Fast tracking students from disadvantaged backgrounds into main stream Computer Science

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Abstract

A computer-based training (CBT) system was used to teach Computer Literacy to full-time students at the University of the Western Cape. This approach was successful in creating computer literate students as well as creating an opportunity for students from educationally disadvantaged schools to enter the Computer Science course. The students experienced this new approach to learning positively. This has laid the foundation to export the computer-based education model to communities outside the university. Lifelong learning opportunities will thus be created.
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1 Introduction

Students at the University of the Western Cape (UWC) come from educationally, linguistically and culturally diverse backgrounds. Many of these undergraduate students are introduced to computers for the first time at university, and for the majority, English (the language of instruction) is a second or even third language. Most of these students thus cannot be expected to immediately start with a fully-fledged Computer Science course. By teaching both Computer Literacy and Computer Science simultaneously in the first semester, it is felt that it will be possible to fast track and accommodate these students (from disparate backgrounds) into mainstream Computer Science.

Students in Computer Science are introduced to Java as their first programming language[1]. Java is a language that is platform independent and is freely available. It was also felt that Java 's use of applets could add a bit of fun into the first-year course. Students studying Computer Science do four modules (two Computer Science modules plus two Computer Literacy modules) in the first semester and two Computer Science modules in the second semester. Thus, two Computer Literacy modules are simultaneously offered with the Computer Science modules in the first semester. It increases contact time and could aid students with inadequate schooling backgrounds to successfully complete the Computer Science first year. If Computer Literacy were taught prior to the teaching of Computer Science, the Computer Literacy modules would infringe on valuable time that should have been spent on Computer Science.

The Computer Literacy course is considered to be the knowledge of concepts, definitions, social issues and applications of computers, as well as the mastery of an application software suite, namely Microsoft Office 97. In 1999 a computer based training (CBT) approach was adopted to teach introductory computer concepts and skills for the computer literacy course[2]. Over the past decade computer based education has been successful in training mathematics and science students at UWC [2]. With CBT students were able to pace their own learning according to their own ability and it was felt that with a CBT model, students would spend a considerable time in front of the computer both reading in English and practicing basic computer skills. In previous studies it was found that language and limited time to acquire practical skills influenced the pass rate of Computer Literacy students at UWC [5]. The compact disk (CD) that accompanies the prescribed book for computer concepts contains presentations on each chapter; interactive exercises on practical skills such as mouse-mastery; video clips as well as self-assessment material. A weekly schedule was provided to guide student progress. For the mastery of specific software (MSWord, Excel and Access) students received instruction and worked through a manual in an electronic classroom of approximately 40 workstations (Pentium I, 133 MHz). Of the eleven formal contact hours for Computer Science and Computer Literacy combined, only 2 hours were spent in a lecture room. In the electronic classroom assistants and the lecturer assisted students. (The student-assistant ratio is approximately 20:1).

The aim of this study was to determine if:

- the parallel teaching of Computer science and Computer Literacy achieved the set objective of fast tracking students with no computer background into main stream Computer Science.

- a CBT model for the literacy course can produce a

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[1]The prescribed book used is called: *Java First Contact* by Roger Garside and John Mariani, published by Course Technology

[2]The book and accompanying software for the computer concepts are: *Introductory Computer Concepts* 3rd Edition by JJ Parsons and D Oja.

computer literate student body; and if

- such a model can be exported to a distance learning/lifelong learning application.

Experience has shown that there are several areas of concern:

- historically under-prepared students;

- the language barrier;

- conventional ("dated") lecturing methods; and

- the fact that the half-life of knowledge in the computer field is diminishing at an alarming rate.

2 Method

In this research effort data were collected using both a qualitative and a quantitative approach. Unstructured interviews using Schns Reflective Protocol [4] and written comments by students were employed to collect qualitative data. The quantitative approach entailed the use of several self-administered questionnaires, administered at different points during the course.

3 Results

3.1 Qualitative results

The following are some of the written comments drawn from the questionnaires and interviews. Students acquired scientific knowledge they learned about computer concepts, the use of computer software packages and how to program.

" –today's future lies in the use of computers. Many jobs require computer knowledge"

They applied their knowledge using available technology.

"I did learn something useful. Now I can do anything I want even when writing essays."

Students became more socially conscious.

"I would like to work with computer but, I think sometimes they are frustrating. They are time consuming. They make life easier. Meaning they perform the work that must be done by hundreds of people. It is good to use them for academic, leisure, and or just for knowledge purposes."

Furthermore, they were released from the "shackles" of their educationally disadvantaged background. This was an emancipating experience.

"I would like to major in Computer Science, and design my own programs. ... I would like to be one of the best programmers in the whole world. Lastly I would like to improve the technology of our country S.A."

