EXPANDING DISTANCE EDUCATION IN THE SPATIAL SCIENCES

Metternicht, G.

Department of Spatial Sciences, Curtin University of Technology,
GPO Box U 1987, Perth WA 6845, Australia.
E-mail: metternicht@vesta.curtin.edu.au

ABSTRACT

By nature of their close relationship with the resources sector, professionals in the spatial sciences industry are often located in remote areas or are not permanently stationed in a single location. Such is the case of staff located in regional areas of Western Australia, off-shore oil platforms and overseas postings, or those who travel from project site to project site on a fly-in, fly-out basis. Obviously, these individuals are unable to attend campus-based professional development course and higher degree programs. Faced with increased pressure by professional associations for continuing professional development and lifelong learning, spatial sciences professionals require more flexible solutions for distance learning.

The rapid pace of technological development, both within the industry and within education, is providing the opportunity to deliver flexible learning to remotely located and mobile professionals. At the same time, a flexible learning programme can benefit students located in the metropolitan region with time constraints, and those in other locations, both nationally and internationally, who do not have access to such spatial sciences programs.

This paper describes the way in which series of undergraduate units have been implemented on-line, using the internet as a means for reaching distance students pursuing postgraduate studies in Cartography and GIScience. It presents the way in which learning resources have been designed and implemented in a Web-based environment where the students can access the unit's study plan, on-line tutorials, hold discussion forums, consult study resources and complete quizzes that enable to monitor their progress within the unit.

1. INTRODUCTION

Web-based distance education technologies can improve education, supporting new education systems [1]. This advancing technology carries the promise of allowing rural and non-traditional learners (e.g. at-home mothers, or full time workers) the opportunity to participate in higher education programmes. Even on campus students are taking advantage of distance learning [2], as many of these students must hold part- or full-time jobs in order to cover the tuition fees. Job or family commitments (e.g. at home mothers pursuing further education) often outweigh university commitments, and students are forced to miss lectures and laboratory sessions. On line, distance delivery of units and degree programmes enable these students to learn lecture materials, and do practical assignments when their schedule permits it, at their own pace. Although these students are not necessarily fully 'distance' based, they can benefit from the flexible delivery environment offered to distance students.

Engineering education has traditionally been imparted through the lecture-tutorial-laboratory paradigm. Education technology in the last few years has tried to make teaching more effective by supplementing the whiteboard teaching with other passive technology such as audiovisual aids, overheads, slide projectors and videos [3]. Recent advancement in computer multimedia has brought in a new teaching environment, which has already proved successful across a wide spectrum of educational programs in the primary, secondary, vocational and higher education, as reported in works by [3-9]. As a result, educational institutions are using this technology to develop a greater range of study and delivery mode of units. The choices available to students are now ranging from on-campus face-to-face contact to remote distance studies, where course materials and resources are delivered totally online [9]. The challenge for technology based disciplines such as GISciences, cartography and surveying, is to develop materials that incorporate the theoretical and practical components of a course, and can be delivered online, making it dynamic and interactive.

The Department of Spatial Sciences at Curtin University boasts one of the few web-based Geographic Information Sciences distance programmes in the world. At present, two postgraduate courses, Graduate Certificate in GIS and Graduate Diploma in GIS are offered fully on-line, in distance mode. Over the past year, we have received inquires into

these degree programs from individuals in over 45 countries, indicating the high demand for flexible and distance-based studies in the filed of spatial sciences.

To this end we have developed and implemented a flexible program via online learning aimed at professionals based off campus (e.g. remote areas, overseas), or with work and family commitments impeding assistance to 'normal' on campus lectures. The programme works within the framework of the existing degree programs in GIScience at the Department of Spatial Sciences. This paper describes the methodology adopted to 'migrate' units part of these programmes from the traditional passive delivery mode of transparencies, PowerPoint presentations, to the dynamic on line, distance based delivery using the WebCT environment, which is the Learning Management System officially adopted at Curtin University. In addition, it presents on-line learning tools developed by staff of the Department to support on-line interactive learning. Such tools have been developed under the frame of the Curtin University Learning Effective Alliances Programme (LEAP).

Using as example the unit Thematic Cartography, the following sessions describe the methods, implementation, and evaluation steps that were followed for the migration from traditional to online mode of delivery, and from online to distance mode. Shortcomings related to the implementation, as identified during the evaluation phase, are discussed as well.

2. METHODOLOGY

A total of four units were implemented in distance mode under the project 'Expanding Distance Education in the Spatial Sciences' [10]. The implementation of the units for distance education followed two main steps: a) from traditional to online mode; b) from online to distance mode. The learning management system and steps adopted for implementation of the units are described here after.

2.1 The Learning Management System

WebCT (Web Course Tools) is one of a number of commercial packages that provide a 'total' environment within which to develop, manage and revise Internet-based learning (IBL). This Learning Management System has officially adopted to deliver on-line and distance-based courses at Curtin University, providing functionality to publish lecture notes, administer online quizzes, create bulletin boards, real-time chat rooms, and provide other features in a secure web environment with full student authentication, grading and tracking, all under the control of the lecturer. Both student and staff interfaces are accessed using any standard web browser on any Internet-connected computer. Learning Management Systems provide tools to structure online learning in a variety of ways. This can range from structured learning pathways to dynamic, interactive virtual classrooms. How a unit is presented online depends on the content and complexity of the learning material, and the delivery methodology used by the lecturer [11].

