```
┌─────────────────────────────────────────────────────────────────┐
│                                                                   │
│   Chapter 5      Conclusions and Recommendations                  │
│                                                                   │
└─────────────────────────────────────────────────────────────────┘
```

Chapter guide

5   Conclusions and Recommendations

In this chapter, the results and discussions from the previous chapter will be used to answer the research questions posed in chapter one. Firstly, solutions to the questions pertaining to this project (from table 1.5.1) will be examined. Finally, possible answers to the major research questions (from table 1.3.1) will be derived from the project solutions and the literature.

5.1   Course design

How did the students cope with the Web as a medium for lesson presentation?

The majority of students polled in 2000 felt that they had successfully coped with the Web-based course (see section 4.3.B *Using the Web pages of the SCI 152 course*). This is supported by the examination results, where, overall, students on the Web-based course performed better than those on the paper-based course (see tables 4.1.a.2 and 4.1.a.3). However, several alarming factors are shown in tables 4.1.a.3 and 4.1.a.4

- more than half the class still failed the examination;
- the disadvantaged students were further disadvantaged by this medium of presentation in that their examination results were worse than those of the disadvantaged students on the paper-based course.

In order to improve the students' performance without lowering the standard of the course, several issues in the design of the course need to be addressed. These include

- face-to-face contact;
- design of assignment and solution pages;
- time management; and
- study aid pages

5.1.A   Face-to-face contact

The majority of students in 2000 felt the need for some lectures (see figure 4.3.b.3). An even bigger majority felt that they would have been unable to complete the assignments without the assistance of the lecturer and the tutors (see figure 4.3.b.4). This implies one of two things

- a feeling of inadequacy amongst the students in not being able to complete their assignments without face-to-face assistance; or

- insufficient information on the Web pages for the students to complete the assignments on their own (this point will be dealt with in section 5.1.B *Assignment and solution pages*).

Students who wrote the supplementary examination in 2001 showed the benefit of having a single discussion session prior to the examination (see section 4.1.D *Supplementary examination*). This session was sufficient to boost these students over the mental barrier which had prevented them from passing their examinations the first time around. The need for face-to-face contact could also be the reason as to why the majority of students were not keen on having other courses run from the Web (see figure 4.3.c.1).

To ensure that students are not overawed by the Web presentation of academic material, regular **formal** discussion sessions should be held with the students. These discussion sessions should consist of fixed groups of not more than six students and the lecturer. In this way, any anxiety caused by a student's doubt in his or her capability to express him or herself in front of others can be minimised. With a small group, it is also easier for the lecturer to detect whether each student has grasped all the necessary concepts. The sessions should be held at fixed times each week and be made compulsory. Any student who feels he or she is coping with the material should show concrete evidence why he or she should not attend these sessions. Any student receiving permission not to attend would, however, remain part of a fixed group with the option to attend whenever they feel it necessary.

5.1.B Assignment and solution pages

As mentioned in the previous section, the students' apparent need for face-to-face support could be as a result of insufficient information on the Web pages. The poorer results achieved by students, on the Web-based course, in Assignments 5 and 6 show that there is a problem with these pages (see figures 4.1.b.1 to 4.1.b.3 and table 4.1.b.2). However, figure 4.3.b.2 shows that the majority of students in 2000 felt that there was sufficient information on the SCI 152 pages for them to complete their assignments. This feeling is reinforced by figure 4.3.d.2, where the majority of students who used the solution pages, felt that these were adequate. However, both figures 4.3.b.2 and 4.3.d.2 show that an appreciable number of students were not satisfied with the information given. figure 4.3.d.1 and table 4.2.c.1 show further, that students were not conscientious enough in using the solution pages, in spite of poor results achieved for the assignments (see table 4.1.b.2). Somehow, students must be taught how to read the pages more diligently. The best place to do this would be in the discussion sessions mentioned in the previous section.