3.2 Quantitative results

Descriptive statistics

A total of 122 students participated in this study in the first semester [6]. Of these, 105 completed the first Computer Literacy module (CS111). Ninety-five students completed the second Computer Literacy module (CS112), (CS111 and CS112 constitute the complete Computer Literacy course in the first semester). Four modules constitute the Computer Science course. Each module is taught for 9 weeks – thus one term. Ninety-five students registered for the first Computer Science module, but only sixty-nine completed (not necessarily passed) the module. Fifty-six students completed the second Computer Science module (CS126), 47 the third (CS137) and 44 students completed the final module (CS148). Students at UWC come from diverse backgrounds. This was clearly reflected in the class language composition: 22% were Xhosa speaking, 17% spoke another African language, 33% were English speaking and 28% were Afrikaans speaking. Eighty percent of students were registered for a Bachelor degree in Science and 20% for a Bachelor degree in Commerce. The class was male dominated (68%). Sixty two percent of Computer Science students had their first contact with computers prior to entering university. The majority of students enjoyed working with computers and felt that computers enhanced their quality of life. They preferred this interactive, hands-on method of learning compared to formal lectures. Students indicated that they did not feel threatened by computers and that computers were not used to manipulate people.

Statistically significant findings

When students had been exposed to computers at school they were more likely also to have a computer at home. The students of the Western Cape Province had the most exposure to computers at school compared to any of the other eight provinces, followed by Gautengs scholars. African language speakers, who were generally the older students, were more likely to have been exposed to computers for the first time at university. Students who had been exposed to computers at school did significantly better in the first Computer Literacy module (Kruskal-Wallis = 8.094, p = 0.0441) The pass/fail profile in CS111 (first Computer Literacy module) , CS115 (first Computer Science module) and Matric English is similar. Students with a Matric average of less than 50% did not do well in the first Computer Science module. The pass/fail profile in the second (CS126) and third (CS137) term of Computer Science is similar. Only 22 students of the 46 (47.83%) passed both of the modules (CS126 and CS137). Various regression equations were calculated to predict the achievement in Computer Literacy modules using the final school results (school average, English and Mathematics), but none of these proved to be significant.

4   Discussion

In the information age the focus is no longer on the acquisition of knowledge but rather on the attainment of skills. A skill needed to function in modern society is the ability to interpret problems and to find appropriate solutions. The ability to use computers to solve problems has become an invaluable skill in modern society. The University of Western Cape has therefore adopted as its policy, that all students graduating from the university should be computer literate. The aim of this study was to determine if:

- the parallel teaching of Computer science and Computer Literacy achieved the set objective of fast tracking students with no computer background into successfully completing main stream Computer Science;

- the CBT model could achieve the objective of effectively creating a computer literate student body;

- the CBT model could be exported to a distance learning/ lifelong learning application.

In a previous study [5] the retention rate of Computer Literacy students was (75%), with a success rate of only 42%. The retention rate of the Computer Literacy students with this new approach was 86% and the pass rate increased to 75%. This intervention could thus be viewed as successful in achieving a higher success rate in Computer Literacy. However the retention rate of Computer Science students (46%) is still a matter of concern. Of these students retained, 50% passed all four Computer Science modules.

In the next research cycle more attention will be given to teamwork and cooperative learning to enhance training of Computer Science students. It is believed that learning in smaller groups [3] promotes both the development of communication skills and helps students to express themselves in the language of the subject.

Our student profile has not changed dramatically over the past few years. Students at our university come from diverse backgrounds, which is reflected in the home language distribution. One has to bear in mind that in South Africa different home languages indicate vast cultural differences as well. Our students were older than expected, as many do not enter the university directly after completing school. Furthermore, our students tend not to complete their degrees in the specified time.

The inability of many students to understand and speak English was again highlighted. Although it seems as if computer exposure prior to university has improved since 1994 it is still not adequate. A 1997 survey found that 43% of schools in South Africa did not have electricity [1] on the premises. Many of our students were schooled in these schools with very little infrastructure.

The majority of the students enjoyed working with computers and they indicated that they enjoyed this interactive, hands-on approach to learning. A frustration highlighted by the students was that computer access and availability was inadequate. In this interactive approach to learning the availability of computers is essential for the successful completion of the course. Students suggested that hours of access to the laboratory be extended. Due to lack of funding, laboratory assistants cannot be employed to man the laboratories after hours and over weekends. It is necessary to have personnel available because of the widespread theft of computer equipment from the university. This problem needs to be addressed in the immediate future to improve the success of this learning approach. Students also indicated that they did not trust the system of on-line testing.

The study taught us that it is possible to teach Computer Literacy to a diverse group of students using CBT. Because of the positive results of the study in 1999, a CBT approach is being used this year (2000) for both the teaching of computer concepts as well as the teaching of practical computer literacy skills[3]. Within the narrow confines of this study it is our belief that the CBT approach could successfully be implemented as a distance learning model which could benefit the university and the communities dependent on the services of our university.

Acknowledgements

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[3]The book and accompanying software is *Get Started with Microsoft Office 97 Illustrated Interactive*^{TM} by Course Technology.