Teachers as learners: an experiential journey through e-learning

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Abstract: Virtual Geology Excursions *is an entirely online postgraduate unit, targeted at practising secondary science teachers. The primary aim of the unit is to raise awareness of ICT rescources and how they can be used to enhance secondary teaching in the earth sciences, and to give teachers the confidence and technical skills to find, evaluate, adapt and create resources for use in their classrooms. The philosophy and structure of the unit are discussed, as is the challenge of developing an effective online unit suitable for professional education.*

Introduction

Virtual Geology Excursions is a unit of a new Master of Science Education degree delivered entirely online by a consortium of five Australian Universities. The unit is designed to progressively shift learners (in this case practicing science teachers) from being passive users of ICT (Information and Communication Technology) resources to either actively adapting materials for specific educational purposes or creating their own resources.

The designers of this unit faced a series of challenges:
• how to most appropriately 'teach' professional educators in a way that acknowledges, uses, and extends their pedagogical expertise;
• how to cater for learners with a wide range of experience in ICT; and
• how to design an educationally useful unit that is delivered exclusively online.

These challenges were largely met by building a team with the appropriate background and expertise. This team included academics with expertise in education and Earth Sciences, an expert to address the development of appropriate technical skills and a professional online course designer. Indeed the prior experience of two of the above in secondary science teaching proved invaluable.

The philosophy and structure behind the setting up of this unit are outlined in herein, whilst on a second level, the process of developing an effective teaching/learning strategy to be delivered completely online is considered.

Unit structure

The unit is structured into five different modules:

• *introduction* – where the strengths and weaknesses of ICT for educational uses are explored; an introduction to Internet searching techniques is also outlined via online resources;
• *exploring existing resources* – students explore the range of ICT resources available for teaching Earth Sciences to secondary students, and develop the means to evaluate the educational and technical value of the resources; students are expected to contribute to an collaborative database of suitable ICT resources to share with other students;
• *integrating resources into teaching practice* – consideration of the practical problems of using ICT resources in schools and some examples of ways to successfully overcome the difficulties;
• *technical background* – tutorials that help the student gain sufficient technical expertise to modify existing resources or create their own; due to the varied expertise of students, the tutorials and activities are designed to cater for beginners to those with some expertise and students are given choices about what they concentrate their efforts on, and at what level to start; and
• *project* – students are expected to produce a resource (or at least a prototype).

Each week is slightly different, but typically involves readings and discussion/reflection points, a range of examples of ICT resources to explore and evaluate, contributions to the discussion forum and to a collaborative database. Some weeks will also require the student to create something, e.g. a *PowerPoint* presentation or a WebQuest, which is posted on the Discussion forum. The weekly activities are designed so that students can start at a number of different points, according to their own learning style.

Assessment is based on participation in the discussion forum, a 2000 word report on any aspect of educational ICT (presented ready for submission to a relevant refereed publication) and a project. The project is intended to help students practice the technical and design issues dealt with in this unit, e.g. producing a computer assisted learning package or an online, e-learning experience for secondary students, with supporting documentation exploring technical and pedagogical design issues. The topics and approach for the report and project are negotiated with staff, and the marking criteria and weightings are also negotiated. All assessment is designed to utilise and develop student strengths, and to ensure the students leave the unit with a practical product.

Teaching philosophy

Experiential learning is the primary pedagogy underpinning *Virtual Geology Excursions,* based on the principles of Kolb (1984) and ‘learning by doing’ rather than the application of distilled wisdom. Instead of a focus on simple and discrete skills, learners are engaged in complex and holistic thinking with tasks sequenced to provide opportunities for students to reflect on new ideas and their own teaching practice.

Technology has been defined as ‘anything that wasn’t around when you were born’. This light hearted definition underscores the challenges of developing a learning context for those who are required to do so for a generation more comfortable with the latest technological advances. This challenge can all too easily remain unmet through an almost unconscious process of adopting comfortable and familiar pedagogies in the new technological environment, or simply adapting old content for a new vehicle. Despite the promise of the new technology, the pedagogy underpinning much ICT development mimics that of traditional models such as face to face teaching and textbook teaching. The difficulties of developing pedagogies for the new technological context applies to the online units such as *Virtual Geology Excursions* as well as to secondary teachers designing resources for their students.

