Is Distance a Factor in Learning by Distance? - A Profile of GIS Distance Learning in Southern Africa.

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Abstract: The GIS Programme at the University of Pretoria has gradually grown from a couple of semester courses in GIS to a fully integrated programme in Geographic Information Science. On postgraduate level, the delivery method for distance learning has gradually changed from a paper-based manual system to a digital Internet delivery system. Parallel to this, the University of Pretoria decided to add distance learning to its portfolio of programmes by creating a new department of Telematic Education. This department provides the software, hardware and support staff to maintain the telematic infrastructure and develop telematic programmes. After 5 years of experience with GIS distance learning at the University of Pretoria, it was time to evaluate the successes and failures. A research project was undertaken to provide a profile of the GIS student and their experience with distance learning. This paper provides an overview of the distance-learning environment at the University of Pretoria, a profile of the GIS distance learner in Southern Africa and a discussion of the advantages and constraints of distance learning as experienced by these students.

1 Introduction

1.1 Background

The proliferation of GIS courses at the University of Pretoria during the early 90's and the consequent problems encountered with funding hardware and software, has resulted in the creation of the Centre for Geoinformation Science. The goal of the Centre was to guide the development of an integrated and interfaculty teaching and research programme in geoinformation science. To get a head start in the education programme it was decided to adopt the International UNIGIS Distance Learning Programme. This allowed for an immediate start to the programme with the first postgraduate students enrolling in 1996. Today the University of Pretoria has a fully integrated undergraduate and postgraduate programme in Geoinformation Science offering BSc, Honours, Masters and PhD studies in Geoinformatics (UPGIS).

Following the UNIGIS UK and Salzburg example, the delivery method for the distance-learning programme has gradually changed from a paper-based manual system to a digital Internet delivery system. From 1996 to 1998 the delivery method was 100% paper-based with e-mail contact where available. During 1999 the study materials were still provided on paper but Internet communication tools were created to improve contact between student and tutor. From year 2000 the programme is almost 100% electronic with the exception of regular workshops and the use of postal services for sending assignments.
Although the GIS distance-learning programme started off as a departmental activity, the University of Pretoria has since decided to introduce telematic teaching as part of a more flexible teaching model. A new Telematic Department was established to provide the software, hardware and staff to support the departments developing telematic courses. This development has made it possible to put the UNIGIS study materials on the Internet in a very short time and it also means that lecturers can spend their time on improving the learning experience without having to support the infrastructure.

1.2 Evaluation

Although it is accepted that distance learning has specific advantages as well as constraints, it is necessary to assess them on a regular basis to ensure a student-friendly teaching environment. After 5 years of experience with GIS distance learning at the University of Pretoria, it was decided to evaluate the progress and student perception of the product. The relatively slow progress of a number of students and quite a number of dropouts also prompted us to evaluate our admission requirements. To accomplish this, a survey was undertaken during April 2000. Apart from the questions designed to establish a student profile, a number of questions were included to determine possible problems or constraints, reasons for cancelling or slow progress, meeting of expectations, etc. The existing student database was used to compile a profile of the students and a questionnaire was sent out to measure the students' perception of the programme and to identify possible problems experienced by them. The questionnaires were targeted at four groups of students: completed, cancelled, current and new. At the time of writing the paper about 55% of the students had responded to the questionnaire and this paper reports on the first round of analysis.

1.3 Content

The experience to date has mainly been in respect of paper-based distance learning with e-mail communication. Since the beginning of 2000 students started with the fully electronic format. The survey therefore relates to distance learning in general with a limited exposure to the electronic format. The paper provides an overview of the distance-learning environment at the University of Pretoria, a profile of the GIS distance learner in Southern Africa and a discussion of the problems and constraints of distance learning as experienced by these students.

