

DISTANCE, MULTIMEDIA AND WEB DELIVERY IN SURVEYING AND GIS COURSES AT THE UNIVERSITY OF SOUTHERN QUEENSLAND

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ABSTRACT

The University of Southern Queensland has been involved with the distance education of surveying courses for over 25 years. In recent times, staff of the Surveying and Land Information Discipline, and the University as a whole, have embarked on multimedia enhancement and web delivery of curricula. This paper examines some of the initiatives undertaken to enhance the delivery of educational materials and discusses some of the issues involved in the effective delivery of distance education materials.

The significant experience in the delivery of traditional educational materials has proven to be an advantage in the repackaging and enhancement of teaching materials. Delivery of education to off-campus students requires a significant support infrastructure which is often not recognised by new entrants into the flexible delivery arena. Traditional support mechanisms such as phone, fax and standard media (eg. videos, audio tapes etc) are being replaced by email, 'electronic' discussion groups, CDs and internet resources. These enhancements, when developed professionally, require a significant commitment of resources and expertise and often require a team approach to their design and development. Access by off-campus students to internet services and affordable software packages also require careful consideration in the design and offering of distance education materials.

INTRODUCTION

Global economic trends, technological advances and the e-economy have not only impacted the traditional business and commercial sectors. Academic institutions throughout the world are grappling with impacts of the internet and the global higher education economy which is forcing change at an ever increasing rate. The emergence of this global higher education economy has also acted as a catalyst in overcoming the institutional inertia that has typified the culture of many universities (Taylor *et al.*, 2001).

Technological advances in surveying instrumentation and the trend towards geo-information management have seen the academic institutions reshape, re-market and transform their traditional surveying courses (McDougall *et al.*,1996). As part of this transformation academic institutions are embracing technology to update their curriculum through the provision of on-line information and the introduction of multimedia delivery (Shortis *et al.*, 2000). The geospatial community has embraced the new technologies and media, particularly the internet (Cartwright *et al.*,2000) whilst educational institutions are experimenting with the potential of this new technology for the delivery of teaching.

This paper examines some of the developments and issues that relate to the flexible delivery of surveying and GIS courses at the University of Southern Queensland (USQ). The historical development of distance education will be presented in order to appreciate the importance of developing a “distance education culture”. Resourcing issues are examined to highlight the need for specific infrastructure to support the various flexible delivery options. Recent developments in multimedia, web delivery and electronic communication at USQ will be presented and future trends will be discussed.

BACKGROUND TO THE UNIVERSITY OF SOUTHERN QUEENSLAND (USQ)

The University

Established in 1967, USQ has built a reputation for offering quality academic courses which are recognised worldwide by other higher education institutions and internationally accredited by many professional bodies. In 2000, USQ was the joint winner of the Good Universities Guide *Australian University of the Year 2000-2001* for criteria focussed on developing the e-university. In 1999, USQ was judged by a panel experts from the International Council for Open and Distance Learning (ICDE) as the best dual-mode university in the world. This award recognises USQ for its global education initiatives and its expertise in providing flexible learning opportunities to the world.

USQ enjoys a current enrolment of approximately 21,000 students, including 5,500 on-campus and 15,500 studying by distance learning. More than 600 academic and 850 administrative staff are employed to provide teaching and support.. The international program is expanding rapidly with 5,000 students from over 45 nations currently enrolled in USQ courses. Approximately 1000 students study on-campus, and a further 4000 study in their home country by distance learning. (USQ Statistics, 2001)

The current ratio of off-campus to on-campus students expressed as a percentage (74%:26%) (USQ Statistics, 2001) is a reflection of the emphasis that USQ places on the distance education. As can be seen in Table 1, the majority of external students could be classified as “mature-aged” with approximately 60% of the external population between the ages of 20-35. This clearly demonstrates that distance education addresses the needs of those in full-time employment and other sectors of the community unable to attend on-campus.

Age Group	Percentage
Under 20	5%
20-24	17%
25-29	22%
30-34	18%
35-39	16%
40-49	16%
50-59	4%
Over 59	0%
TOTAL	100%

Table 1: Nature of USQ's Off-campus Student Population: 2001

Students may choose to study on-campus or off-campus and may study either part time or full time. This flexibility enables students to move between off-campus and on-campus modes of study and to pace their studies to meet the changing requirements of family or career paths. Further flexibility is offered through a choice of two admission periods, February and July and the ability to articulate through a variety of courses.