2.2 From traditional to online mode of delivery

This stage involved taking the core components of a unit and making them available on line. In order to create a familiar environment, in terms of presentation of the information, a common 'basic' design was adopted for all units delivered online and distance mode.

Such design comprises the following online components:

- Study Plan – involving unit outline, requirements, readings, regulations, etc.
- Study Guide – content and material with links to relevant examples, references, etc. The Study Guide often resembles little more than lecture notes online.
- Work Guide – practical session/laboratory materials, activities and data; assignments, field work, etc.

In addition, communications facilities are made available to students who are encouraged to use them and take advantage of their convenience, accessibility and ease of use. Such facilities may include:

- Discussion forum used by students and staff alike to inter-communicate and discuss topics relevant to their unit of study
- Electronic mail for communication with the unit coordinator, tutors, etc.

2.3 From online to distance mode of delivery

Simply placing the unit online does not mean that it is suitable for distance studies. On the contrary, a considerable amount of effort and thought must be expended to prepare the unit and "distant-ise" it. In particular, the following components were addressed in this stage:

- Developing and enhancing the existing online Study Guide to make it "standalone" by: incorporating more descriptions and explanations, adding module outlines and expected outcomes to the start of each module, adding module summaries and student achievements to the end of each module, expanding the links and references, increasing the number of examples and ensuring adequate descriptions exist for each, etc.,

- A consistent and friendly user interface. This can be achieved by a consistent “look and feel” interface, easily identifiable icons, simple and yet comprehensive pages of information, and consistent and harmonising use of colour and fonts,
- Developing a “Distance Guide” identifying contacts, distance study requirements, sources of information for distance learners, study tips, resources for the unit that are available to distance students, etc.,
- Site navigation. The web site must be easy to navigate to find appropriate information and study topics, and
- Study Resources and Frequently Asked Questions (FAQ) provides resources and information commonly required by students.

2.4 The example of Thematic Cartography

Online resources were developed for the unit Thematic Cartography 281/581 (Stage 1 of the project) for on-campus students in order to obtain a significant sample of students responses regarding the way the unit has been implemented (see Figure 1). The following components were included:

- *Study Plan* (Figure 2a) involving the unit outline, requirements, library resources, School and University regulations (including a definition of plagiarism and its consequences under current University regulations);
- *Study Guide*, containing the lectures' content, learning outcomes and reading materials, grouped in modules. A module is usually covered in a two-hours lecture. The lecture notes are a copy of the materials presented during the lecture, and frequently include graphics and diagrams in addition to text (Figure 2b).
- *Study Resources*: the notes covering the materials presented during the lectures are expanded by a 'reading for further understanding' (Figure 2c) document indicating to the students relevant web sites, journals or books available in the reserve collection of the Library that the student must consult in order to gather further understanding on the issues being dealt with during the two hours weekly lectures.
- *Work Guide*, containing a description of the tutorial sessions, activities to be undertaken, deadline for submissions and materials needed to complete such tutorials.

Additionally, the following communication facilities were included for the students' easy of use, convenience and access (see Figure 1):

- A discussion forum to be used by students and staff alike to inter-communicate and discuss topic relevant to the unit (Figure 3a);
- Electronic mail for communication with the unit coordinator;
- Other tools, offering the students facilities to compile notes, search, and a glossary. The glossary intends assisting students in easily remembering basic definitions related to thematic cartography (see Figure 3b)

Figure 1. The main screen on the WebCT unit Thematic Cartography.