2 Telematic Education

2.1 Introduction

The words distance learning, telematic education (tele: over a distance; -matic: by means of) and asynchronous learning network (ALN) are just a few of the terms used today for more or less the same phenomena. It basically refers to an alternative for face-to-face-teaching and includes paper and electronic modes of delivery. Although paper-based distance learning is not new, it is the potential of the modern communication and information technologies that is receiving all the attention in creating new horizons for teaching. In South Africa the University of SA (UNISA) started distance learning way back in 1873, but the majority of the traditional universities are now starting to establish flexible teaching/learning environments with flexible educational delivery systems. At the University of Pretoria (UP, 2000) this means an integration of:

- contact tuition;
- paper-based distance education;
- electronic education through technology-driven learning packages that use interactive multimedia, virtual campus technology that integrates with other technologies and interactive television teaching and video conferencing.

This approach accepts that there is a need for all three types of delivery modes, specifically in a developing country where the necessary technology is not equally accessible.

2.2 Advantages and Problems

Although telematic education has its positive side there are a number of new barriers for students to contend with. These include postal delays, computer hardware malfunctions, and problems with access to the relevant institution's server or the Internet service provider, slow response time due to heavy traffic, telephone connection problems and of course the telephone and service provider costs.

Limited experience makes it premature to comment on the value of telematic education, but it will help to give some indication of other institutions experience thus far. Several studies have been conducted to evaluate the consequences of applying telematic teaching with software such as WebCT. In one such study (Morss, 1999) it was found that it:

- Is not time consuming or burdensome to the students;
- Helps some of the students to focus their attention on the subject and learn more quickly;
- Is not favoured to immediately replace either text or conventional textbook as the preferred method of instruction;
- Provides an important exposure to the technology associated with many disciplines.

A study by Pauley (1999) found that:

- 91% of students rated the quality of WebCT courses as "good" to "excellent";
- 80% indicated that the instructional value was equivalent to traditional courses;
- 94% would be willing to take another WebCT course;
- 93% would recommend a WebCT course to others.

In evaluating the Web's contribution to telematic education Owsten (1997) asked the questions: does the Web increase access to education? Does it promote improved learning? Does it contain the costs of education? The conclusion was that the Web has much to offer in all three areas. Research by Russell (1996) titled 'No significant difference phenomenon' concludes that the study means make no difference in terms of learning achievements. Hiltz (1994, 1997) reported that "dropout or incomplete outcomes are somewhat more prevalent in asynchronous based courses (ALN) than in traditional courses, while grade distributions for those who completed the courses tend to be similar. In addition, the overall ratings of courses by students who complete ALN courses are equal or superior to those for traditional courses". These statements are obviously positive about distance learning but the results of this study show that there are various problems and issues resulting in students taking up to 4 years to complete the course.

2.3 Telematic Education at the University of Pretoria

The establishment of a campus-orientated Centre for GIScience, the UNIGIS distance-learning programme and the creation of a new Telematic Education Department started at more or less the same time. The Centre for GIScience sentralised all GIS teaching activities on campus and is in the process of co-ordinating all GIS-related research. This centralised approach helped to obtain sufficient funding and support to create an integrated teaching and research programme in GIScience and also the necessary equipment and software to support this programme. By incorporating UNIGIS in its programme, the Centre for GIScience could start with the minimum of effort on the postgraduate level. This gave the staff time to develop undergraduate courses, establish a GIS helpdesk and create a centralised infrastructure supplying the necessary software and hardware for researchers.
For a department accustomed to the face-to-face teaching mode, the running of a paper-based distance learning programme turned out to be quite an experience with many, mainly administrative, problems. But compared to this, the idea of moving to the electronic Internet format seemed almost impossible for a department to get involved with. The creation of the Telematic Teaching Department changed all this because they supply the technical infrastructure and software, the staff to assist with project management, telematic teaching methodologies, graphic design and web development. Staff members only have to compile the study materials. Even this turned out to be a daunting task because no funding was available for additional staff. Again UNIGIS made thing easier by providing electronic study materials that only had to be adapted to local circumstances.

2.4 WebCT functionality

The University of Pretoria opted for the WebCT Software as the tool to facilitate the creation of educational environments via the Internet. WebCT requires minimal technical expertise on the part of the designer or student and only requires a connection to the Internet and a suitable web browser. To develop the study materials, the tutor can use any software that can translate to HTML. This is then uploaded to WebCT and left to the support staff to manage the technical side. Students register online through the university web page to obtain access to the

courses. Where UNIGIS student administration was previously handled by the department, it is now part of the internal administrative process.
WebCT provides a number of tools to assist the tutor and student:
Tutor:

- **Course Management:** tools to manage the files containing the course content.
- **Student Management:** tools to manage student class list, marks, access to materials, etc.
- **Evaluation:** tools to develop multiple-choice examinations.