Faculty of Engineering and Surveying

The Faculty of Engineering and Surveying is one of the foundation faculties of the University. It has experienced consistent growth to become a leading provider of engineering and surveying courses in Australia and overseas. Over 2,100 students study our courses in Australia or overseas, with approximately 30% attending classes on-campus whilst the remainder studying off-campus by distance education. The Faculty operates as an integrated unit and close links amongst staff across discipline areas facilitates the design and development of our fully articulated courses. This, together with our broad interface with industry and flexible study programs, enables the design of courses relevant to the current and future needs of industry and our students.

The Faculty comprises of four Disciplines, namely:

- Discipline of Agricultural, Civil and Environmental Engineering
- Discipline of Electrical, Electronic and Computer Engineering
- Discipline of Mechanical and Mechatronic Engineering
- **Discipline of Surveying and Land Information**

The Surveying and Land Information Discipline

The Surveying and Land Information Discipline comprises of a group of nine academic staff and three support staff. Over the past six years the Discipline has made substantial progress in the development of its teaching programs. The following programs are offered by the Discipline:

- Doctor of Philosophy
- Master of Geomatics
- Graduate Diploma in Geomatic Studies
- Graduate Certificate in Geomatic Studies
- Bachelor of Surveying
- Bachelor of Technology (GIS)
- Bachelor of Technology (Surveying)
- Associate Degree in Surveying
- Associate Degree in GIS

The most of these courses are offered by both on-campus and distance modes. The courses have been designed to form an articulated suite of offerings that enable students to progress to their highest potential. The duration of these undergraduate courses is shown below in Table 2.

Course	Years of Study	
	Full-Time	Part-Time
Bachelor of Surveying	4	8
Bachelor of Technology (Surveying)	3	6
Bachelor of Technology (Geographic Information Systems)	3	6
Associate Degree in Surveying	2	4
Associate Degree in GIS	2	4

Table 2: Duration of Courses by Study Mode

A significant proportion of students enter these courses with advanced standing and often swap between external and on-campus study modes as they progress through their academic programs.

DISTANCE EDUCATION VERSUS OPEN LEARNING

It is important to understand the breadth and fundamentals of distance education in order to appreciate its role in the higher education sector. Terms such as distance education, open learning and flexible delivery are often used interchangeably, however there are distinct differences and limitations that characterise each.

The concept of distance education is not new. The process of providing education to off-campus students had been undertaken in varying forms by most universities. Bennett (1986) refers to 'distance education' as an educational process that is characterised by:-

- separation of teacher and learner;
- the influence of an educational institution that distinguishes it from private study;
- the use of technical media, usually print, to unite teacher and learner;
- the provision of two-way communication so that the student may benefit from, and initiate dialogue;

- the teaching of people mainly as individuals and rarely in groups; and
- the elements of a more individualised form of education.

This mode of education is commonly classified as ‘flexible delivery’ indicating the basic strengths of this form of education.

In contrast, other forms of delivery, such as ‘open learning’, are inherently different and include some administrative and educational constraints (Bennett, 1986). Administrative constraints mean the learner must:-

- attend in a specific place
- attend at definite times
- attend over a stated period, and
- join a group of a minimum size.

Educational constraints require learners to accept:

- the sequence of teaching offered
- a teaching strategy which suited the teacher
- the learning objectives already defined, and
- minimum entry requirements which may have little or no relevance to personal learning.

The delivery systems required for distance education and open learning are therefore quite different as they cater for differing markets. The expectations of off-campus students are also quite different to on-campus students, as are their reasons and motivation for study.

HISTORICAL DEVELOPMENTS IN DISTANCE EDUCATION

Most people have heard of, or come in contact with, some form of distance education. Whether it was the early developments in correspondence teaching or the recent forays into the technology delivery platforms such as the internet, there is no doubt that it has become a major player and a truly global business.

The developments of distance education can be tracked over time and include the following models (generations) of development:

- (i) Correspondence Model (First generation)
- (ii) Multimedia Model (Second generation)
- (iii) Enhanced Model (Third generation)
- (iv) Flexible Learning Model (Fourth generation) (After Taylor,1995)

Table 3 summarises the attributes of each of these models and highlights some of the specific delivery characteristics that differentiate each generation.