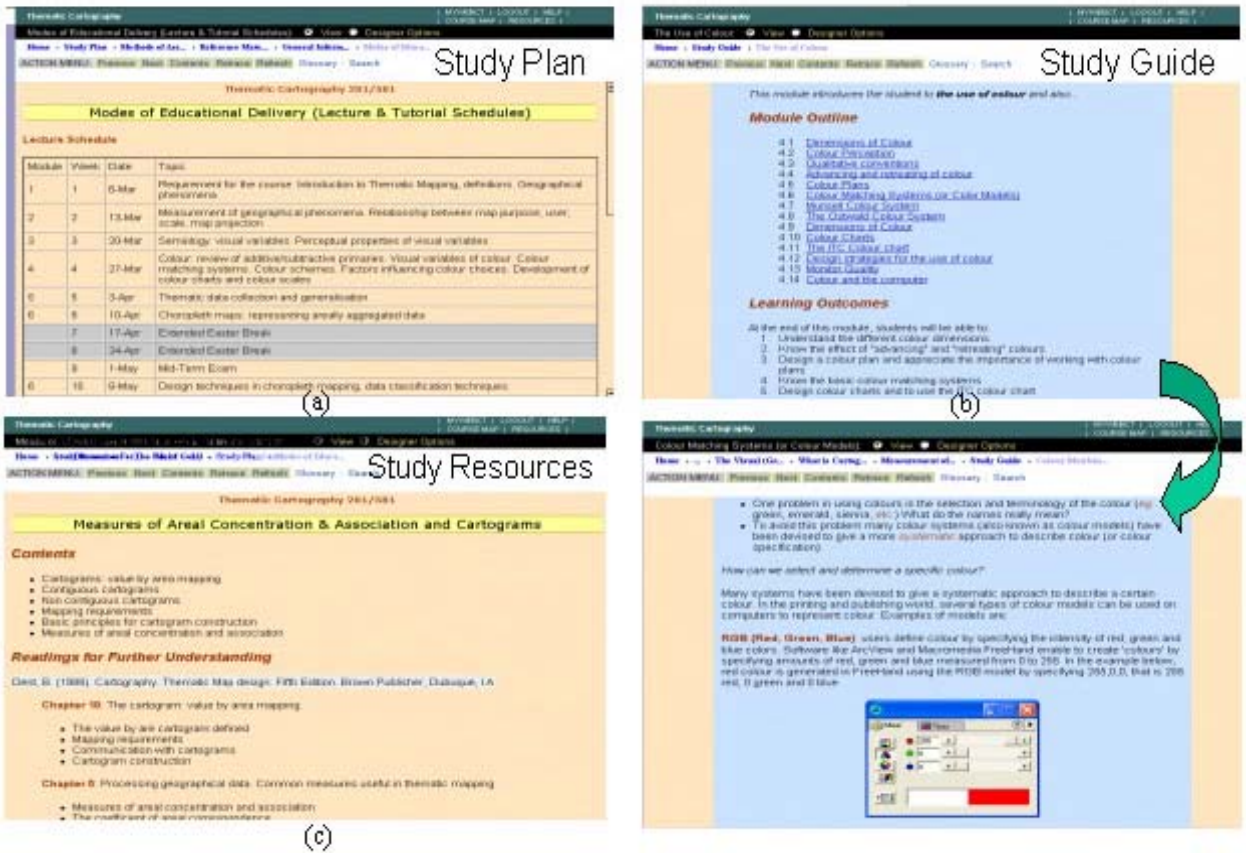

Figure 2. Components of the WebCT unit: (a) The unit's study plan; (b) Study Guide, with learning outcomes and one example of lecture notes; (c) Study resources to expand the theme discussed during the lectures.

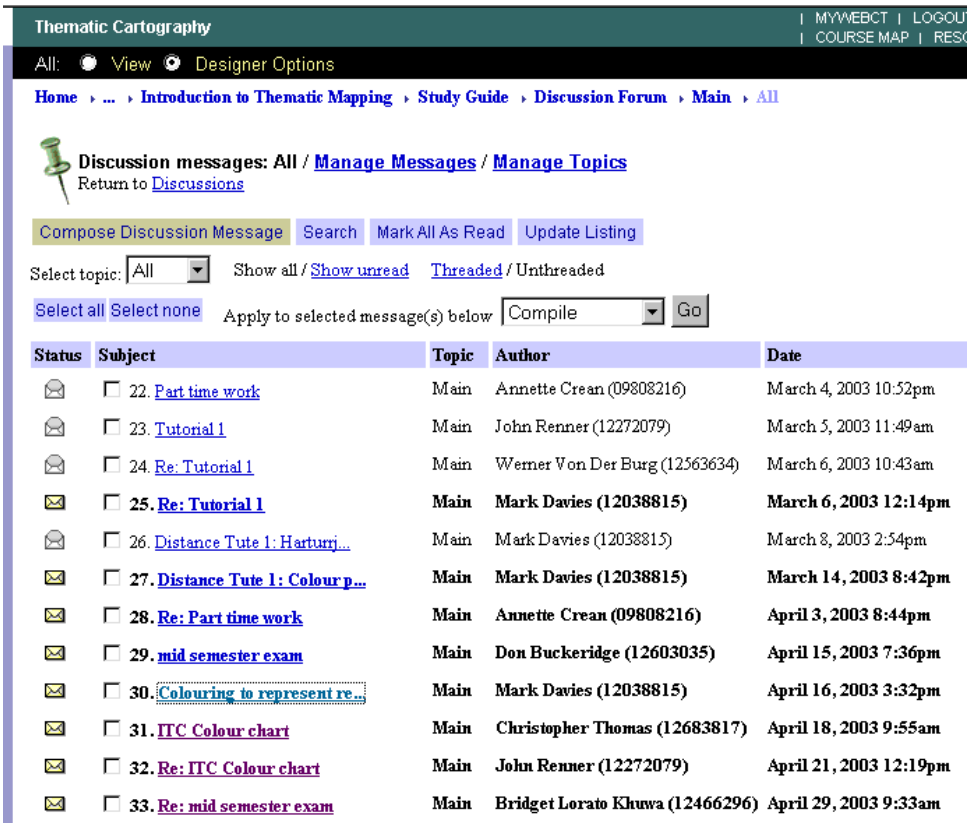

Figure 3a. The discussion forum.

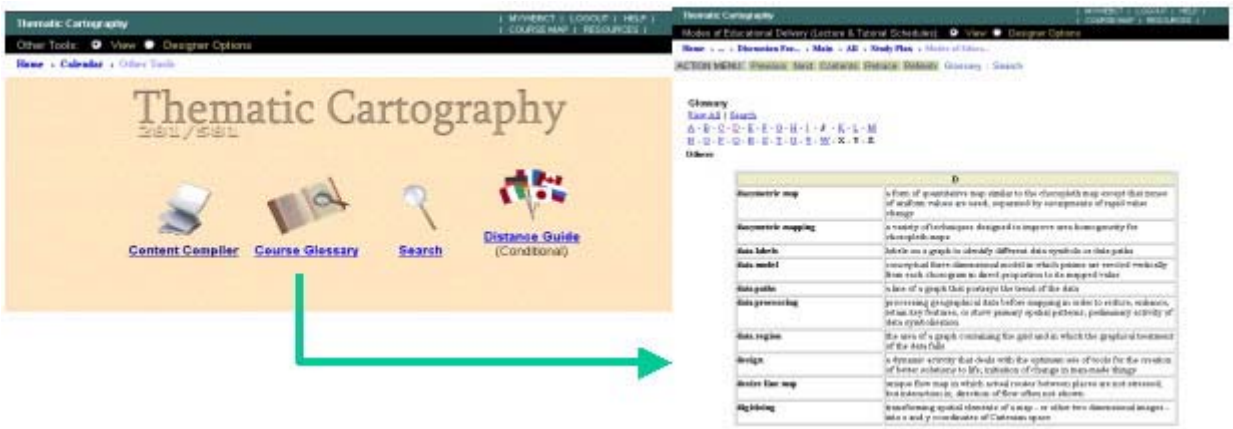

Figure 3b. 'Other tools', including a note compiler and glossary of cartographic terms.