Student:

- **Bulletin Board:** allowing one-to-many and many-to-many fully searchable communication between lecturers and students. Dedicated fora can be created to focus discussions on specific topics or assignments.
- **Electronic Mail:** an electronic mail facility allowing searchable one-to-one message transfer between student and lecturer.
- **Chat Tool:** for real-time communication among students showing the chat room, names, and a list of course participants in each room.
- **Student Self Evaluation***:* providing multiple-choice questions that are automatically marked. Explanations can accompany each answer saying why the chosen answer was correct or incorrect, and perhaps supplying hints or extra information.
- **Searchable and Linkable Glossary:** A searchable glossary of terms can be created by the course-author with links from the notes to the glossary entries
- **Student Presentation Areas:** allowing the lecturer to set aside an area for student-generated web pages. The designer can give authoring privileges to a single student, a group of students, or to the entire class. Students with authoring privileges can upload pre-prepared web pages to their area for view by all course participants.
- **Timed On-Line Quizzes:** allowing the lecturer to design and deliver quizzes on-line on a predetermined day. A clock on the quiz page counts down the number of minutes assigned to the quiz once the student has begun. Once completed and marked the grade assigned plus comments are made available to the student.
- **Grade Tool:** for students to view their own marks as entered by the marker. The student can also be given access to minimum, maximum and average grades for each course component. Students also have on-line access to the comments and grades for each on-line quiz written and marked.

3 UNIGIS Student Profile

3.1 Student numbers

As can be expected with any new technology, the interest in the GIS programme was high from the very beginning and even this year there were more applications than places. Between 1996 and 1999 251 students where accepted for registration. Of these 81 didn't register due to various reasons and they will be excluded from this analysis. This leaves 170 students who started with the modules over the four-year period. In January 2000 about 90 applications were received of which 45 where accepted. There is a waiting list of around 40 for 2001. The

new students from the January 2000 intake are not included in the profile although they were interviewed on their first impressions of the Internet learning mode.

3.2 Success rate

Although the number of applications was high, the success rate tells another story. Of the 170 students who started their studies between 1996 and 1999 only 31 (18%) have completed all ten required modules while 26 (15%) cancelled their registration after completing a number of modules. This leaves 114 (67%) students at various stages of completion by the end of 1999. Some of these students have been studying for up to three years. Table 1 shows the progress of the 114 students in respect of the modules completed by the end of 1999.
These figures illustrate a relatively slow progress. It also shows a clear bottleneck around Module 4 where software knowledge becomes important. This was one of the reasons why workshops were introduced to assist those students with limited software background. This situation is one of the reasons for the survey: to determine why the progress is slow and why so many students dropped out of the programme.

Table 1. Module completion rate at the end of 1999

Module	Percentage Completed
Module 1	77
Module 2	40
Module 3	43
Module 4	20
Module 5	23
Module 6	9
Module 7	3
Module 8	1
Module 9	5
Module 10/11	1

3.3 Age and Gender

The average age of the student group is 33 years with the youngest 23 and oldest 53. There is no significant difference between current and completed students. There are however slightly more male students (55%) than female students (45%).

3.4 Qualification Level

Although the boundaries are disappearing, SA has a two-level tertiary education system consisting of Technicons and Universities. The Technicons provide National 3 and 4 year Diplomas as well as BTech and MTech degrees. The Universities focus on degrees studies up to PhD level but in certain cases diploma studies are also offered. UNIGIS is registered as a

BSc/BA Honours as well as a Postgraduate Diploma. This was done to allow for students from a variety of backgrounds. It was also decided to accept students with National Diplomas because there are no other options for them to study GIS on a distance-learning basis. In certain cases students with no qualification but years of relevant experience were also accepted. Table 2 provides a breakdown of the types of qualifications of the students registered for UNIGIS.