Correspondence Model (First Generation)

The “Correspondence Model” is the earliest form of distance education and was characterised by the provision of study notes and assignments. Students were usually left

to their own devices to study the materials provided and eventually to sit for an examination usually held at central location. It was seen as an aside to the main stream of on-campus education.

Many traditional universities at one stage or another provided a form of correspondence studies for remote students or students who were bridging their studies from one institution to another. The offerings were generally sporadic and often determined by the availability of documented course notes. In most instances the institutions had limited infrastructure to support these programs, and hence, most have now disappeared.

Models of Distance Education and Associated Delivery Technologies	Characteristics of Delivery Technologies				
	Flexibility			Highly Refined Materials	Advanced Interactive Delivery
	Time	Place	Pace		
First Generation - The Correspondence Model <ul style="list-style-type: none"> • Print 	Yes	Yes	Yes	Yes	No
Second Generation - The Multimedia Model <ul style="list-style-type: none"> • Print • Audiotape, Videotape • Audio and Video Conferencing • Computer-based learning (eg CML/CAL) • Interactive video (disk and tape) 	Yes	Yes	Yes	Yes	No
Third Generation - Enhanced Model <ul style="list-style-type: none"> • Software and CD ROMS • Electronic Discussion Groups • Audiographic Communication • Broadcast TV/Radio and Audioteleconferencing 	Yes	Yes	Yes	Yes	Yes
Fourth Generation - The Flexible Learning Model <ul style="list-style-type: none"> • Interactive multimedia (IMM) • Internet-based access to WWW resources • Computer mediated communication 	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	No	Yes

Table 3: Models of Distance Education - A Conceptual Framework
(Adapted form Taylor *et al.*, 2000)

Multimedia Model (Second Generation)

For those institutions that continued as significant providers of distance education services, their range of support services and learning strategies continued to improve. The traditional printed materials began to be supported by a range of other media including audio tapes, videos and computer assisted learning (CAL) packages.

Phone-based technologies including audio conferencing and facsimile were utilised effectively to improve the learning process. The technology was simple to operate, reliable and provided a more personalised and interactive mode of delivery. It enabled students from study centres all over the country to interact with the lecturer and other students to discuss differing approaches to problems, and, to discover new solutions.

The printed materials were improved in their design as instructional designers began to provide a more comprehensive “educational” approach to the study materials. Improvements included the development of study guides, sample examples and examinations, a consistent “look and feel” to the presentation of materials and more comprehensive student support facilities.

Enhanced Model (Third Generation)

The Enhanced Model built on the previously mentioned models through the provision of additional electronic resources. These included:

- application software
- demonstration software
- sample data sets
- access to unit web site for lecture notes, powerpoint displays and other materials
- electronic discussion groups
- electronic submission of assignments.

The application software and data sets are incorporated into the study materials to help the understanding of the theoretical components of the unit. This has proved extremely popular with students, but relies on the access by all students to a computer system. Web sites and electronic discussion groups were later incorporated to provide students with a more dynamic resource base.

Flexible Learning Model (Fourth Generation)

The Flexible Learning Model incorporates the recent technological trends in delivery of materials over the internet. In this model, the provision of the teaching and learning materials is focused on almost complete electronic delivery. The study materials are provided online in an interactive multimedia environment that may encompass digital video, audio and demonstrations.

Communication to the lecturer and other students is channelled through electronic discussion groups and email. Assessments may be submitted and returned electronically with some assessments marked by computer managed learning (CML) systems. The advantages of electronic delivery for external students also provide benefits to full time student teaching (Young, 1997) through a greater flexibility in teaching resources.

DEVELOPMENT OF DISTANCE EDUCATION INFRASTRUCTURE

Distance education systems are complex and are widely believed to be more complex than conventional on-campus systems (NBEET, 1994). In its simplest form distance education consists of two components, a materials development component and a student support component.

The process of materials development normally culminates in the delivery of specifically prepared material designed to meet the educational objectives of the course. Materials have traditionally been delivered in print, however, this is increasingly giving way to electronic delivery. Irrespective of the media the process requires:

- planning and design of the unit
- materials development and writing
- production, and
- dispatch

It is important to recognise that the delivery technologies (printed materials, internet delivery, CD ROMS, videotapes, computer managed learning etc) simply provide students with access to information and instruction to enable an educational experience. What really matters is the quality of the instructional message, rather than the inherent characteristics of the instructional medium (Taylor, 1999). Therefore, it is possible to provide students with the most sophisticated graphics and electronic delivery systems without any significant increase in the pedagogical efficacy.

