Flexibility in GIS Education – A Vision

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Abstract

In the last 5 years there has been dramatic changes in the development, design, and implementation of GIS. Rapid advances in processing power, developments in software, and increased availability of digital data have allowed diverse applications and the execution of complex geocomputational analysis. With the advent of the new millennium, speculation on the form of future systems is an important issue. This is a major consideration for those charged with the specification of GIS curricula in tertiary education environment. The over-riding question is what future aspects are going to be most useful to graduating students entering the industry or undertaking scientific research? This paper represents the authors' postulations on the likely influences on future tertiary GIS education. It is proposed that to meet this challenge at Otago, that a new joint board of studies be established to oversee the formation of a proposed multidisciplinary degree in GIS.

2 Vision

To develop a new course in any subject or discipline today requires knowledge of the market place and/or the power of great foresight. They are necessary to justify both the economics and relevance - maybe euphemistically, here called *acceptance*. The introductory section of this paper concentrates on the vision rather than the market place, though the two are inextricably linked. The issue directly addressed here is - "*Where will we be with the spatial systems in the year 2020?*". This question is approached with some domain confidence, but with an equal amount of scepticism as to the reliability of any forecasting. It is only with these tenets well understood that it is possible to proceed.

Spatial systems are inclusive of all matters relating to geographic information systems, - the teaching and learning, the people, the data, the systems, the analysis techniques, the context and the society within which it is being used. So, where will we be? There are sufficient indicators and visionaries that predict the generalities as follows;

1. more/most people will be working from home,
2. both software and systems will be disparate and distributed,
3. the world will have "shrunk",
4. people will increasingly have to respect the planet,
5. power will concentrate in those with information.

From these unfolds a vision of the spatial world;

1. systems and software will be distributed internationally,
2. data sources will be distributed internationally,
3. problems and solutions will be addressed internationally,
4. education will be student centred and experiences will be for all of life (Meade 1997),
5. spatial systems will rely on *implemented* applications based on interoperability and software solutions to standards (data standards per se will have faded),

6. representations of reality - within spatial systems - will be life like and real,
7. learning will be all of life, with continual up-skilling,
8. spatial education will be multidisciplinary.

From the above generalities and visionary concepts must unfold a more tangible future. It is considered both possible and desirable that the future spatial industry will in fact rely far more on distributed systems and solutions. The foundations for this are in place. There is an institution of people with the perception that what we have *done* is the model of what we have *to do*. The future is not a life member of that club. What we have to do is not yet before us.

To summarise, consider the following scenario for the year 2020. We at Otago propose to put in place the building blocks for the assault;

> *A spatial system is an integration of systems, software and knowledge, all distributed international and used by multidisciplinary teams in real-time - without delay - with charges - and with complex security walls. The system itself is a biological computer using 'nano-technology based knowledge intelligent agents' to roam data repositories. No longer are systems confined to one-dimensional disc data. Nano-explorers navigate through real terrain databases, with the ability to find, analyse and discover and report.*

3 Introduction

The problem as identified in the vision is simple (Figure 1). The solution is more difficult to define. Figure 1 shows a timeline from this year (1998) until the year 2020. It is impossible to prepare under-graduates and post-graduates for the skills and attributes required for the year 2020. At present this period in time is a blurry fog of possibilities and guesswork because future requirements are unknown, and the technology has yet to be invented. In preparing GIS education and research, it is only possible to predict within a degree of certainty perhaps the developments to occur in the next five years (2003). If GIS courses and research are prepared with a five year (or shorter) time frame in mind, we can only hope that this is enough to maximise developments in the area of spatial information systems as the time-line progresses and the year 2020 arrives.

> *The challenge is to educate in the new technologies, and undertake research initiatives that advance development, in the minimum amount of time, so that the accumulated knowledge at the year 2020 is maximised.*

This paper argues that significant change must occur in all aspects of GIS teaching and research to achieve this goal. The changes are required as a result of both historical structures that are becoming less suited to an ever-diverse education and training environment and external influences on Universities. It is proposed in this paper, that at Otago, a Joint Board of Studies provides flexible ownership to oversee future education and research along with the formation of a dedicated four year degree in Geographical Information Science. While this paper does discuss the content, it is beyond the scope to directly suggest the exact composition of such a four-year degree. Quite correctly, this should be the responsibility of the proposed joint board of studies.