Table 2. Qualifications of students

Qualification	% Total Students	% Completed Students
PhD	0,5	3,2
Masters	10,0	12,9
Honours Degree	26,9	45,2
B Degree	26,3	29,0
National Diploma	23,9	9,7
No qualifications (life skills)	12,4	0
Total	100	100

Although there are a variety of qualifications, the results show a significantly higher proportion of degree students completing the course. Although about 24% of the total number of students have a three/four year diploma only 10% of the completed students fall in this group. Of the 12% of students accepted on the basis of life skills, no one has yet completed the course. This could imply that these students are not up to the demands of this level of study but there could be a number of other reasons for this as will be seen later on.

3.5 Academic Background

The following table provides an indication of the academic background of the students grouped into a number of main categories.

Table 3. Background Discipline of Students

Discipline	% Total Students	% Completed Students
Natural Sciences	38,2	30,7
Professions	23,6	34,6
Geoinformatics	23,6	15,4
Computer Sciences	7,3	7,7
Socio-economic Sciences	7,3	11,5
Total	100	100

The natural sciences include Geography, Geology, Soil Science, Botany and Forestry; the professions category includes Town and Regional Planning, Architecture, Landscape Architecture and Civil Engineering; the Geoinformatics group include Surveying,

Cartography and Remote Sensing; Computer Sciences includes Computer Systems, Information Management and Datametry and the Socio-economic category includes Archaeology, Demography, Business Administration.
Of the completed students the majority in the professional group are Town and Regional Planners, in the Geoinformatics category mainly surveyors and in the natural sciences category mainly Geographers.

3.6 Organisation Type

The workplace of the student body is analysed in Table 4. The largest group of students are from Government organisations (National, Provincial and Local) including departments such as Water Affairs and Forestry and Land Affairs. The research institutions are semi-government institutions such as the Council for Geosciences, Council for Scientific and Industrial Research, Human Sciences Research Council and Universities. Companies in the industry category include Mining and Prospecting, Forestry, Utilities, Property Development, and Telecommunications. The consultants are mainly Civil Engineering and Town Planning companies.

Table 4. Students by Type of Organisation

Organisation	% Total Students	% Completed Students
Government	42,3	57,8
Industry	21,6	3,8
Research Institutions	20,5	19,2
Consultants	8,4	3,8
Geoinformatics Consultants	7,2	15,4
Total	100	100

The table shows a high success rate for Government and Research Institutions in comparison to a lower success rate for Industry. The high success rate for geoinformatics consultants is to be expected.

3.7 GIS-related experience

Accepting that prior GIS-related experience should influence the success rate of students an analysis is made in Table 5 of the average number of years of experience before starting GIS studies.

Table 5. Years of GIS-related experience

Experience	Average for Total Students	Average for Completed Students
GIS	2,8	4,5
CAD	2,4	2,8
Remote Sensing	0,7	2,8
Cartography	2,5	2,6
Surveying	3,2	4,3

For the completed students these figures show a higher average in all categories and significantly higher in GIS, Remote Sensing and Surveying experience. This shows that prior experience or for that matter working in a GIS-related environment improves the success rate of students. It also indicates that the distance learning programme is not as effective for the new comers to the discipline and that this should be kept in mind when admitting students. The other possibility is to provide more workshops to create a GIS-related environment but this will increase costs.

3.8 Study Experience

To determine whether the number of years between previous studies and starting UNIGIS has any effect on the success rate, the students were asked to provide a history of their previous studies.

Table 6. Years since previous study

Years	% All students	% Completed Students
0 -4	52	55
5 - 9	24	15
10 - 14	13	15
15 - 20	10	15

The gap between previous study and starting UNIGIS is not significant. The average time gap for both groups is 5,9 years with a minimum of 0 for both groups and a maximum of 17 years for the completed group and 24 for all students.

3.9 Geographical distribution

It is interesting that by far the majority of students are within 100 Km from the University of Pretoria but then it must be kept in mind that Pretoria is in Gauteng Province which is described as the economic heart of South Africa. As the Administrative capital of SA, Pretoria also houses all the National Government Departments while the Gauteng Provincial Government Departments are housed in Johannesburg only 50 Km away.