2.5 Evaluation

In order to evaluate the rating of the unit's WebCT design and contents as compared to other units, and in terms of its perceived value for the students, seventeen questions were designed and implemented as an on-line survey (see Appendix I).

Eleven students, most of them enrolled in the BSc in GIS, replied to the survey. Table 1 and Figure 4 show these results, as well as the mode and median of each answer recorded. As the mode expresses the more common answer recorded for each question, it was used to analyse the results, which are summarised hereafter:

- The organisation of the unit was found good, and comparable to other units (Question 1);
- The practical sessions were found useful and relevant to the unit (Question 3)
- The on-line calendar was not valuable for the students to work out important unit-related dates and help with time management (Question 4);
- The Study Plan (e.g. unit outline, tutors and unit controller contact details, etc) was found well organised and easy to understand (Question 5);
- The Study Guide (content modules, guideline of lecture contents) was found well organised and easy to understand (Question 6)
- The Study Resource module (additional notes, required reading for each lecture, past exam papers) was found well organised and useful for understanding the concepts discussed during the lectures (Question 7);
- The Work Guide, containing the tutorials for each session was well organised and easy to understand (Question 8);
- The unit was found relevant as part of their careers (Question 10)
- The practical sessions were reported as just fine (Question 11);
- Students agreed that the web based learning resources provided for this unit somewhat improved on traditional learning practices;
- Students found the unit was presented fairly well, and it was quite easy to follow (Question 13);
- Web-based resources are said to be used by far more than the library and other non-web resources (Question 15);
- Students find the web a stimulating learning environment (Question 14), and they would like to see more interaction (between student and computer) built into the web based learning environment (Question 9);
- Students found the flexible web based environment for this unit easy to use and interact with (Question 16);
- Varied answers were supplied at the question on whether the discussion forum was a valuable facility to communicate with fellow students and/or staff. About 50 percent agreed it was a valuable communication source, while the rest thought it really was not.

Table 1. Statistics of the questionnaire output

STUD	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17
Mode	4	1	4	2	4	4	4	4	4	4	3	4	4	4	5	4	4
Median	4	1.5	4	2	4	4	4	4	4	4	3	4	4	4	5	4	3.5
Vratio	0.6	0.91	0.64	0.82	0.64	0.64	0.64	0.64	0.64	0.64	0.73	0.64	0.64	0.64	0.55	0.64	0.64

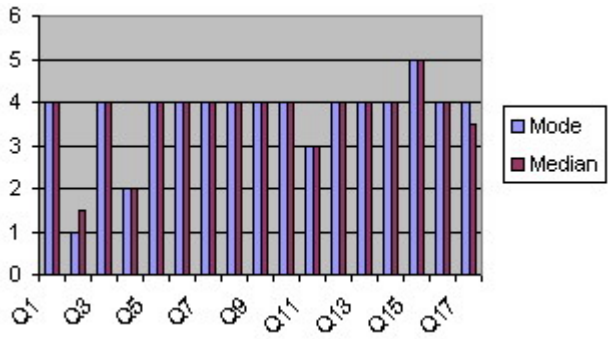

Figure 4. Mode and median values of the answer to the 17 post-unit survey questions.

2.6 Dealing with copyright issues

The unit Digital Remote Sensing was implemented using the same methodology. In accomplishing the first stage of the project two important issues were identified [10]: a) Digital delivery of copyrighted, online resources to students (on campus and distance); and b) Provision to distance students of software needed to complete practical lab assignments.

The unit Digital Remote Sensing required the use of numerous images and complex diagrams to explain remote sensing concepts. Many of these visual aids can be obtained via scanning of remote sensing textbooks. The library e-reserve of Curtin University is the mechanism available for provision of copyright materials in digital form. However, its primary aim is to provide materials such as continuous book chapters and not many small pieces of information (e.g. diagrams and images) as required for the unit [10]. Therefore, for this particular unit a solution was found by releasing individual lectures that contained less than 10 percent of copyright material from any one source. For instance, a set of notes for a Monday lecture was released to students on previous Thursday and was available for one week until the Wednesday after the lecture. In this way issues related with copyright could be overcame.

3. ADDITIONAL ON-LINE LEARNING TOOLS: THE VIRTUAL ONLINE LEARNING (VIRTU-O-LEARN) PROJECT.

Parallel to the development of full online, distance mode of delivery of units for the GIS programmes, a team of the Department of Spatial Sciences developed the Virtu-o-Learn project, to effectively harness online technologies in a student's learning environment [12].

The framework used by the Virtu-o-Learn project to develop a virtual online learning environment is illustrated in Figure 5. Learning objects are the building blocks joint into topics. They comprise such things as images, content descriptions, animations, panoramic views linked to interactive maps, interactive visualisations and fly-throughs, interactive questions/problem-solving, etc. There exists a many-to-many relationship between learning objects and topics. A sequence of topics forms a module. Although a topic usually resides in one module, it can be shared across modules.