A key process in the improvement of the quality of teaching and learning has been the incorporation of a systematic approach to the instructional design of materials. In its simplest approach, instructional design entails the systematic analysis of the knowledge base and cognitive skills in order to design a sequence of well structured learning experiences.

This process tends to be beyond the expertise of discipline or subject experts and often demands the skills of educational professionals. These include specialists in system design, information systems, graphic design, educational processes, electronic publishing and project management. The team approach to instructional design has been institutionalised at USQ since 1977 (See figure 1). It is supported by a quality management system and an imperative to deliver materials on time.

The materials development and writing relies heavily on the expertise of the academic staff member and their ability to access suitable resources. The development and subsequent production is assisted by materials development staff and graphic designers.

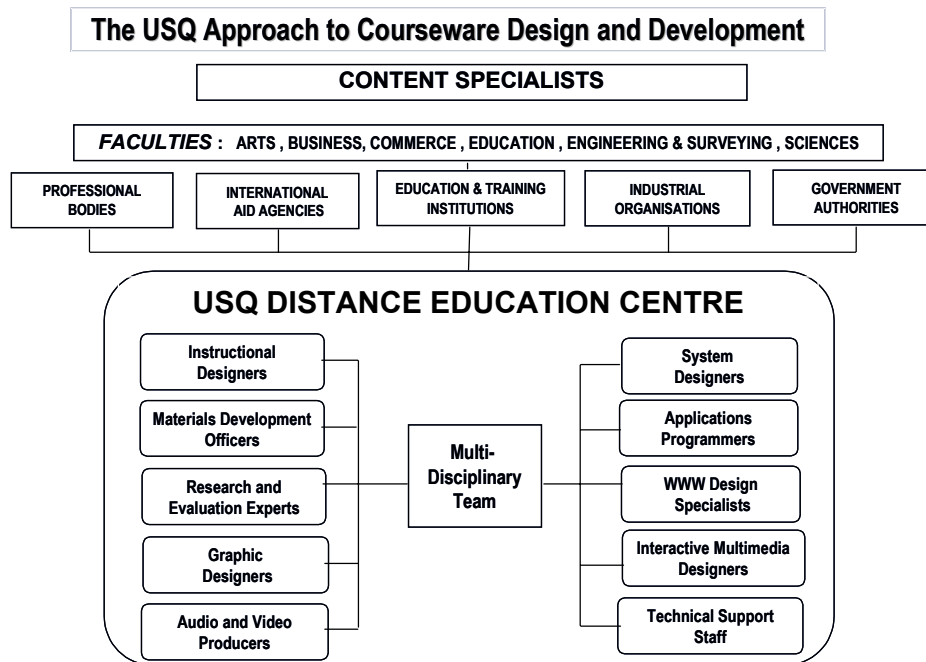


Figure 1: USQ Development Team Model
(Adapted from Taylor *et al.*, 2000)

Student Support Facilities

Student support facilities for distance education require a broad range of services both on-campus and in regional study centres. Advisory and contact staff must be in place to provide after hours advice for students who are completing their studies at night. Examination and study centres provide regional support for the diversely located student body. Prompt turn around of assessments is essential for distance education students, as this is often their only form of feedback. In addition, surveying and GIS courses normally have a significant component of on-campus residential school attendance to complete practical assessments. All of these services must be effectively resourced.

In the early models of distance education it became evident that student support was an essential ingredient for a successful learning outcome. The sophistication of these facilities has developed progressively over time to support both the academic needs of students as well as their personal and social needs.

Although support by traditional mechanisms such as telephone and fax continue, electronic support services now provide students with the ability to access a greater range of information and facilities. Web interfaces provide a portal to an expanded range of services. At USQ the student web interface, *USQConnect*, provides students with an increasing range of services including:

- Electronic course materials for an increasing number of units

- Access to up-to-date library catalogues, electronic journals and articles, and text databases
- Secure access for enrolment details, assignment lodgement and return dates, and end semester results
- Faculty information on departments, courses, policies, and staff details
- Electronic mail (email) – useful for communicating with academic and support staff and other students
- Conferencing and group communication
- Internet learning resources
- Electronic Noticeboard for external students including Residential School and telephone tutorial timetables, learning circles and other information.