Table 7. Distance from the University of Pretoria

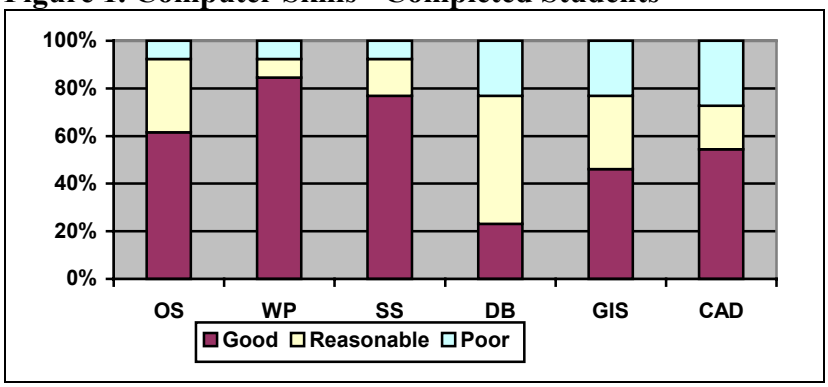
Km	% All students	% Completed Students
< 100	76,2	74,2
250 - 350	6,4	12,9
400 - 700	4,6	3,2
> 1000	12,8	9,7

Although not conclusive, the figures in Table 7 show a slightly lower percentage of completed students living more than 400 km away from the university. Theoretically distance should not play a role in telematic learning but students within 300 km from the university obviously have a greater opportunity to visit staff and attend workshops.

3.10 Computer Literacy

The level of general computer literacy does not seem to have a significant influence on the success rate of the students. Overall skill levels in respect of Operating Systems, Word Processing and Spread Sheets are high (60-80%) while Database literacy is low (20%). Figure 1 shows the literacy levels of the completed students but in the first 4 categories there is no difference between the total student body and the completed students. The only difference is in the GIS and CAD literacy levels where the completed student levels are between 10-15% higher than the total student body (see par. 3.7).

Figure 1. Computer Skills - Completed Students



4 Evaluation of study problems

Although the description of the student profile in the previous section shows some interesting trends, it does not necessarily show underlying problems and student satisfaction levels. This section describes the results of the questionnaire that was designed to measure the study experience of our students; first generally and then specific remarks from various groups of students.

4.1 Problems with study content and assignments

The survey showed that quite a number of students work through the study materials finding it easy to understand but when it comes to writing the assignments they often experience problems: in some cases not understanding what is required, but mostly a problem with time and self discipline.

Table 8. What was the difficult part, understanding the content or writing the assignments?

	% Current Students	% Completed Students
Writing Assignment	67,9	46,1
Understand Content	15.3	30,8
Neither	5,1	15,4
Both	1.7	7,7

Table 8 clearly shows that around 68% of current students have problems with writing the assignment and that even the completed students had more problems with the assignments than the content.
Finding time to study and specifically writing the assignment was a complaint of more than 80% of the students. This however is to be expected from students working full-time. Even our so-called full-time distant learning students find it difficult to complete the programme in two years. A number of students indicated that the knowledge they acquire by reading the study materials is more important than obtaining the qualification.

4.2 Ways to improve the programme

On a question on how to improve the programme the following comments were made (in order of importance):

- More workshops.
- Better feedback from tutors.
- Stricter target dates.
- Improved interaction with tutors and encouragement.
- More local examples and exposure to practice.
- More web-based material.
- Clearer questions and guidelines to answer assignments.

Although the first three suggestions where put forward by about 80% of the respondents the latter four suggestions are important indications for improvement of the study materials.

4.3 Career improvements for completed students

The response on a question whether the GIS qualification has helped them with their career was as follows:

- Yes - 77%
- No - 15%

- Marginally - 8%

4.4 Reasons for slow progress

Students currently falling behind schedule were asked why their progress is so slow:

- Time
- No target dates
- No classes
- No computer access
- No study partners
- Lack of motivation
- Slow marking of assignments

Although lack of time was mentioned by 85% of the students most of the rest refer to student motivation and discipline problems. The last reason refers to an administrative problem but very few students complained about it.