All the assignment and solution pages should be re-evaluated in conjunction with students who have already completed the course. During the 2000 course, several pages were modified in this way with the help of the two students who were ahead of the rest of the class (see section 4.4.A *2000*).

5.1.C Time management

As many students felt that a time management page could be useful (see section 4.4.C *Assistance with time management*), such a page should be added to the Useful information page. This page should be developed in conjunction with the course presenter of the SCI 153 course (Academic Skills) to ensure that the time management principles covered in the SCI 153 course are reinforced for students taking both courses.

In order to make time management easier for the students, the number of assignments should be decreased from six to five. This should be feasible as several students in 2001 were able to complete two assignments in one session - see section 4.4.B *2001*. This would allow the students more time to work on their church projects. Whether this would result in better projects remains to be seen, as experience has shown that most students leave assignments and projects to the last possible moment before the due date (see sections 4.4.A *2000* and 4.4.B *2001*).

A generic time management page should also be developed for undergraduate students doing other Web-based courses at the University of Pretoria. It would be very surprising if these students were any different to the SCI 152 students in not needing assistance in managing their time.

5.1.D Study aid pages

5.1.D.1   Objectives As the students found the Objectives page irrelevant (see sections 4.2.A *Objectives* and 4.3.E *Honesty in answering the questionnaire*), the title and language used to describe the objectives of the course need to be changed to make the content more meaningful to the students (see, for example, Draper 2001b). Furthermore, the discussion at the end of section 4.2.A *Objectives*, shows that many leaders in the field of Instructional design feel that the objectives of a lesson or course are more important to the course designer than to the student. As the significance of course objectives in Instructional technology has diminished, it no longer warrants a major link, such as on the home page. The link should be moved from the home page to the Useful information page where interested students would still be able to find it.

5.1.D.2   Useful information As shown in table 4.2.e.1, students showed little interest in the Useful information page. This meant that it failed in its primary goal of acting as a bulletin board for the course presenter.

In order to make this page more obvious to the students, the link on the home page needs to emphasised, either by using a larger font or a small picture which depicts the contents (or changes) to the page. It may also be necessary to change the name of the page to something which attracts the students' attention. Currently, the link to the Useful information page is at the bottom of the home page (see figure 3.3.c.1). As pages are loaded in the same direction that people from western education systems read (left to right, top to bottom), before downloading is complete, people tend to

- scan the information
- click on an interesting link as soon as it is spotted
- click on the browser's back button if the information appears irrelevant.

So it is easy to see why the students' attention stops at the "important" information for them, the current assignment. Their scanning seldom reaches the link to the Useful information page. Because of the importance of the information in the Useful information page, the position of the link should be moved from the bottom of the home page to the position currently occupied by the link to the Objectives page near the top of the home page.

5.1.E   Additional recommendations to course design

Several students wanted to be able to complete their assignments off campus. In order to allow them this opportunity, the current proprietary Logo package (PC Logo) would have to be changed to a non-proprietary package. Possibilities in this regard are

- a Java version of Logo (see section 6.3 *JavaLOGO*). A disadvantage of this is that the author of JavaLOGO wants a per download royalty paid, which puts this software back into the proprietary bracket.
- MSWLogo, a freeware version of Logo (Mills 2000). Students could download the software from the MSWLogo site to their home computer.

It would appear thus, that the only option is MSWLogo. Using this package would mean a complete redesign of the current course Web pages to take into account the differences between MSWLogo and PC Logo.

It should, however, be noted that allowing students to work off campus would favour the advantaged students. The disadvantaged students would still only be able to access their course material from computer laboratories on campus.

5.2 Web-delivery as a means of course presentation

What were the students' attitudes towards Web-delivery of course material?

Although attitude is difficult to measure, by looking at the responses to some of the direct questions in the questionnaire, as well as the students' approach to handling their assignments and projects attitudes can be gauged.