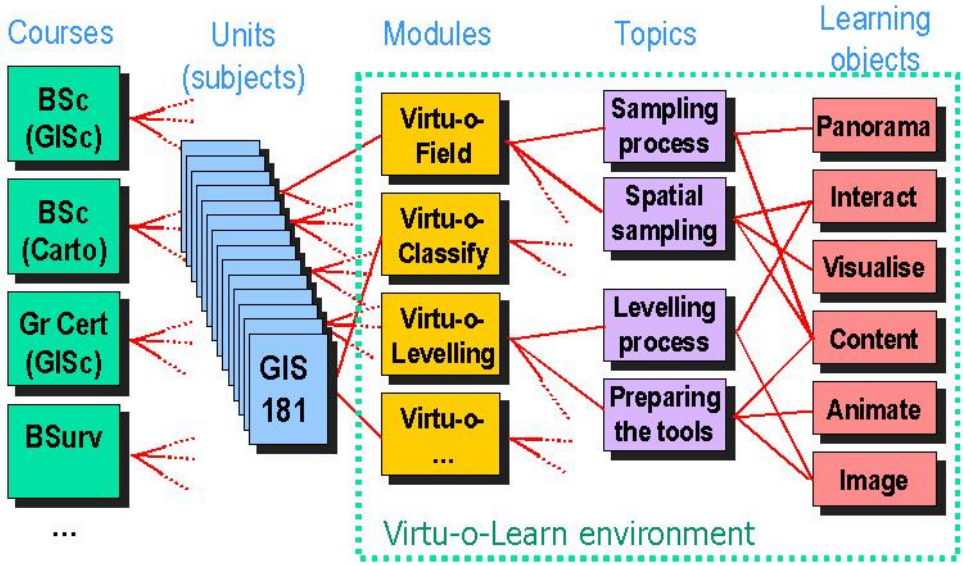

Figure 5. Framework for the virtual online learning environment (Source: 12)

Each module is a component of one or more units (or subjects) within one or more courses (programs of study). For example, the Virtu-o-Classify module is a component within the the Thematic Cartography 282 unit within the Bachelor of Science (Cartography) course, and is also a component within Geographic Information Systems 181 unit within the Bachelor of Science (Geographic Information Science) degree course. Rather than using complete modules within a unit, it is also possible to simply integrate individual topics within a unit.

The modules are designed to be self-contained, enabling their use within distance study units as well as for independent and self-study for on-campus students. They can also be utilised as "refreshers" for students in units where prior knowledge and skills are assumed.

The topics within the modules are very short and focussed, as shown in Figure 6. The purpose is to be able to utilise the topics as individual components or assessments within the units. For this reason it is possible to integrate a specific topic within multiple units. Many of the learning objects, and in particular the interactive ones, are (re-)useable within multiple topics. Most can easily be customised with the use of alternate datasets or images, displaying a subset of buttons and options, or providing different instructions regarding their use. The flexibility in utilising learning components enables them to be used more effectively (e.g. easier access and integration), more broadly (e.g. re-useable over many units) and over a longer period of time (e.g. extended lifetime).

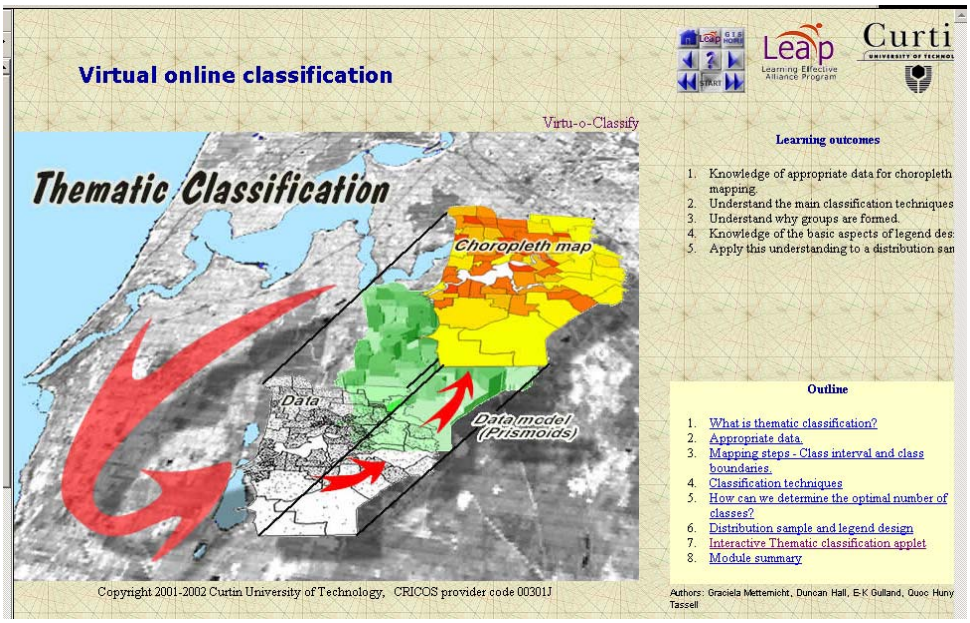

Figure 6. The Virtu-o-classify module: short, focussed concepts related to the issue of thematic classification for the production of choropleth maps.

3.1 Interactive learning components

The Virtu-o-Learn project focuses on student-centred learning, so that the student is more directly involved in their learning environment. One manner in which this "involvement" can take place is through direct interaction with the learning components. This is where online interactive learning components have an important role. The learning objects within the Virtu-o-Learn project were designed with this focus on learning rather than teaching.

