A Review of the Use of Computers in Education in Southern Africa: Tertiary Education

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Abstract

This informal review is based on personal discussions carried out within the last year with various experts in the field on the current use of computers in tertiary education, particularly at universities. An attempt has been made to obtain information on the type of use being made of Computers - here this generally means: "Which academic departments are involved and what aspects of their teaching are they attempting to use Computer-Assisted Instruction (CAI) for?" Also of importance are the hardware and authoring languages or authoring systems used, and any interesting research or social responsibility programmes in progress.

The present economic climate has resulted in any advances in the use of CAI at universities depending largely on sponsorship from private sources. The urgent need for ways of reducing the drop out and failure rate of students in first year particularly in the Science, Engineering and Medical faculties remains, however. There is a very real economic necessity for improving the productiveness of teaching at universities in Southern Africa.

Introduction

The extent to which the success of Computer-Assisted Instruction is dependent upon the enthusiasm of particular members of the academic staff is particularly noticeable at university level. So strong is this relationship that CAI centres are often very closely associated with, or controlled by, one or other teaching department in the university. The head of the centre at the University of Delaware, Prof. Hoffstetter, was initially in the department of Music! Here in South Africa a similar phenomenon is evident, with particularly strong bonds between departments of Chemistry and Physics and CAI. It is for this reason that we refer to the people closely associated with projects by name in this article.

University of the Western Cape
When discussing the use of computers in education in South Africa, one must start off with the University of the Western Cape and its PLATO system as it was the first university to make a major commitment to using Computer-Assisted Instruction. The first sixteen terminals, attached to the Escom mainframe, were installed in 1979 for use in a pilot project and in 1980 the university bought its own Cyber mainframe with 64 terminals. Since then extensive use has been made of PLATO and a considerable amount of research into Computer-Assisted Instruction has been done. Computer scientists have developed courseware for teaching English, Latin and Biochemistry, amongst other things, and have played a large part in modifying and translating the SASSC (South African School Science Curriculum) modules. They do, however, also use a great deal of PLATO courseware developed elsewhere. The language TUTOR is used for developing courseware on the PLATO mainframe system. Professors Sinclair, Mehl and Vermeulen, in particular, have published extensively on the work done at the University of the Western Cape.

University of Rhodes
Possibly the second most active user of CAI at university level is Rhodes. The PLATO centre here is headed by Dr. Graham Oberem, who has just returned to South Africa after spending a sabbatical year at the CLEAR centre at the University of Texas. Dr. Oberem was initially a physicist and has developed an Intelligent Tutoring system, ALBERT, for teaching certain aspects of Physics. PLATO has been in use at Rhodes since 1984 and the number of student contact hours on the system has nearly trebled, from fifteen thousand in 1984 to forty-four thousand in 1988. An impressive number of departments are active on the system:
Business Administration, Chemistry, Computer Science, English, Human Movement Studies, Latin, Law, Linguistics, Journalism, Mathematics, Music, Physics, Plant Sciences, Psychology, Social Work and Zoology.

An interesting aspect of Rhodes' use of PLATO is its system of selling resources to other users, some of whom are sponsored by third parties, and in this way helping to finance its own CAI. In this way Trinity High School in Port Elizabeth can use the courseware for schools on the Rhodes computer thanks to the sponsorship of Firestone. Other users are the University of the Transkei, the National Institute of Personnel Research (which has terminals in both Cape Town and Johannesburg), Kingswood, St Andrews and

All Saints in Bisho. The use of this system by external users is also growing rapidly, from negligible in 1985 to 60% of the total use in 1988.

Computer scientists at Rhodes have written courseware, including lessons which are used extensively by the students taking English, some rather interesting lessons developed by a Law lecturer, M. Lambiris, which have recently been enhanced, and the intelligent system, ALBERT, which was mentioned earlier for teaching aspects of Physics. Rhodes' own courseware is used for about a third of the total student contact hours on the system. The courseware developed on the mainframe system is written using TUTOR but an investigation into the possible use of TENCORE for adapting some of the courseware for use on micro-computers is envisaged. The courseware is usually designed by the staff of the PLATO centre at the university, in consultation with the lecturers who intend using it, and implementation is carried out by the staff at the centre. Occasionally, however, academic staff develop the courseware completely themselves.