In 2000, the majority of the students on the SCI 152 course were against Web-delivery of course material (see figure 4.3.b.5). Equal numbers of students were either in favour or indifferent to this method of lesson delivery. The poll also clearly showed that the majority of disadvantaged students were against the Web-based delivery of course material. Although the majority of advantaged students were in favour of Web-based delivery of the course material, this majority is not as clear cut as with the disadvantaged students against Web-based delivery (see figure 4.3.b.5). Even the top-performing students from the disadvantaged group were against Web-delivery of the course material (see figure 4.3.b.6) while the top-performing advantaged students were marginally in favour or indifferent to this method of lesson delivery. As expected, most of the under-performing disadvantaged students were against Web-delivery, whereas the under-performing advantaged students were spread throughout the group (see figure 4.3.b.6). From table 4.3.e.1 it can be seen that the majority of "honest" students were indifferent or against Web delivery of course material.

A small majority of students in 2000 felt that other courses should not be run from the Web (see figure 4.3.c.1). In keeping with the findings on the Web-delivery of the SCI 152 course material discussed in the previous paragraph, the majority of disadvantaged students were against Web-delivery of other courses, while the majority of advantaged students were in favour of it.

As discussed in section 4.1.B *Assignments* students on the Web-based course faired far worse than their counterparts on the paper-based course as far as their assignments were concerned. Yet, as shown in table 4.2.c.1, the number of hits on the solution pages to the assignments was low (less than one hit per student in most cases). This would imply that the students were not interested in finding out where they had gone wrong.

As the disadvantaged students were against Web-delivery of course material, one feels that they are still uncomfortable with the use of technology as a supplement to a teacher. This is probably a mindset problem and could be changed with careful nurturing (see section 5.1.A *Face-to-face contact*). These students need to become more self-reliant and

so gain belief in their own capabilities to solve problems without the assistance of others (see section 4.1.D *Supplementary examinations*).

5.3   The digital divide

How did the digital divide affect the students' performance?

In discussing the digital divide for students on the SCI 152 course, one must be aware that there are two aspects of digital technology which come into play:

- using Logo as a problem solving tool. This would have affected students on the paper-based course as well, but the problems found by students on the Web-based course would have been exacerbated by not having classroom activities to rely on; and
- using the Web as a lesson delivery mechanism.

As both of these are computer based, one would expect the digital divide to influence the outcome of any activities.

As mentioned in section 5.1 *Course Design*, examination results of disadvantaged students on the Web-based course were very much worse than those of the advantaged students (see figure 4.1.a.1). They were also worse than the disadvantaged students on the paper-based course (see tables 4.1.a.2 and 4.1.a.3). For these students, it would appear that Web-based delivery of lesson material had broadened the digital divide.

5.3.A   Computer expertise

Figure 4.3.a.5 shows that the majority of students in 2000 had little or no prior computer experience. As expected, a higher percentage of the disadvantaged students had little or no prior computer experience, whereas the advantaged students were evenly split between little or no computer experience and medium to high levels of computer experience.

For the students overall, figure 4.3.a.6 shows an even spread of examination marks for all the categories of computer literacy. As expected, those advantaged students, with higher levels of computer expertise faired better in their examinations than the rest of the students on the course. However, the majority of disadvantaged students with a medium to high level of computer expertise failed their examination. For these students, having crossed the digital divide prior to starting their university careers, seems to have been a distinct disadvantage.

Section 4.1.D *Supplementary examinations*, showed that a single, formal face-to-face discussion with disadvantaged students gave them the confidence to rely on their own

judgement, rather than the communal brain or a recipe, in solving the supplementary examination problems. Hopefully, these students have now, not only crossed the digital divide, but are also on the way to become self-sufficient life-long learners.

5.3.B Ability to complete a solo project

As a project of this nature entails competency with the Logo software, one would have expected that students who were more at ease with various software packages (*i.e.* those students with higher computer literacy levels) would have fared better with the project.