Administration and Resources

The internet delivery of educational materials has been seen by some universities as a solution to declining student enrolments. Although the rush to put materials on-line continues, many institutions have now realised the significant time and resource implications required to develop and maintain these offerings.

The development of quality educational materials is more than simply putting powerpoint slides on a web page. Notes designed for face to face teaching may not be directly applicable to distance students (Veenendaal *et al.*, 2000). Professionally structured educational materials may cost between \$30,000 - \$120,000 per unit to develop, depending on the content and degree of interactivity. Of course, the costs to provide an educational product of this nature do not stop here. Each offering of a unit requires annual modification and updates of the materials and the development of new assessment instruments and examples. This ongoing maintenance must be managed and sequenced to ensure that units are delivered on time across the whole university.

New technologies bring new resource issues and problems. Some of the issues that now face universities with the advent of improved communication technology include:

- Email – students expectation of immediate responses to their questions
- Internet resources lead to plagiarism and “cut and paste” answers
- A world wide student body with diverse cultures
- Variations in terminology with the global offerings
- Need for 24 hour service as we deliver to an expanding global market

A significant component of time and resources for distance education is devoted to the management of assessments. Assessments may take many forms, but usually include assignments, computer assisted learning exercises and examinations. Design of the assessments for the distance education students must consider the possible learning barriers, time constraints and sometimes the resource constraints. In the surveying and GIS areas it is important to understand the student’s ability to access equipment, computers and communication infrastructure.

Importantly, it is the overall management and administration of these assessments that is often critical to the success of distance education. At USQ the assessments for the 15,000 external students are all sent to a central mail location, the Distance Education Centre (DEC), to be logged in and distributed. Each assessment has a unique barcode which, once scanned, is listed on the database so students can see that the assignment or exam has been received. These are then distributed to the appropriate academic staff who will mark and return again via the DEC.

On completion of marking, assignments and marks are once again logged at the central mailroom and the results made available to students via *USQConnect*. The assessment database provides a quality assurance process to control the enormous amount of assessments that come into the university each day (approximately 100,000/semester).

The system also provides a record of the turn around time for marking of each assignment so that management can monitor areas that may require improvement. The feedback, as well as the timely return of assignments, is critical for external students. It is often their only indication of progress so it must be comprehensive enough to ensure the student can remedy any problems within a reasonable timeframe.

A final examination is still used by most distance education institutions as a key component of the total assessment. Students are usually required to pass both the assignments and the final examination of a unit. The organisation of examinations for external students is a massive task in its own right. At USQ, with students in over 45 countries, it is a considerable task to organise and manage the distribution of examinations, invigilation and secure return of examination scripts in these remote locations.

FLEXIBLE DELIVERY IN SURVEYING AND GIS AT USQ

The hype of internet delivery by some universities has painted the picture that with the click of a mouse all of their courses would be “virtually” available. The reality of the situation is somewhat different. Universities have now realised that to establish a quality and sustainable range of offerings via flexible delivery requires substantially more than the conversion of word-processed notes to HTML pages.

In the Faculty of Engineering and Surveying the approach to this hype has been a little more cautious. Understanding the enormous resourcing issues as well as the technical issues has been a great benefit in the development of new initiatives in the Surveying and GIS courses. Given that all our units are already in electronic form, it would have been quite easy to convert our existing products over to web delivery and provide students with a complete on-line course.

However, we have adopted a measured approach to the development of enhancements and delivery of our distance education courses. This approach includes:

- On-line development of a selected number of units using limited video and audio enhancements

- Greater utilisation of CD ROM enhancements to include additional software and imagery
- Development of some Computer Assisted Learning (CAL) marking for external assessment
- Greater use of supporting application software for areas such as GIS, remote sensing, photogrammetry, GPS and adjustments
- Development of unit web pages that enable external students access to the same lecture materials as internal students, and
- Incorporation of discussion groups and mailing lists to enable improved communication both amongst students and also with the lecturer

There is no doubt that resourcing constraints play a major role in any significant strategic developments within the area of distance education. The decision to proceed with our approach has been based on sound pedagogical grounds but also with a realisation of the economic constraints.