Polarised views about advances in education technology dot the literature with some seeing it as a universal panacea (e.g. Mergendoller 1996) and others expressing scepticism (Cardenas 1998). When pedagogy rather than the medium is the starting point, however, students are engaged directly in how the technology is utilised (e.g. Shrum 2000).

Virtual Geology Excursions is designed to provide an experiential learning environment which will serve as a model for the students taking the unit. Materials and activities aim to provide exemplery and imperfect examples of resources for students to evaluate. This is supported by on an individual and group basis via the discussion forum. All parts of the unit shift the responsibility for learning onto the students.

Because of the different skills base of students in the unit and the 'hands-off' role adopted by unit instructors, scaffolding is essential in unit design. The online unit content allows multiple entry points rather than a linear task focussed sequence of learning experiences. Online content is therefore quite unlike lecture and tutorial materials transposed onto a web interface and more like a complex map structure with an array of links, questions, suggestions and discussion points. This enables self guided discovery that empowers learners to utilise technology to create learning materials and programs that best suit their own needs and teaching methodologies and learning styles.

This approach is appropriate for professional science educators. It recognises and respects the fact that they will bring a diverse variety of teaching and learning strategies into the program as a result of their own professional experiences. The role of the unit instructor in this situation is more one of facilitation, support and negotiation. This is reflected in a number of ways in the unit content. Topics for assigned work are negotiated and thus enable learners to build on their own specific interests and experiences. There is also ample scope for variable assessment criteria in assigned work. Assessment criteria are also negotiated and can include components of self-assessment and peer review by other learners or groups of learners engaged in the unit or external colleagues. There are also options for the submission of initial proposals and 360 degree feedback and analysis.

Aims of the unit

Increased accessibility and use of computers has introduced a host of new challenges to secondary science teachers. Any cursory observation of secondary school classrooms will show that school students are becoming increasingly adept with the new technologies, often outstripping their teachers' knowledge, while other school students have only limited experience. Schools range in their ability to provide computers and Internet access, e.g. from individual students using 'subsidized' laptops, to classrooms sharing one or two computers. Add to this the explosion in the number of ICT resources, and the rapid changes in ICT technology and you have ingredients to produce chaos.

Teachers reflect the general population in having a range of abilities and experience with the new technologies. Research as shown that teachers within one school can vary from 'innovators' of new technology to the majority who range from pragmatists to conservative users, and to those sceptics who lag well behind the general population (Myers 1997). As more students become computer literate (some with quite sophisticated knowledge) and more students learn the basics and more from primary schools, there is increasing pressure on secondary teachers to 'keep up' with the revolution. The unit *Virtual Geology Excursions* was designed to meet this need.

The principle aim of the unit is to equip teachers with the knowledge and skills to evaluate and use ICT resources effectively in the teaching of Earth Sciences in a secondary school setting and to give them the confidence and skills to create their own resources.

The unit is constructed around a hierarchy of concepts. Firstly the teachers gain experience in critical evaluation of existing materials, including examination of examples of different approaches, development of search strategies to find additional resources, effective evaluation of resources, and linking these resources to teaching and learning outcomes. This provides a strong foundation in the diversity of styles and approaches available. Emphasis is placed on the educational value of the resource, with technical evaluation primarily viewed in relation to how this enhances or detracts from the educational application of the resource. For instance the influence of navigation tools is examined with respect to learning outcomes (Farrell and Moore 2000-2001).

The teachers then examine ways of integrating existing materials into classroom teaching strategies. In particular this approach seeks to explore innovative strategies that go beyond merely using so-called 'educational packages' for one-off classes, or only for extension, or only for selfdirected learning in selected students. Consideration is given to strategies (e.g. WebQuests, Real Time Data Projects and collaborative online projects) that address the practical problems faced by teachers in classrooms. Finally the unit seeks to equip teachers with a range of basic technical skills so that they can create new resources that meet the particular needs of their students e.g. using *PowerPoint* effectively, designing webpages, digital photography, animations and virtual reality.

In essence this unit tries to shift teachers from being passive users of ICT resources to either actively adapting materials for special needs or creating their own resources, and much of the unit is dedicated to doing this in a guided, gradual, and supported way. The teaching emphasis avoids the notion of 'training' which concentrates solely on technical expertise, and focuses on analysing ICT resources on the basis on their educational application. Part of this process involves developing information literacy skills in the teachers e.g. Internet searching techniques.

