Providing Increased Access to English L2 Students of Computer Science at a South African University*

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Abstract: In our paper we describe an intervention aimed at providing increased chances of success in the study of Computer Science (CS) to members of South Africa's historically disadvantaged communities. Research has shown that many African students perform poorly in CS, possibly because of language problems. We have developed a web-based application that integrates classroom practice in first year. In our research we explore the relationship between English and the students' mother tongues in constructing technical meanings with a particular focus on the integration of new terminology into existing knowledge structures. We hope that this new approach and an early intervention will provide better access to the study of CS to more African students and contribute to overcome the inequalities of Apartheid.

Key words: computers in education e-learning social issues in education higher education in Africa

1. Introduction

In this paper we describe the implementation of a Web-based application designed to assist speakers of an African language from a disadvantaged background in learning Computer Science at university level in South Africa. Since the end of Apartheid in 1994, South Africa has been engaged in a process of social reconstruction. Providing access to ICT to the African[1] component of the south African population is a priority for the Government, and education has a key role to play (Department of Education and Department of Communication, 2001). Under Apartheid, the education system was racially segregated. The bad quality of teaching and severe underfunding of "Black" institutions ensured that African students could not gain a good level of proficiency in English and were excluded from the study of technological subjects.

According to Heugh (2002), little has changed since the end of Apartheid. The average level of English proficiency within the African community is still comparatively low. For this reason, in many rural area and township schools students are still taught in their mother tongue, in spite of the official language policy which (in most cases) prescribes the use of English as the sole medium of instruction. Therefore, when they reach university, many African students are disadvantaged compared to English speakers, since they have to grapple with the language as well as the concepts taught.

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[1] In spite of the tendency of many individuals of European descent but born in Africa to consider themselves African, here the term will be used to refer to individuals classified as "blacks" under Apartheid, consistently with the terminology currently used in South Africa.

In trying to solve this problem, the South African Government has recently encouraged traditionally "White" institutions to increase the possibilities of access to tertiary education for African students (Council on Higher Education, 2001). Like other universities, Rhodes University runs a foundation year course designed to prepare members of previously disadvantaged communities for studying at tertiary level. Students in this course are all speakers of English as a second language who would not normally meet the entry requirements for Rhodes but have academic potential. During the foundation year, students attend a course of Academic English, a course of Computer Skills and a limited number of mainstream courses.

The course in Computer Skills is designed for students who need a basic computer literacy as well as those who intend to continue their studies in Computer Science. Since most students have little or no experience with computers, a hands-on approach is taken and all lectures and practices take place in a computer laboratory from the very beginning. A tutor is available to answer the questions of the students and to assist them on request.

2. Problem Statement

Preliminary investigation shows that speakers of an African language from a disadvantaged background[2], although they constitute about 80% of the South African population and 30% of the student population at Rhodes, are a small minority (14%) in Computer Science (Rhodes University – Information Technology Division, 2004). Average marks show that speakers of an African language perform poorly compared to English speakers in all years of study. In particular, the average in third year is far from the requirement to continue at postgraduate level (Table 1).

Table 1 Number of Students in Various Years of CS in the Period 1999-2004 (Average Mark in Parenthesis)

	1st	2nd	3rd	Honours	Masters	PhD	Total
English L1	3446(67)	565(62)	465(62)	83(73)	48	13	4620(66)
African lang. L1	781(56)	81(54)	88(51)	1(62)	2		953(56)

In the classroom observation and interviews with the lecturer, the tutor and the students indicated that, besides lack of exposure to computers up to the university level, this might be due to two sets of factors: language problems and problems of communication and organisation in the classroom.

As far as language problems are concerned, the current approach to foundation programmes in South Africa is mainly informed by studies in the Humanities (Boughey, 2002) and seems to address the particular problems of students in that field (e.g. internalising the values of the academic world, adopting a style of writing which is considerably different to common language, mastering specific syntactic structures etc.). According to Halliday and Martin (1993), students of scientific subjects have different problems, mainly at the lexical level. Apart from technical terms, students in the computer skills course appear to struggle with more common English words, such as *buffer* or even *drag*. Students try to cope with the situation by asking for help to classmates sitting nearby, and usually interaction takes place in an African language. Consistently, interviews with lecturers, tutors and students suggest that, no matter how simple the level of English is, there are concepts that some students can understand only in their mother tongue.

Prior to our intervention, in classroom practice, it was not uncommon for several students to lag behind because of the same problem without the lecturer realising it. Students relied on a classmate sitting nearby or on the tutor for help. Often, the tutor had to run around the classroom explaining the same concept to different students, while the lecture carried on.

3. Intervention

[2] Please note that we relied on the language chosen as a first language in the matriculation exam rather than the home language. The former is in fact a good indicator of the school background.

The analysis of the problems mentioned above led to the development of a Web-based application, designed to assist classroom practice. It comprises three features (a chat room, a knowledge base/newsgroup and an online glossary) and it is instrumented to inform our research as well as the development of the tool itself. In the interactions with the system, the use of both English and the students' mother tongue is encouraged. This allows them to integrate new knowledge about computers into their existing knowledge structures (Sweetnam-Evans, 2001).