Surveys of our students have indicated that although they would like to see more on-line units developed and more multimedia enhancement, they also value the flexibility of the printed media. The printed media provides significant advantages when students travel with their employment, and importantly, does not require computer access. In remote areas it has been found that, although there may well be access to the internet, its performance and reliability is inconsistent. This variability is a function a number of factors including the server location, the quality of the communication infrastructure and the volume and format of the materials being distributed. USQ has addressed the first issue by establishing local servers that mirror the study materials throughout mainland Australia, SE Asia and the USA.

Students have also shown a dissatisfaction with studying and reading materials only from the computer screen. Being required to print out large volumes of web material is not only time consuming but also a very costly impost on the student. Instead our efforts have concentrated on the improvement in the other areas of delivery, namely the quality and diversity of materials, assessment mechanisms and improving communication.

The obvious question to ask of these developments and initiatives is “*Are there any improvements in the learning and teaching outcomes?*” The assessment of the outcomes is not easy (Shortis *et al.*, 2000) and immediate results may not be available until a student graduates. For USQ, the initiatives are part of the need to keep the organisational infrastructure relevant and current and to provide students with better quality materials and greater flexibility.

Future initiatives at USQ are geared towards the greater utilisation of the convergence of technology to put in place the e-University. These projects include:

- Development of techniques to provide flexible and generic materials through the use of XML technology
- Expanded on-campus access for students including wireless networking for web access of materials, and

- Development of a new web interface to provide greater flexibility for students and staff teaching .

CONCLUSIONS

Australia generally, and the University of Southern Queensland in particular, has been a leader in distance education over the past 20 years. However with the convergence of technologies such as the internet, telephony, digital television and personal communication devices, the opportunity to move into this market is open to global competition.

The rapid rate of technological change and the rapidly growing number of institutions now embarking on internet-based delivery means that more institutions are involved in distance education than at any time in history. As institutions throughout the world increasingly offer courses via the internet, there will emerge a global higher education economy in which institutions will face global competition for students, especially those involved in continuing professional education and lifelong learning (Taylor *et al*, 2000).

In many universities the development of online initiatives are not systemic, but are often “random acts of innovation”, initiated by risk-taking individuals. In contrast, the implementation of web-based applications at USQ is strategically planned, systematically integrated and institutionally comprehensive.

REFERENCES

Bennett, R. (1986), Through the open door – today’s revolution in open access and distance learning. *Journal of European Industrial Training*, 10(6):1-7.

Cartwright, W and Miller, S. (2000), Setting a research agenda for multimedia cartography, *Proceedings of Mapping Sciences Institute Australia National Conference*, Sydney, 2000. pp 333-343.

McDougall, K and Dowling, D. (1996) Education, communication and integration: a look at the future of distance education in surveying. *Proceedings of 37th Australian Surveyors Congress*, Perth, Australia, pp 435-443.

National Board of Employment, Education and Training (NBEET), 1994, Costs and quality in resource-based learning on and off-campus, *Commissioned Report*, 33:212

Shortis, M. and Cartwright, W. (2000) An overview of curriculum transformation and multimedia delivery, *Proceedings of 2nd Trans Tasman Surveyors Conference*, Queenstown, New Zealand, pp 37-49.

Taylor, J.C. (1995). Distance Education technologies: the fourth generation. *Australian Journal of Educational Technology*, 11, 2, 1-7.

Taylor, J.C. (1999). The death of distance: the birth of the global higher education economy, in *e-Journal of Instructional Science and Technology (e-JIST)*, 3, 1, 6-11, 1999.

Taylor, J.C. (2001). Fifth generation distance education. Keynote address delivered at the ICDE 20th World Conference, Dusseldorf, Germany, 1-5 April, 2000.

Taylor, J.C. and Swannell, P., (2000). USQ: An e-university for an e-world, *International Review of Research in Open and Distance Learning*, Vol 1, No 2, 2000.

University of Southern Queensland Statistics, 2001, Enrolment Figures, www.usq.edu.au/vc/planstats/index.htm. Accessed: 15 June, 2001.

Veenendaal, B and Wright, G., (2000). Flexible education in spatial sciences, *Proceedings of Mapping Sciences Institute National Conference*, December, 2000. Sydney. pp345-357

Young, F.R. (1997), The changing face of education: meeting the surveying and mapping education needs, *The Australian Surveyor*, 42 (4):148-155.