Technical training

The outcomes of the technical training aspects of the Unit were to develop:
• an awareness of, and familiarity with tools available to the developer which required little or no expertise in technology;
• a knowledge of issues related to the presentation of graphics via the Web;
• expertise in creating and manipulating graphics, simple animations, interactive graphics and virtual reality;
• a knowledge of, and experience, with either HyperText Markup Language (HTML) or a web page construction software program; and
• some small web-based resources that illustrate the skills developed and an awareness of sound pedagogical application.

To cater for a range of backgrounds and experiences within the student cohort, a number of tasks addressing differing levels of expertise were included in each week's activities.

When the learners investigate teacher productivity tools available to prepare web-based activities or content, the tasks range from very simple activities such as converting a *PowerPoint* presentation into HTML or creating Portable Document Files (pdf files) using *Adobe Acrobat* to using web-based tools such as *Filamentality* to create WebQuests or downloading software packages (e.g. *Hot Potatoes*) and using them to create educational resources. In all cases, the learners were provided with a comprehensive list of web-based resources which provided the necessary support while at the same time catering for a variety of computer expertise and learning styles.

In all activities, the tasks allowed the learners to extend their skills and experiences whether they were novices or if they had already developed extensive skills in the area. The tasks were supported by well designed and freely available tutorials and samples.

Online educational design

The main emphasis in course design was on presenting the content in ways that would support learning. The structure and design considered learners' initial skills and experience of online learning but with a deliberate aim to significantly improve and build these skills along the way. No specific minimum level of technical ability was set as entry requirements for the course so there was an underlying concern that the learning environment enhanced rather than hampered learning.

The course is offered using *WebCT*, an environment that can be complex to use. The online environment was made as simple to manage as possible, to cater for novice users, e.g. by removing additional tools (e.g. chat, whiteboard) that were not necessary or that would not directly enhance the learning process. This allowed the course designers to keep the interface uncluttered and divided into six areas: overview; main course content by week; resources; communications area (email and bulletin board); student tools (assignment drop box, presentations); and Assessment. Clark (1994) suggests that instructional method should be more important than instructional media. If it is method that influences learning it is important that the learner can focus on method rather than being confounded by trying to master the medium. This also means that design should be learner-centred rather than medium-centred (Cobb 1997).

A consistent structure and pattern was maintained each week, again to allow the focus to be on learning rather than on mastering the technology. The structure forms a framework that allows learners to quickly access material and be aware of the expectations of them. The style of the writing was deliberately made to be 'chatty' and conversational as if talking directly to or tutoring the individual learner. This has been described by Rowntree (1990) as the 'tutorial in print' in the distance education literature; this unit adopts the same principle but used online. The content was interspersed with regular activities to maintain the learner's interest. There are also regular trips to the discussion forum, allowing learners to build a relationship with the facilitators and with each other. This can be an extremely important factor in reducing the sense of isolation that fully distance/online learning can create.

Sequencing of content was another important factor. In this unit, learners were initially given quite simple approaches to introducing ICT to their teaching practice. They are presented with a simple yet real example of the use of ICT by being asked to use the Internet and gain the very fundamental skill of searching. Reigeluth's (1999) elaboration theory provides an ideal basis for this approach as it concerned less with the specific content and ideas and more with the sequencing of those ideas. The emphasis is on how to group and order the material moving from the simple or core principles to the more complex. For example, simple searching comes first but quickly develops to the need for effective and efficient searching and then to evaluation and critique of what is found.

Another important element was to provide examples and to encourage exploration of resources that are useful to the learners' field of practice. This works as scaffolding, which according to Jonassen (1998) is a method for presenting problems and ways of solving them so the learner can apply this to their own problem. The course also makes the learning 'authentic' (Jonassen 1998) by encouraging the learner to apply what they have been learning to their own situation by actually undertaking searches for material relevant to their own context and to evaluate what they find. A review of the literature shows that this also fits with general theories of adult learning by allowing learners to approach learning by problem

solving and to learn experientially and highlighting the relevance to their current work situation.

Conclusion

Developing effective teaching strategies for an exclusively online environment is still a relatively new endeavour. Students in such environments often have different needs and demand different approaches to those doing the same course content in a classroom environment. The development of *Virtual Geology Excursions* will continue with some changes in delivery and structure planned for the future, such as modification of a strict 'weekly' schedule to a more flexible approach. The course designers will continue to work on ways of developing truly effective online learning communities.

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