As discussed in section 4.1.C, the Church project was implemented to test the students' ingenuity in using the tools given to them in the Logo assignments. As each student had to produce his own church, the communal brain (discussed in section 4.1.B *Assignments*) would have minimal influence on the final product.

As shown in table 4.1.c.1, the disadvantaged students on the paper-based course excelled in their church projects. There marks were almost 15% better than their advantaged counterparts, and more than 15% better than the disadvantaged students on the Web-based course. By comparison, the advantaged students on the Web-based course were a mere 2.6% better than the advantaged students on the paper-based course and less than 3% better than the disadvantaged students on the Web-based course. As discussed in section 4.1.C *Church project*, the advantaged students on the paper-based course were very lax in their attitudes towards the church project, so one would assume that this influenced their marks. As both groups on the Web-based course performed much more poorly than the disadvantaged students on the paper-based course, the assumption must be made that the digital divide had no influence on the results of the church project.

5.3.C Open Internet access

The effect of the digital divide on first time Internet users is clearly shown by the very poor performance of the disadvantaged students in 2001 in their examinations (see figure 4.1.a.1). These poor results can largely be ascribed to excessive Internet surfing instead of academic pursuits (see section 4.5 *Off-task activities*). Open Internet access should thus be restricted, but not removed entirely, as these students deserve the chance to be able to explore the information available on the Web. The current Internet open time in computer laboratories at the University of Pretoria (18:00 to 22:00) should be re-evaluated as it discriminates against day students. A more realistic open time would be 15:00 to 22:00, which would allow day students some Internet time before having to leave in search of transport home. The 15:00 starting time would also allow overlap with the

staff's working hours, which would still leave students time to ask questions, concerning aspects of Internet usage, of the staff.

5.4   The influence of the student's background

Was there any difference in the ability of students from disadvantaged and advantaged communities to successfully complete the Web-based course?

As discussed in the previous section on the digital divide, the effect of the divide on the performance of the SCI 152 students was not nearly as marked as expected. Hence, one must look further into a cause for the poor examination results of the students from disadvantaged communities. Something is clearly influencing these students' ability to handle a problem outside their current comfort zone[1]. This inability to inability to handle new problems can be directly attributable to the school system. Teachers, instead of teaching problem solving skills, rather teach recipes to solve a particular type of problem. These recipes prevent the students from adapting previously learnt skills to new situations. Coaching techniques for examinations lead students to expect a particular type of question (de Bono, 2000:6). This is not the fault of the teacher, but rather the education system in South Africa, as many mathematics and science teachers in Black communities have not studied the subjects they teach beyond the senior school year. Initiatives to assist teachers in improving their qualifications have been implemented at many tertiary education institutions.

However, if the lot of the teaching profession is not improved, teachers are not going to strive to improve themselves, and if the teachers do not improve, students will remain academic underperformers when they reach tertiary level. It was clearly shown in the previous section that students from the disadvantaged communities **do** have the ability to complete a course of this nature. Care, however, must be taken to ensure that the medium of lesson delivery does not become the stumbling block in the learning process. Students need to be taught to use resources, other than the teacher, in order to become successful life-long learners.

As Clark (1983 & 1994) stated, the medium of lesson delivery should play no role in the learning process, but one should be make sure that the student is capable of using that medium. To extend Clark's "grocery truck" metaphor (discussed in section 2.3.C *The medium of delivery*): the goods delivered are the same regardless of the vehicle, but we

---

[1] Comfort zone is a term used by Meyer (2000) to describe a person's current state of knowledge. A person is loath to work with issues outside his or her comfort zone, unless a perturbation caused by external factors (such as new information) forces the person to change the boundaries of his or her comfort zone. This

must make sure that the driver can drive the vehicle **and** knows the directions to his delivery point.

