuals were expected to critically examine their role within the team. It is worth noting that this student cohort had never undertaken any form of reflective analysis before and therefore this element added significantly to their understanding of the process and ultimately their learning outcomes.

WebCT was used by teams for discussion and information dissemination, and as a private repository for project documentation, it also allowed facilitators keep a 'big brother' style watch on the information gathered and disseminated. The experience of the first three years of PBL is summarized here with reference to students own reflective experiences, a more detailed analysis of the outcomes can be found in [6].

Evaluation of PBL

The effectiveness of PBL as a learning mechanism was measured by reflection on the learning outcomes of the students and through analysis of the assessment methodologies employed. It was found that effective team learning was achieved through the problem-solving approach which provided an appreciation of the relevance of individual topics. Thus the aforementioned problem of module granularity was reduced. In addition, enhancement of the student learning was evident from an examination of team and individual oral and written submissions. The introduction of a more learner-centric model resulted in more vigorous interaction with the content material thus reducing the passive approach to learning that had become so prevalent [6].

The formative assessment methodologies adopted included: Formative staff assessment of students: Peer assessment: and Self assessment. These assessment methods proved more onerous on the staff and in the case of Peer Assessment contentious however, student grades when compared to previous summative examination results increased by approximately 10 – 15 %, this was considered appropriate relative to the increased self-learning time required for the module. Overall it was found that learners extended their knowledge base and incorporated cross-subject disciplines.

It is recognised that the development of any new and innovative teaching and learning methodology is an iterative process. In the case of this PBL module, the adoption of robust Quality Assurance (QA) procedures had the advantage of providing objective learner group feedback. This then allowed the facilitators to focus on weakness in the undergraduate programme and formed the basis for the iterative changes which occurred in successive PBL modules. In 2005, GeoLearn was awarded the DIT Teaching Excellence Award in the School of Spatial Planning as recognition of the efforts employed to adopt and apply PBL as an innovative learning methodology.

CONCLUSIONS

Since its inception GeoLearn has lead a number of teaching and learning initiatives in the DSIS. The utilisation of E-Learning for CPD represents one initiative whilst the shift from a teaching paradigm to a learning paradigm through the introduction of PBL represents another. In each of these initiatives the support provided by both the LTC and the LTT has been central in developing new learning methodologies and providing staff with the necessary tools to develop and utilise current learning and teaching technologies.

As shown by the 3 pilot studies, properly designed and accredited distance-based E-Learning resources are eminently suited to CPD and skills updating and the role of academics in the area of CPD cannot be underestimated in the surveying and spatial information community. Indeed with the proliferation of the Internet the potential for delivering online courses to an international audience has never been so straightforward. Ideally academic institutions with expertise in specific areas should work in tandem with industry and the professional bodies to meet the required CPD needs of professionals.

In terms of undergraduates, independent online learning is not yet a reality and difficulties remain in associating Internet use with formal learning and education E-Learning materials are considered 'extra' information rather than integral part of the learning experience. However the adoption of more learner-centric models such as PBL will hopefully trigger the imagination of students and allow them to take ownership of their own learning.

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