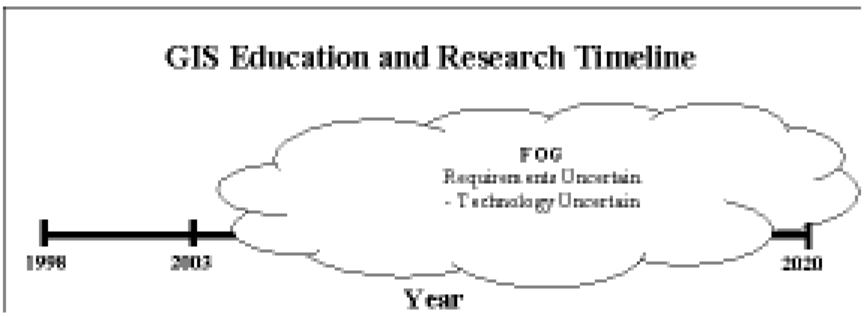

Figure 1 - GIS Education and Research Timeline

4 GIS Education and Research Issues at the University of Otago

There are major issues that effect GIS education and research at the University of Otago as they all experience ever changing forces and economic and societal drivers. These issues are both internal and external, and need to be understood before change can be designed and implemented.

4.1 Background of Existing Education and Research

Undergraduate GIS education at the University of Otago is provided mainly through the departments of Surveying, Geography, Computer Science and Information Science. The education provided both at the undergraduate and postgraduate levels tends to be related to the main departmental foci.

These departments represent the core GIS educators, which is a relatively unique attribute to Otago, and provides the University with a strategic advantage in terms of the nature of multidisciplinary activities.

In addition, the Spatial Information Research Centre (SIRC) was established in 1989 to conduct research and development in the general area of spatial information science. SIRC undertakes multidisciplinary research into aspects of spatial data acquisition, storage, manipulation, visualisation and analysis. Staff members of the university departments of Computer Science, Geography, Information Science, Marine Science, Maori Studies, Surveying, Preventive and Social Medicine, Zoology, History, Public Health, Botany, Anthropology, Biochemistry, Clothing and Textiles, Dental School, Geology, Injury Prevention Research Unit, Marketing and Physics, are associated with SIRC.

Bacon (1998), refers to the need to prescribe what the future of GIS-related education at the University of Otago should look like, adding that this will need to be evolved out of broader discussion. Discussion in his report highlights the need to extend conventional GIS-related education concepts and explore better concepts and approaches. Bacon (1998:2) argues that education activities "...should not continue to be along the lines of the "territorial edifices" through which they are currently manifest at the University...". It is however argued in this paper that the current university management structure and government EFTS based funding models promote territorial *protectionism*, and do not necessarily represent the best interests of the student, especially with the new demands for life long learning. Given the multidisciplinary nature of GIS there is a need to develop methods for crossing the departmental boundaries in a seamless and consistent manner.

There are obvious issues involved in the creation of GIS education programmes that exhibit the level of cross-discipline coverage discussed. Gahegan & Veenendaal (1996) highlight the need for computing, mathematical, geographic, and application skills in this area. They also note (1996:2) the politics involved in co-ordinating GIS education '...against an existing programme of geography, surveying, computer science and so on'. They argue that in the establishment of such programmes '...you are always stepping on somebody else's toes' and that this type of politics 'has caused a good deal of behind-the-scenes opposition at many of the world's GIS education institutes both within and between departments'. It is important to emphasis the need to develop the interests of the student rather than protect the interests of the departments involved.

4.2 Current Bachelor of Science in Land and Spatial Information Systems

Currently, there is only one dedicated GIS style degree offered by the University of Otago. It is the Bachelor of Science in Land and Spatial Information Systems offered by the Department of Surveying. While this degree exists, the majority of GIS education at the undergraduate level is undertaken by students selecting certain papers as part of other degree specialisations. Typical papers are offered by Surveying, Geography, and Information Science, but have obvious bias toward the course specialisations of each department concerned. It is fair to say that the number of students attracted to the existing BSc in Land and Spatial Information Systems has been small.

There is mixed opinion as to whether GIS education warrants its own independent subject and or degree. It is believed that in the New Zealand context that a Department of Spatial Information is not justifiable at this time. One the one hand, GIS has become so technically developed that its own subject is desirable, but on the other, some evidence suggests that it has become so mainstream (such as maps in Microsoft Excel) that the full development of a subject is not required. This said, the experience at Curtain University of Technology (Gahegan & Veenendaal 1996) in running a GIS degree appears to have been very favourable.