The hope has been expressed in education circles that by making Web-based academic material available to all, both students and teachers will be able to improve their performance levels. The feasibility of this concept will be discussed in the next section where an attempt will be made to answer the major research questions outlined in table 1.3.1.

5.5   Web-delivery of academic material as an aid to alleviating the educational shortfall in disadvantaged communities

To what extent can Web-delivery of lesson material be used to address the education shortfall in disadvantaged communities?

5.5.A   Scholars as Web-learners

As shown by the results of the students on the SCI 152 course, much assistance and encouragement is required for students from the disadvantaged communities to make the transition from classroom-based learning to Web-based learning. Although this is mentioned in the original TELI discussion document (TELI, 1996), neither the subsequent document (TELI, 1997) nor the ICT document (Departments of Education and Communications, 2001) make any reference to it. Teachers, who are dedicated to both their subject and to the use of technology as an aid to their teaching are required as mentors for the students in making the transition. These teachers would also have to be more than familiar with the use of these technological tools to make TELI work.

5.5.B   Teachers as Web-learners

The hope has been expressed that, by putting computers in schools and giving these schools Internet connectivity, upgrading of teacher skills could be carried out via the Web (Pretorius 2001b). These teachers, however, will suffer from the same problems found by students on the SCI 152 course: until they are proficient in the use of the technology, and acquire the unique skills required for Web-based learning, they will require face-to-face assistance. Ideally, this assistance would come from a competent IT teacher at the school. However, teachers with up-to-date IT skills are not easy to find (Pretorius 2001b) because of the high demand for IT skills in industry.

---

perturbation is equivalent to the *anomalous state of knowledge* in Information Science (Dervan & Nilan, 1986; Ingwersen, 1996).

5.5.C Schools as centres of Web-based learning

According to Pretorius (2001c), the item highest on the wish-list of disadvantaged schools is a computer facility for the students. However, as mentioned repeatedly in the TELI discussion document (TELI, 1996), computers should only be placed in schools where they will serve a definite purpose in the teaching process. Merely placing computers in schools, without a strategy to use them, is a waste of time and money.

The delivery of services, such as electricity, water and telephone connectivity, to the poorer communities as fundamental to the implementation of any technology-based teaching initiative. While these are important, the infrastructure to support and maintain these services, as well as the computer hardware and software, are just as important. In rural areas, these support people are scarce because of the better salaries and living conditions found in the metropolitan areas.

A noteworthy objective of the ICT strategy (Departments of Education and Communications, 2001) is to make schools the centre of community life by allowing the community access to the computer facilities after school hours. However, no mention is made as to who is going to run these facilities after hours.

5.6   Knowledge and information

What is information and what is knowledge?

5.6.A Teaching and learning

In spite of the current trend to use these words interchangeably, they cannot be regarded as synonymous. From table 2.2.f.1,

- **Knowledge** is the skills which enable a person to solve problems. It is also the stored facts which allow a person to understand the problem or situation.
- **Information** is the medium by which knowledge is transferred between people.

Knowledge is something unique to a person, and each person increases his knowledge by creating links between his or her existing knowledge and new information he or she receives. From these definitions of knowledge and information, definitions for teaching and learning can be developed:

- **Learning** is when a person makes links between existing knowledge and information presented to create new knowledge.
- **Teaching** is assisting a potential learner in creating the links between his or her existing knowledge and new information presented. It is also the ability to assess whether the new information has been successfully assimilated by the learner *so as to create new knowledge.*

The highlighted point above is important in assessing whether deep or shallow learning has taken place. Another important attribute of a good teacher is knowing the size of the chunk of information which can be accommodated by the learner (ΔI in the Brookes equation).

5.6.B World Wide Web

The World Wide Web is a repository for massive amounts of information. However, it is not always possible to find pertinent information, nor is it possible to check the validity and accuracy of the information found. To be able to do this requires special skills and some knowledge of the subject matter being sought. Until these skills are learned, the novice user faces a daunting task in using the information available as a means of increasing his or her knowledge.