The types of Virtu-o-Learn learning objects vary in the level of interactivity that they offer. Figure 7 indicates, for example, how the Virtu-o-Content and Virtu-o-Image learning objects have a low interactivity level as compared to learning objects such as Virtu-o-Panorama and Virtu-o-Interact. The reason is that, for example, the focus of the Virtu-o-Content objects is to impart concepts and knowledge to the student usually in preparation for understanding and interacting with subsequent learning objects. The emphasis on interaction is low and may be limited to some quiz questions on the content contained (see Figure 8a). On the other hand, the Virtu-o-Panorama has a greater level of interaction, allowing the user to "move" through and interactive map and view panoramic views from specific predetermined locations (Figure 8e). Likewise, the Virtu-o-Classify includes an applet for students to create choropleth maps of the city of Perth using different classification techniques (e.g. standard deviation, equal intervals, arithmetic progression, etc) (Figure 8f). The maps can be created to 'float' on the screen and the students are able to compare the impact of applying different classification techniques on the same data set, using the same number of classes (Figure 9). This helps greatly to illustrate the importance of evaluating more than one classification technique when dealing with thematic data.

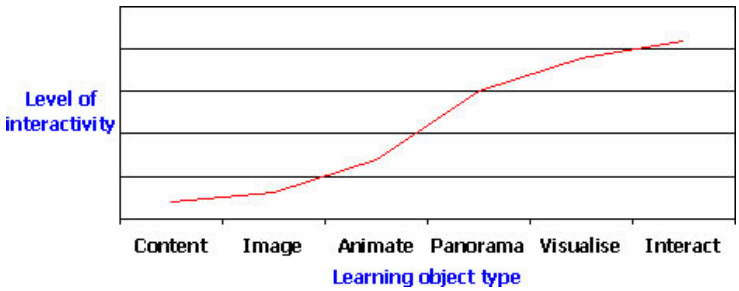

Figure 7. Level of interactivity among learning object types (Source: 12).

3.2 Integration within the learning environment

The challenge is to integrate the learning components into the student's learning environment in a flexible and interactive manner. Traditionally, the various methods of delivery were distinguished by the specific knowledge and/or skills that were imparted to students. For example, lectures were used to deliver content, tutorials were used primarily for teaching problem-solving skills, practical skills regarding equipment operation and use were obtained in laboratory sessions and field trips were used to apply knowledge and skills [12].

Figure 8. Examples of virtual online learning object types: a) Content, b) Image, c) Animate; d) Visualise; e) Panorama; f) Interact.

The Virtu-o-Learn project sought to use virtual online learning to break down these distinctions and provide a more integrated approach. Through the implementation of the learning components across 15 units within 6 course in 4 discipline areas, the following outcomes are indicative of the integration achieved [12]:

- On-campus students work through online modules prior to attending lectures which are used to reinforce and further explain concepts and applications. This has reduced the strong focus that has traditionally been on lectures.
- Online simulations and interactive virtual environments are used in lectures to demonstrate concepts and applications in order to prepare students for laboratory sessions and field trips. This saves time in the actual use of equipment and hence these resources can be more efficiently utilised. Because of prior preparation, the time for field trips can also be utilised more efficiently.
- Previously it was impossible to teach some units in distance mode since there was no viable way for students to attend field trips to obtain skills. Now distance students can perform virtual field trips and even obtain real data virtually without even setting foot in the field trip study area!
- In some instances, the virtual environments have reduced the need for students to physically handle expensive equipment or attend field trips where the study area is geographically distant from the campus. In many cases, the virtual environment allows students to test various scenarios that would have taken days or even weeks to perform in real life (e.g. vegetation sampling over a large study area).