At the University of Otago, the present Bachelor of Science in Land and Spatial Information Systems is described in Table 1.

It is likely that the content of this course will have to be adapted to the multidisciplinary arena for which GIS is now used and for all students that may wish to undertake a degree in GIS. For example, a student whose main background or interests in GIS are databases and information technology, may consider that studying Land Tenure Studies 1, 2, and possibly 3, as less suitable than other papers offered in the university. Similarly, students whose background and specific GIS application focus are outside of the main four GIS educators may wish to substitute more relevant papers (eg. Maori, Zoology, Mathematics, Dentistry, Anthropology, Horticulture, Medicine, etc). It is therefore suggested that the existing structure that while appropriate at the time, is in need of revision and advancement.

4.3 Flexibility, Life-skills, and Student Centred Learning

[*The following discussion is paraphrased from Meade (1997) in which the first author of this paper assisted in its compilation*.]

Universities have begun to experience a more intense challenge to their traditional view of tertiary education and its activities than at any time in history. The ever rising cost of higher education has inevitably led to the requirement for demonstrable cost-benefits, and concerns relating to education quality. Student satisfaction has gained increased importance, particularly as institutions, and even departments, compete for enrolments. In terms of the overall trends in tertiary education there are three other major paradigms that are having a profound effect on this area.

- ***Developments in Information Technology*** – The impact of rapid technological development is changing the range of available teaching mechanisms and delivery. This not only effects the structure of a course, but also the development of

100 - Level	• Surv111 – Introductory Surveying • Surv112 – Computers and Surveying • Comp102 – Information Engineering • Comp103 – Computer Programming
200 – Level	• Surv206 – Land Tenure Studies 1 • Surv208 – Communication for Surveyors • Info211 – Systems Analysis and Design • Info212 – Database Design and Management Principles
300 - Level	• Surv306 – Land Tenure Studies 2 • Surv332 – Spatial Information Systems • Surv308 – Project *And 9 points from:* • Surv323 – Photogrammetry 1 • Surv324 – Remote Sensing and Environmental Monitoring • Surv326 – Special Topic 1 • Surv427 – Land Tenure Studies 3

Table 1 – The Structure of the BSc in Land and Spatial Information Systems

VWAN's (very wide area networks), and hence the scale under which a course may be taken.

- ***Student Centred Learning*** – Where once "the professor" was the main focus of the education delivery, there has been a transition from the traditional teacher-centred approach, to a learner-centred model. This means that the student is surrounded by resource material, only one of which is the professor, and tuition is problem-based, self-directed and peer-assisted. This facilitates the student to learn at their own pace, in their own way.
- ***Lifelong Skills Learning*** - There is a move away from the traditional transfer of technical knowledge from educator to student, to more of a broad based education experience. This potentially allows the student to have the knowledge to solve problems not previously encountered, even though the student does not have direct training. This is increasingly being sort as desirable features by potential employers.

Increasingly these paradigms are being described as 'flexibility' in education. That is a very broad term covering what is taught, how it is taught, where it is taught and is very much a student oriented approach.

The trends in tertiary education are for a broadening of the students' horizons towards life-long learning skills. In an ever 'shrinking' world, there is some discussion with regard to the mandatory pursuit by students of spoken languages as part of an internationalised GIS degree base. This idea has significant merit as does permitting portions of the degree to be undertaken while working or researching with overseas GIS organisations.

4.4 The Changing Nature of GIS Itself

The first system to be called a GIS was the Canadian Geographic Information System developed in 1967 by Roger Tomlinson (Zwart 1992). Since its conception, GIS has continued to evolve, with the most notable development occurring in the last ten years. GIS has undergone a maturity process (Marr 1996a) that has transformed GIS from a standalone novelty software tool suffering from misconceived hype to an integral part of mainstream spatial information management and analysis. The teaching and research of GIS at the university level has largely reflected these changing fortunes. Marr (1996b) demonstrated that many local government organisations who represent large users of spatial information were ineffective in their use of GIS for complex spatial analysis and other relatively advanced uses.