4.5 Reasons for cancelling

Students who have cancelled their studies gave the following reasons:

- Time.
- Financial problems.
- Personal reasons.
- Left the GIS environment.
- No motivation for self-study.
- Lost interest.

Time was the major issue but quite a number did experience problems with finding funding their studies.

4.6 Internet study experience

Although the new students have only just started using the Internet they were asked to give their first impressions:

- 84% do not experience any problems entering the virtual campus.
- 75% find it easy to access and read the study materials.
- 67% make use of the communications tools.
- 80% find it easy to communicate with the tutor.
- 80% find it easy to communicate with other students via the Internet.

Comments from the new students on possible improvements were as follows:

- Workshops or classes
- Improved access to reference material
- Clear instructions on using Internet
- Should allow students to send assignments via e-mail
- Include local examples
- Make downloads easier (speed)

5 Conclusion

The main purpose of the research project was to evaluate the telematic teaching programme and to identify problems experienced by our students. In this process it was necessary to develop a profile of our distance learners in order to identify characteristics that could influence the success or failure of students. The implied influence of distance in the title of this paper refers to the obvious difference between telematic and face-to-face teaching namely the physical separation of student and tutor in the case of telematic teaching. Distance of course is relative; a student can be in the classroom but never meet the lecturer personally, but at least the student has the opportunity to speak to the lecturer in person.

The issue is however not about replacing face-to-face with telematic teaching but providing working people the opportunity to study. The interesting fact is that in the case of the University of Pretoria the physical distance for 75% of our students is less than 100 km. In SA terms this is an easy trip by motorcar for students wishing to speak to the lecturer in person. This also means that a large number of students can form study groups and meet personally on a regular basis.

The question whether distance has an influence on the success rate is not easy to answer because of the many other factors that can play a role. The survey results are not conclusive but do show that relative to the total student body 75% of the completed students live within 100 km from the university and that those students living more than 400 km away where slightly less successful.

Greater distance does however become important if one looks at one of the main requests that were made by students, namely more workshops. The demand for workshops can point to a need for personal contact and direct support from lecturers, to inadequate study materials on the Web or even lack of personal discipline. But in a number of cases students use workshops to get time away from work to complete assignments. Experience shows that these workshops are very successful because students can complete their assignments during these workshops.

Apart from the aspect of distance, the survey did show that telematic students would like improved electronic communications between tutor and student and student and student. With the introduction of the Internet teaching facilities this problem is solved by the web page facility of WebCT that makes it possible for every student to create a personal homepage on the telematic server. This is a good way for students to make contact - at least indirect. The bulletin board and e-mail facilities should solve the problem of communication between student and tutor.

The fact that a large percentage of students asked for fixed target dates for handing in assignments shows that discipline is also a problem. The practice of fixing target dates was replaced with guideline dates due to the frequent requests for extension of time to hand in the assignments. This obvious didn't work and we re-introduced fixed dates again this year and it seems to be working. This of course is one of the important advantages of face-to-face teaching - the inbuilt discipline of class schedules and fixed test and examination dates that will be difficult to simulate in telematic teaching.

A point often ignored is that contact at a distance is often more time consuming for the tutor than face-to-face contact. In the latter case the tutor communicates with all the students in one class. Although the telematic software provides good communication tools a lot of the

communication is on a one-to-one basis. Although students are asked to use the bulletin board for group communication, quite a number prefer to use the personal email facility forcing the tutor to reply to them individually.
Although there are a number of important issues in telematic teaching the most important one seems to be the lack of time and the motivation to make time to study. This, unfortunately, is something the university can do very little about. One could ensure that the study demands on students are reasonable and also improve the level of motivation through continuous contact between student and tutor.
Apart from the occasional comment on slow return of marked assignments there seemed no complaints about organisational matters and also the content of the study materials. The one issue that some students complained about was the lack of local examples and Internet reading material.
In conclusion one must accept that telematic teaching has many advantages and also that there will always be problems of a technical, administrative or personal nature that will need evaluation and attention on a regular basis. This will help to improve the success rate of students. The comforting aspect in our case is that more than 90% of the current and completed students feel that the programme met their original expectations.

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