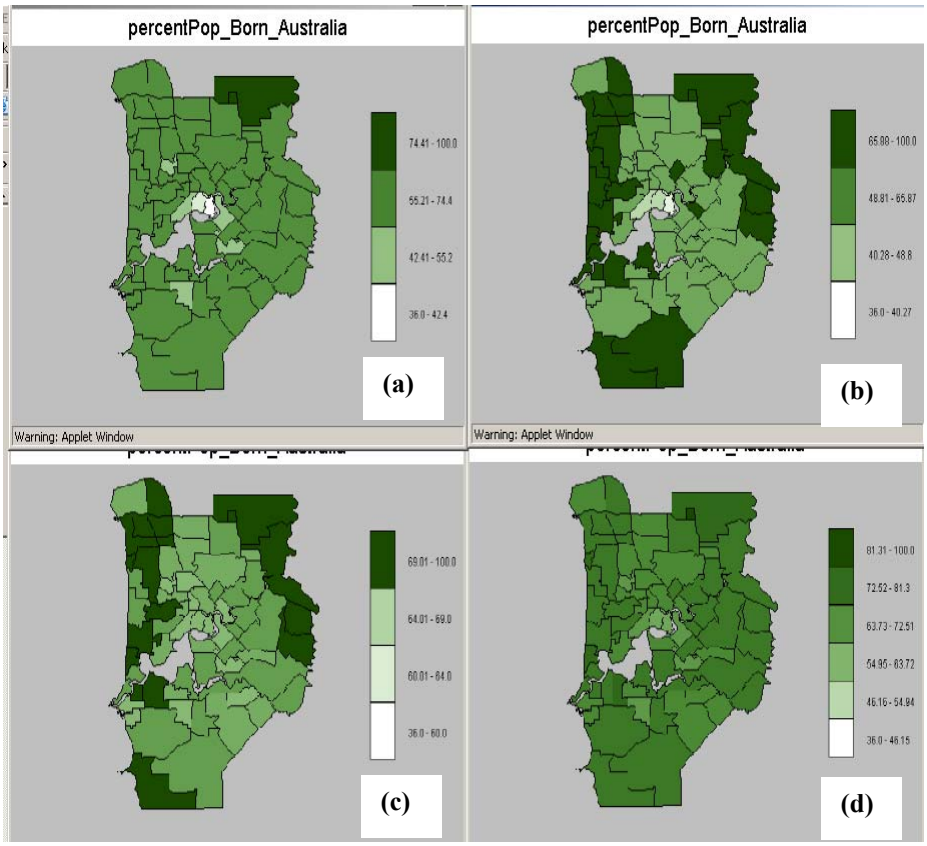

Figure 9. Examples of choropleth maps produced using different classification techniques (on same data set and class numbers): a) arithmetic progression; b) geometric progression; c) quantiles; d) standard deviation.

4. CONCLUSIONS

This recent initiative in distance, open and flexible learning undertaken at the Department of Spatial Sciences is in accordance with the new 'Spatial Information Industry Action Agenda' of the Commonwealth Government, which recognises the role of academic institutions as data and education providers. Although the size, composition and economic contribution of the broad spatial information industry are unclear, international market studies indicate that global expenditure on spatial information in the order of $US17 billion per annum and growing at a rate of 20 percent [13].

The distance online learning units implemented as part of the programme in GISciences at Curtin University, in addition to the Virtu-o-Learn project, have demonstrated a great potential for flexible delivery of higher education, from a traditional 'group centered' activity to an 'individual-centered' approach that enable any one to access educational multimedia materials regardless of geographic location, at any time.

5. ACKNOWLEDGMENTS

This work has been funded through Learning Effective Alliance Program (LEAP), Distance Open and Flexible Learning (DOFL) and Online Learning Development (OLLD) grants from Curtin University. The author would like to acknowledge the contributions of Duncan Hall and Elizabeth-Kate Gulland, who made much of this work possible. Also, special thanks to colleagues A/Prof Bert Veenendaal, A/Prof Mike Stewart, Dr Robert Corner, Dr Derek Lichti, Tony Snow and Mike Tassell of the Department of Spatial Sciences, who are joint researchers in the developments of the LEAP modules.

6. REFERENCES

[1] Fox, G. and Mills, K., 1997. Web technologies and the potential for innovation in distance education. International Jnal of Modern Physics C-Physics and Computers. 8:107-119.

[2] Spierre, P., 1998. Distance learning in physical education teacher education. Quest, 50:344-356.

[3] Lewis, L., roach, B., Haynes, E., 2000. A low-cost approach to public health education using multimedia packages. Jnal of Telemedicine and Telecare, 6 (Suppl 2):41-43.

[4] Bishop, M., Shroder, J., Moore, T., 1995. Integration of computer technology and interactive learning in geographic education. Jnal of Geography in Higher Education, 19:97-110.

[5] Krants, J. and Eagley, B., 1996. Creating psychological tutorials on the worldwide web. Behavior Research Methods, Instruments and computers, 28:156-160.

[6] Hurst, S., 1998. Use of virtual field trips in teaching introductory geology. Computers and Geosciences, 24:653-658.

[7] Cartwright, W., 1999. Extending the map metaphor using web delivered multimedia. International Journal of Geographical Information Science, 13:335-353.

[8] Veenendaal, B. and Corner, R., 2001. Online learning for GIScience fieldwork: a virtual challenge. Proceedings of AURISA 2001 conference, 19-23 November 2001. Australasian, Urban and regional Information Systems Association Incorporated ISBN:0-9588349-54.

[9] Snow, T., Veenendaal, B., Stewart, M., Lichti, D., Metternicht, G. and Corner, R., 2002. Interactive Learning: a surveying example. Proceedings of the 26th National Surveying Confernce of the Institution of Engineering and Mining Surveyors Australia, Darwin (Australia), 8-12 July. CD-ROM.

[10] Veenendaal, B., Metternicht, G., and Lichti, D, 2001. Expanding distance Education in the Spatial Sciences, DOLF Project, Final Report, March 2002. Dept. of Spatial Sciences, Curtin University, 18 pages.

[11] CEA, 2001. IBL development and WebCT. Online: http://www.curtin.edu.au/home/allen/we3/igm/02020101.html

[12] Veenendaal, B., Corner, R., Lichti, D., Metternicht, G., Snow, T., Stewart, M., 2002. Online learning: creating flexibility and interactivity. Proceedings of the 8th International Conference on technology Supported Learning and Training, 'Online Educa Berlin', Berlin, Germany, 27-29 November 2002. CD-ROM.

[13] Minching, N., 2000. Agendas: the Spatial Information Industries Action Agenda. http://www.isr.gov.au/agendas/Sectors/

7. WEBSITE

More information on the Virtu-o-Learn project is available from the website at http://www.cage.curtin.edu.au/leap. Temporary access to the WebCT unit Thematic Cartography is possible via the granting of a 'guest' password and username, obtained by email to graciela@vesta.curtin.edu.au

APPENDIX I: Questionnaire

Question 1: *In terms of the organisation of this unit, how does it compare with other units that you have taken (or are taking)?*
- This unit is poorly organised compared to other units;
- This unit is not too badly organised, but needs attention to be on par with other units;
- Uncertain. Can't really compare this unit to others;
- The organisation of this unit is good and is comparable to other units;
- This unit is well organised, compared to other units.