The recent growth in prominence of "geocomputation" highlights the transition of research away from that of basic GIS techniques and implementation, to analysis techniques that exhibit a greater level of sophistication and complexity. Couclelis (1998:17-18) states that:

> *'Geocomputation is understood to encompass a wide array of computer-based models and techniques, many of them derived from the field of artificial intelligence (AI) and the more recently defined area of computational intelligence (CI). These include expert systems, cellular automata, neural networks, fuzzy sets, genetic algorithms, fractal modelling, visualisation and multimedia'*.

In addition, other traditional problems symptomatic of GIS are being directed to such issues as data sharing and incompatible data formats. The current research and development into interoperability and open GIS (OGC 1996), and knowledge acquisition (Fayyad 1997) will have a profound effect on future GIS development.

With significant change on the future of GIS so imminent, there is a requirement to ensure that teaching and research undertaken at university continues to be both current and relevant. It is asserted that at Otago, changes to course content and structure will be required to meet this challenge. This of course highlights the need for multi-disciplinary study.

4.5 Overseas Case Studies

4.5.1 Edinburgh University Master's Programme in GIS

The MSc. programme at Edinburgh University (Edinburgh 1997) represents one example of a particularly innovative GIS course structure. The 12-month course is formed by a 6-month taught component followed by a 6-month dissertation. The modules taught as part of the course do not adhere to the traditional semesterised course structure. The base modules of the taught course consist of the mandatory study of:

- Data Models and Data Structures
- Spatial Analysis using GIS
- Research Design and Project Management

In addition, optional modules consist of:

- Principles of Geographical Information Science
- GIS and Public Policy
- Principles of Digital Image Processing
- GIS Software and Systems
- Geomatics and Digital Terrain Modelling
- Software Engineering and Geographical Algorithms
- Computer Cartography and Computer Graphics for GIS Applications
- Locational Modelling
- Environmental Modelling

Other optional modules may include (taught outside Geography):

- Remote Sensing 1
- Remote Sensing 2
- Resource Management
- Information Technology

Besides providing flexibility to those student partaking in the MSc course by the provision of optional course selection, the module structure has facilitated the formation of a "Customised Personal Training Programme" (CPTP). The CPTPs are designed for those wishing training rather than degree-level qualification in the field. The CPTPs appear to be aimed at commercial training needs and are income generating. The construction of the CPTP course follows the same module structure of the MSc course. In an Otago context it is very possible that these could be offered at night, during semester breaks and/or remotely.

The merits of the Edinburgh example for other Universities teaching GIS are many. Although this example is aimed at the masters level, there would appear no reason why the modules listed could not exist at the 300 and 400 level of an undergraduate degree. The clear focus of the module topics, and the flexibility that a student has to select a course of interest are clearly desirable. Another important point is that the content of the modules loosely follows those classified as advanced in nature such as the subject details emerging from the geocomputation theme. In times of decreased government funding, and increased competition, the ability to attract students beyond those completing degrees is obviously very attractive for the departments, and Universities concerned.

4.5.1 Birkbeck College MSc GISci Distance Learning Degree

Birkbeck College, London provides a MSc degree in GIS though distance learning (Birkbeck 1998). The mode of delivery is mainly by means of the WWW. Other sources of information provided include discussion groups, access to GIS software at the user's location, library inter-loans, and meetings at international GIS conferences. The 12-month, full time MSc programme costs £3700 for non UK and EU students. While this example is not unique, it does demonstrate the type of competition that Universities teaching and researching GIS are likely to face in the near future. It is appropriate that future University course development considers the implications.

5 Proposed Joint Board of Studies

In proposing a hypothetical GIS degree structure, there are many issues that need to be addressed. These issues arise from the changing university environment, and the need to address the educational requirements of the student. It is argued that the optimal method of addressing the multidisciplinary nature of GIS, given the unique operating environment at Otago, is the establishment of a joint board of studies to oversee the running and management of the degree. The teaching staff from those departments with the mandatory structure of the proposed degree would form the board members. In its draft form the board would be constituted from Computer Science, Information Science, Surveying, Mathematics, Geography, and one other. The other department would be taken from Psychology, Philosophy, or languages. Each of the departments listed has various roles in the teaching of the proposed degree.

The Computer Science role would be to provide computer education with the inclusion of programming and algorithm development skills. The Information Science department would provide system development and database competence, while for Surveying, the role would be the teaching of material relating to measurement science. Mathematics would be responsible for the teaching of algebra and statistical analysis techniques. Geography would teach earth and natural science and if appropriate, spatial analysis. The inclusion of Psychology, Philosophy, or languages, is designed to enhance and broaden the educational experience of the student and to provide them with an increased international competitiveness. The inclusion of languages in particular is designed to develop the students ability to function and apply the skills developed as part of their degree in an international sitting. Tuition of languages would be with respect to language, speech and science rather than the literature aspects.