5.6.C The World Wide Web and teaching

A lecturer can make his or her course notes available on the Web. This has the advantage that students can prepare for a lecture by studying these notes prior to the lecture. However, students then tend to start skipping lectures as they feel they already have the necessary background material. Another advantage for the lecturer is that notes can be rapidly updated and deployed. A disadvantage for students is that they usually want a hardcopy of any lesson material, so access to a printer is required. Part of the lecturer's knowledge building exercises could be to have a page of subject related links, whereby the student could obtain the views of others, thus broadening his or her own view of the subject.

Many educators and education administrators see Web-delivery of lesson material as a means of overcoming the shortage of classroom space. By putting courses on the Web, students could study at any place and at any time. However, this presupposes that the students will have access to the Internet. As mentioned in earlier paragraphs, this is not the case, especially in the poorer communities. The education administrators also see Web-delivery of lesson material as a means of increasing the number of students that can be handled by a single lecturer. However, research has shown that off-campus students, who do not have face-to-face contact with the lecturer, require more of the lecturer's time in order to cope with the lesson material. The lecturer has to spend more time composing email messages and answering telephonic queries than would be the case in the equivalent face-to-face situation. Without spending this time on composing a reply, the lecturer cannot assist a learner at-a-distance in creating new knowledge.

In using the Web as a teaching mechanism, the teacher assumes that the learner is capable of independent study. With undergraduate students and scholars, this is seldom the case. These learners still require the physical presence of the teacher as a role model. They also need to develop skills such as time management and discipline in order to complete their courses. Discipline is also necessary to avoid being side-tracked by following off-topic links during on-line sessions.

The Web can be useful as a teaching mechanism. However, learners must be taught to use it in order to make successful knowledge gains.

5.7 Is the Web effective as a medium for teaching?

In closing this discussion, the question posed in the title of this document must be answered. For undergraduate and school students, using the Web to teach must be used with caution. The teacher must first make certain that the students can use the medium successfully. Care should also be taken that the important facet of role model, played by a teacher in helping students solve problems, is not removed before the students are capable of self-directed study. Students also need to be able to manage their time efficiently, in order to make a success of Web-based study.

For postgraduate students, as well as those students capable of self-directed learning, the Web can be used successfully as a medium for teaching.

5.8 Summary

The topics that have been discussed in this chapter are all tightly interwoven, and should not be viewed in isolation.

- What is clear is that many students do not have adequate background and skills to handle a Web-based course. It is unfair to impose technology-based teaching on these students without giving them some form of transitional training in moving from classroom-based learning to technology-based learning. (Prior computer skills amongst the disadvantaged students was of little assistance to them). Hopefully, the recommendations made above, especially the face-to-face discussion sessions (section 5.1.A *Face-to-face contact*), will help these students in making this transition. One would hope that this would help these students in achieving the academic improvement shown by the advantaged students.
- Web-based course presenters should monitor students' progress closely by examining, not only academic results, but also student activity on the Web pages. Problems found by students on Web pages should be rectified immediately.

- No form of telematic teaching should be allowed with undergraduate students, without first ensuring that they are capable of using the medium of lesson delivery.
- The school system in South Africa needs to be re-evaluated. The image of the teaching profession needs to be improved to attract highly qualified and motivated people, dedicated to transferring their skills to the students. Without this, students will never become lifelong learners, but remain followers of academic recipes.
- The current trend of pouring millions of rands, dollars and pounds into placing computers in schools (Pretorius, 2001b), with the hope that these will make-up for inadequate teaching practice, will never succeed without first giving the students the background to use technology. This, in turn, cannot be done without competent teachers who, themselves, are at ease with the technology.
- Students need to be taught the special skills required to convert information on the Web into usable knowledge.
- "The Internet is not a magic bullet that will solve rural poverty..." (Elliott, 2001).