Question 2: *What is your primary course of study?*
- BSc GIS; 2. Graduate Diploma in GIS;
- Graduate Certificate in GIS;
- I'm doing another (related or not) degree;
- I'm an Extension student (not associated with any particular program of study)

Question 3: *What, do you think, is the contribution of the practical sessions to this unit?*
- The practical sessions did not help me at all in understanding this unit;
- The practical sessions were useful, but I did not understand their relevance to the rest of the unit;
- Uncertain;
- The practical sessions were useful and I understood their relevance to the rest of the unit;
- The practical sessions were very useful and they certainly helped me to understand the rest of the unit.

Question 4: *Is the online Calendar a valuable facility to work out important unit-related dates and help with time management?*
- No, definitely not;
- Not really;
- Don't really know;
- Yes, somewhat;
- Most certainly

Question 5: *Was the Study Plan (unit outline, contacts, etc.) well organised and easy to understand?*
- No, definitely not;
- Not really;
- Don't really know;
- Yes, somewhat;
- Most certainly

Question 6: *Was the Study Guide (content modules, etc.) well organised and easy to understand?*
- No, definitely not;
- Not really;
- Don't really know;
- Yes, somewhat;
- Most certainly

Question 7: *Was the Study Resources module (additional notes, required reading, past exam papers) will organised and useful for understanding the concepts discussed during the lectures*
- No, definitely not;
- Not really;
- Yes, to some extent;
- It certainly was a great help to understand and expand concepts discussed in the lectures; 5. Yes, I could have understood all the concepts of a particular module without going to the lectures.

Question 8: *Were the Work Guide (practical sessions, assignments, etc.) resources well organised and easy to understand?*
- No, definitely not;
- Not really;
- Don't really know;
- Yes, somewhat;
- Most certainly

Question 9: *Would you like to see more interaction (between student and computer) built into the web based learning environment?*

- No, definitely not;
- Not really;
- Don't really know;
- Yes, somewhat;
- Most certainly

Question 10: *How would you best describe the overall relevance of this unit to your current/future career?*

- Not at all relevant;
- Not that relevant;
- Uncertain;
- Relevant;
- Very relevant

Question 11: *Which of the following best describes the practical sessions for this unit?*

- Very difficult;
- Fairly difficult;
- Just fine;
- Quite easy;
- Very easy

Question 12: *Do the web based learning resources provided for this unit improve on traditional learning practices?*

- Definitely not;
- Not really;
- Don't really know;
- Yes they do somewhat;
- They certainly do

Question 13: *How would you best describe the presentation of this unit overall?*

- Not presented well. Difficult to follow;
- Presentation was okay. It could be improved;
- Uncertain;
- Presented fairly well. Quite easy to follow;
- Very good presentation. Found it enjoyable to follow.

Question 14: *Do you find the web to be a stimulating learning environment?*

- Definitely not;
- Not really;
- Don't really know;
- Yes, somewhat;
- Most certainly

Question 15: *Did you find that you used the web-based resources more than the library and other non-web resources?*

- No;
- Not really;
- Don't really know;
- Yes, somewhat;
- Most certainly

Question 16: *Did you find the flexible web based environment for this unit easy to use and interact with?*

- No, definitely not;
- Not really;
- Don't really know;
- Yes, somewhat;
- Most certainly

Question 17: *Is the Discussion Forum a valuable facility to communicate with fellow students and/or staff?*

- No, definitely not;
- Not really;
- Don't really know;
- Yes, somewhat;
- Most certainly

EXPANDING DISTANCE EDUCATION IN THE SPATIAL SCIENCES

Metternicht, G.

Department of Spatial Sciences, Curtin University of Technology,
GPO Box U 1987, Perth WA 6845, Australia.
E-mail: metternicht@vesta.curtin.edu.au

Biography

Associate Professor Metternicht has 14 years of experience in the production and management of spatial information for land degradation and agriculture-related applications. Her MSc in Geoinformatics (The Netherlands) and PhD in applications of remote sensing and GISystems to the mapping of land cover and land degradation, with emphasis on salinisation and soil erosion processes (University of Gent, Belgium) have furnished her with the skills and expertise that she has continued developing since her appointment as Associate Professor in Cartography and Remote Sensing at Curtin University. In addition to funding received from the Australian Research Council, A/Prof Metternicht has been recipient of awards and research grants by the Australian Academy of Science (1999), the Chinese Academy of Sciences (1999), the Science and Technology Agency of Japan (2001), the Rural Industries Research and Development Corporation (1997), the Netherlands Fellowship Program (1991-96), the European Association of Remote Sensing Laboratories (1993), the European Community (1995) and the American State Organisation (1989). In 1998 A/Prof Metternicht was awarded the Dean's Medallion for distinguished research at Curtin University.

Dr Metternicht is Principal Investigator on the Envisat Program of the European Space Agency, active member of the ICA commission on Mapping from satellite imagery, and editor of the International Cartographic Association Newsletter. She has also served as on the Western Australia Land Information System (WALIS) Advisory Committee, being member of the Australian Mapping Sciences Institute, the IEEE Geoscience and Remote Sensing Society, the Remote Sensing and Photogrammetry Association of Australia and the Remote Sensing Society (UK). Her research interests include agricultural remote sensing, spatial analysis and modelling for land use/cover and land degradation mapping and monitoring and change detection, with emphasis on the use of fuzzy logic, and advanced remote sensing classifiers.