Student are still able to undertake other degrees of their choice, that involve in part elements of GIS education from any department, but this would not fall under the jurisdiction of the joint board. The multidisciplinary nature is flexible by design, but also promotes wide diversity in the students who undertake this course.

There is a growing requirement that university education exhibit a high degree of flexibility. In practical terms this may manifest itself with the admission of students who were not resident on campus but whose teaching and/or research was conducted within another organisation, perhaps overseas. Another aspect of flexibility is utilisation of emerging technology to facilitate distance-teaching initiatives, as has been the case with the development of the diploma of health informatics, by the department of information science.

The proposed degree includes encouragement for the student to embark on a recognised formed of vocational training. Ideally, this would be undertaken at an overseas institution whether this be commercial, government, or educational. While the overseas aspect is promoted, completion with a local organisation would be acceptable. The purpose of the vocational experience is to encourage closer co-operation with outside entities, as well as developing a broader attitude to GIS in the student.

The proposal of such a degree is not viewed as the teaching and testing of student proficiency in GIS, rather the development of life- long skills in the student that would see a wider range of ability, and less dependence on pure technical knowledge. It is regarded as crucial that the proposed degree has the ability to follow on into postgraduate research and further education opportunities. Such postgraduate research may be conducted solely within one department or following on from the proposed structure of the under graduate degree, a multidisciplinary approach is likely to ensue.

The principal focus of the proposed structure is the student. In proposing this structure, there may be the temptation for individual departments to second guess the overall impact on their funding based on perceived student numbers. It is important at this stage to focus on the needs of the student, with the realisation that a quality course that is properly marketed, utilising distance teaching technology where appropriate, should attract the relevant student numbers.

6 Proposed Four Year GIS Degree

The proposed GIS degree structure would consist of a four-year course (Figure 2), which does not include honours. It is important to note that this figure represents the anticipated course of study for the majority of students studying for a GIS degree. The concept is not fixed and may vary to suit the specific requirements of a student in their chosen field of study, conditional on any criteria specified by the joint board of studies being attained.

With the requirement for flexibility and particularly the needs of those students not resident at Otago, the joint board could recommend to waive, alter, or stipulate any requirement considered necessary given the individual needs of the student or students concerned.

In Figure 2, the first year of study would be considered a generalist year, with no direct GIS tuition although in most cases, the student would select first year papers from the departments listed. After the first year the student would undertake the course of their choice, as long as it met the criteria and approval of the joint board of studies. The students would be encouraged to select a course that was as multidisciplinary in content as possible. This could be achieved in practice by a limit specification on the number of papers that may be completed in any department at any level (for example, 3 as shown in Figure 2). There is also a compulsory restriction that student must undertake the spatial information papers at year 2, 3, and 4 as the major of their course.

To examine how this might work in a given situation, a course has been designed for a student who wishes to study GIS from the earth and natural science perspective, including spatial analysis, and the design and management of environmental information systems. Figure 3, shows a possible degree structure consistent with the aims and aspirations of the student. In addition to the principle study areas of Geography and Information Science, the structure promotes foundation learning of algebra and statistical analysis techniques in mathematics and the concepts of earth measurement science in Surveying. The course incorporates the mandatory study of the primary spatial information papers, while allowing the student to develop language skills. The inclusion of languages not only develops additional skills for the student consistent with the internationalisation of the degree, but also provides variety from the scientific nature of study found in the other aspects of the course. In the last year, one feature of the course is the ability of the student to undertake vocational training and forge closer ties with potential employers at the same time.

7 Conclusion

Developments in GIS over the last 5 years have been dramatic and the ongoing process of innovation is likely to continue for the foreseeable future. It is asserted in this paper that we need to consider the role of spatial systems in the year 2020. The stated challenge is to maximise accumulated knowledge at the year 2020 by rapid advancement of teaching and research in the short to medium term.