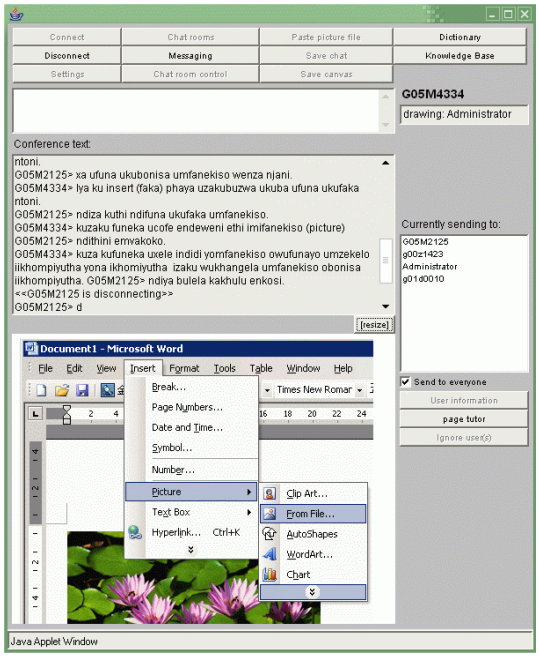

Figure 1 Main Page - Chat Room

With the *chat room* feature (Figure 1) students can communicate with each other during lectures. Reliance on the help of the persons sitting nearby, which classroom observation indicates being the first "port of call", can therefore be extended to the whole class. In this way, students who have time at their disposal can assist others, either in English or in an African language. The students' number/username, displayed next to what they type, should be anonymous enough for them not to feel shy about asking questions but would also make it possible to track someone who is misusing the tool (chatting about private matters, for instance).

The tutor can answer at least some of the questions from one of the machines in the laboratory. This allows him or her to work more efficiently and save some time. The lecturer has the application running on their screen during lectures. This makes it possible for him or her to see the kind of questions students are asking, thus getting a better feeling of the problems. Moreover, the lecturer notices immediately when several students are asking the same question, and can slow down or repeat.

Tutors and lecturers can draw and copy images and screenshots on a *shared canvas*. This adds a visual component to the explanation. Students can also page their tutor when the question they want to ask has already been asked by someone else. This would highlight problems which are common to more than one student. The text that appears in the chat room is recorded for future research, as it could help to inform the development of the course. Recording also make it possible to track students who misuse this resource.

Students can use the *knowledge base/newsgroup* feature to ask more complex problems. The system links their question to relevant documents available on the Web or, alternatively, gives the possibility to e-mail lecturers or tutors. The title of the query eventually becomes the reference for the answer, which becomes available to all students in case others are interested in or share the same problem. This resource contributes to better communication between students and teaching staff, which in turn informs teaching practice. The advantage is that, once an explanation is given to one student, it is readily available to the others.

The *online glossary* works very much like existing resources (Webster's Online Dictionary, 2005). It is possible for students to choose between an explanation in technical English, one in simple English and one in various African languages. Explanations in technical English are readily available on the Internet (High-Tech Dictionary, 2005), while explanations in simpler English and in the African languages can be produced by the students themselves under the appropriate supervision.

Given the difficulties many speakers of an African language encounter with the written variety of their mother tongue (Barkhuizen, 2001), audio-recorded explanation are also used. The audio can be streamed from the database to the machines on which students are working, and they can listen to it with headphones (see

Discovering Computers, 2005 for an example with English). Keeping track of the words students look for more frequently, of the preferred explanation and, most importantly, of the terms for which no explanation can be provided will help to shape the database to the students' needs. Students meet once a week to collaboratively produce the missing explanations with the help of a coordinator.

Consistent with the current trend in South Africa, for the development of our application we have used open-source software (Martindale, 2002). The chat room has been developed starting from Java Babylon Chat 2.1 Beta (2005). The knowledge base/ newsgroup and the interface of the online glossary are also in Java. The latter is connected to a database indexed by the word being queried, to which the database associates definitions/explanations in English and in various African languages, audio files and statistics of use.

4. Conclusions

In summary, the goal of our application is to provide increased and more meaningful access to the study of the new technologies by addressing the particular problems of students in our focus group. Focus on lexical problems and use of multilingual material can contribute to crossing the digital divide. We feel that our application contributes to researching into the role of technology in teaching and learning in Higher Education by providing an example of a tool whose development has been fully shaped by the needs of and with the help of the students. All interactions with the resource are recorded in order to inform future research as well as the development of the resource itself. This makes it a very flexible tool which can be easily customised to suit the needs of different groups of students, at different levels of education and in different contexts. The use of open-source software and the active involvement of the students in producing material in electronic format contribute to cutting the costs.

We are currently busy with the implementation and fine-tuning of the application. Its future developments will be entirely informed by feedback from the students and the lecturer. We are also exploring the possibility of extending the implementation to neighbouring institutions and schools in the future.

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