	Comp Sci.			Geography			Info Sci			Mathematics			Surveying			Spatial Majo	Psychology	Philosophy	Languages	Vocationa	Overseas	Other
4th Yea	4A	4B	4C	4A	4B	4C	4A	4B	4C	4A	4B	4C	4A	4B	4C	12pt	4A	4A	4A			
3rd Yea	3A	3B	3C	3A	3B	3C	3A	3B	3C	3A	3B	3C	3A	3B	3C	12pt	3A	3A	3A			
2nd Yea	2A	2B	2C	2A	2B	2C	2A	2B	2C	2A	2B	2C	2A	2B	2C	12pt	2A	2A	2A			
1nd Yea																						

Figure 2 - Proposed Structure of Four-Year GIS Degree

	Comp Sci.			Geography			Info Sci.			Mathematics			Surveying			Spatial Major	Psychology	Philosophy	Languages	Vocational	Overseas	Other	Total Point
4th Year				8	8	8										12				6			42
3rd Year				6	6	6	6									12			6				42
2nd Year				6	6	6	6									12			6				42
1nd Year				6	6		6	6		6			6						6				42
																							168

Figure 3 - Example Course Structure using New Degree Format

Many institutions have significant experiences in GIS teaching and research accumulated over the last ten years, but it is asserted here that in many cases, the current situation may be in need of reconsideration given the rapidly changing circumstances found both within universities and in the nature of GIS itself. The influencing factors on teaching are the desire to incorporate flexibility, life-skills, and student centred learning into teaching programmes. Added to this change in the style of teaching is the expected growth of internationally based, distance teaching programmes, which will add increased competition to the GIS market place. GIS itself in undergoing significant change, which will be reflected in teaching and research. The established global research themes of geocomputation (Couclelis 1998), interoperability (OGC 1996), and knowledge acquisition (Fayyad 1997), means that in many cases the content of current teaching programmes may required reconsideration.

This paper proposes that in the case of the University of Otago, the needs of GIS teaching may be best met by the formation of a joint board of studies whose primary role would be to oversee the co-ordination of a new four-year degree in GIS. Both the board and the degree are regarded as a possible vehicle to consolidate current GIS teaching and as a method to facilitate flexibility. The formation of the board would provide enhanced focus to GIS education at Otago and potentially maximise the use of existing resources and expertise currently dispersed through out the University. The addition of a new degree in GIS under the management of the board could provide a mechanism for the organisation of teaching particularly in respect to ongoing global research and innovation.

8 References

Bacon, C. (1998) Geographic Information Systems (GIS) Education at the University of Otago – Where to from here? – Some thoughts to initiate interdepartmental discussion, Internal Report, University of Otago, p5.

Birkbeck (1998) Birkbeck College MSc GISci Distance Learning Degree, http://www.bbk.ac.uk/Departments/Geography/online.htm, Viewed: 18 Oct 1998.

Couclelis, H. (1998) Geocomputation in Context, In: *Geocomputation - A Primer*, Longley, P.A., Brooks, S.M., McDonnell, R. and MacMillan, B. eds, Chichester, John Wiley & Sons Ltd., p17 - 29.

Edinburgh (1998) Edinburgh Geographical Information Systems (GIS) Server Home Page, http://www.geo.ed.ac.uk/home/gishome.html, Viewed: 18 Oct 1998.

Fayyad, U.S. (1997) Editorial, Data Mining and Knowledge Discovery, Vol 1, Issue 1, p5-10.

Gahegan, M. & Veenendaal, B. (1996) Teaching GIS as an Undergraduate Degree Subject, In: *NCGIA GIS In Higher Education Symposium*, 1996, http://www.cs.curtin.edu.au/~mark/eduhtml.html.

Marr, A.J. (1996a) Geographic Information Systems Maturity in New Zealand Local Government, University of Otago, Unpublished M.Sc. Thesis, 126p.

Marr, A.J. and Benwell, G.L. (1996b) Maturing GIS in New Zealand Local Government In: The 8th Annual Colloquium of the Spatial Information Research Centre, University of Otago, Dunedin, 9 -11 July 1996, p60-66.

Meade P. H. (1997) Challenges Facing Universities: Quality, Leadership and the Management of Change, University of Otago, p143.

OGC (1996) OpenGIS Website Menu. Open GIS Consortium, Inc., Viewed: 19 Oct 1996, (http://www.opengis.org/menu.html), gbuehler@mail.opengis.org.

Zwart, P. (1992) Mature GIS - or Taking the G out of GIS, In: The Proceedings of the Fourth Annual Colloquium of the Spatial Information Research Centre, The Spatial Information Research Centre, Dunedin, 18 - 20 May 1992, p1 - 9.