The University of Zululand
The University of Zululand started using PLATO in 1988. Since they are such new users, not much is known at this stage about their progress.

The University of Stellenbosch
The University of Stellenbosch has been involved in developing courseware both for the university and for outside clients for some years. Staff members have developed a great deal of courseware for ESCOM for use on PLATO. They have had some experience in using the authoring language TENCORE for developing courseware for use on micro-computers and are also using the authoring system QUEST extensively. They have recently completed a large amount of academic courseware for upgrading students' knowledge and understanding of English so that they can read academic material more easily. This courseware is at present being evaluated and it is hoped that it will be made available in 1989.

At present lecturers are busy developing courseware for Analytical Reasoning. Prof. Kon du Plessis, with Dr. J. Botha in an advisory capacity, is developing a Xhosa course for first-year students which uses interactive video, interactive sound (plays the student's own voice back) and a scanner to obtain visual material. Ms. Bodenstein is developing courses on German grammar for German Special students.

University of Cape Town
Prof. G. Delpierre, formerly of the University of the Western Cape, is now at the University of Cape Town, Department of Chemistry. Prof Delpierre has been an enthusiastic believer in the use of computers in education for many years and has, of course, had extensive experience in the use of the PLATO system.

He, together with other enthusiasts in the department, is now developing Computer-Managed Instruction Units for Chemistry students, using the authoring language TENCORE. Mr. Donald Cook, formerly of the Unit for Educational Technology, is now a member of the staff of the Department of Computer Science. He is particularly involved in teaching problem-solving skills using computers in a bridging program for Computer Science students.

University of Pretoria
The University is active in the field of computers in education on a number of fronts. Staff members use Phoenix on their mainframe computer to do Computer Literacy training of students and staff. Dr C Boshoff is involved in this. The university has recently been the fortunate recipient of a large donation from Goldfields to be used specifically for computers in education. Members of Physics Department, particularly Prof Strauss, have been particularly enthusiastic about the possibilities that this technology offers and will be making use of the PLATO system (consisting of 16 terminals attached to a mainframe computer) bought with these funds.

Dr Z Apostolides from the Department of Biochemistry spent his study leave in 1987 at the University of Delaware and worked at the Office of Instructional Technology (now renamed the Centre for Academic Computing and Instructional Technology) with Dr Hofstetter. While there, Dr Apostolides developed courseware, written in Pascal, to simulate a biochemical instrument. This program is in use at the University of Pretoria and has been evaluated, using a control group of students in a laboratory. The students using the CAI system did as well in their final results as those using the laboratory.

The University of Pretoria has recently obtained a copy of TENCORE, which is what the University of Delaware is currently using to develop courseware on micro-computers.

The Department of Computer Science of the University of Pretoria is in the process of developing a sophisticated computer-based programming environment, EPOS, which assists Computer Science students in learning programming by relieving the student of the need to remember details of program language syntax and hence enabling him to concentrate on the broader issues of problem-solving. The system also has components in which graphics are used to assist the student in planning his program and other components which help him to find errors in the program by displaying the contents of various key fields as the program executes. This system was also written in Pascal. Students taking the Computer-Assisted Learning component of the Computer Science Honours course learn to use PCD3. Courseware for teaching Pascal syntax has been developed by these students under the guidance of the lecturing staff.

A bridging program (UPOKWIS) for first-year Mathematics students is at present being evaluated by the University of Pretoria. This program was developed by Prof. J. Engelbrecht of the Department of Mathematics at the University of Pretoria, who has had six years of experience developing courseware for high school Mathematics (the SERGO courseware). This system presents students with a brief tutorial on the topic and an example, after which problems are generated by the system. The student is only permitted to progress to the next section once he has answered a pre-set number of questions on this topic correctly. The UPOKWIS system runs on a local area network of AT compatible micro-computers, with a single micro-computer in the network acting as a dedicated control unit. The system produces class and individual progress reports. A book of exercises is included for students to use for homework to re-inforce the material learned while using the computer.

Finally, the Departments of Dentistry, Accounting and Auditing use computers in Computer-Managed Instruction to do some testing of students.

The University of the Orange Free State

Although the University of the Orange Free State does not use computers in the teaching of students on a large scale, at this stage the Bureau for University Teaching is carrying out some experiments in the departments of Chemistry, Nursing Science, Accounting, Agricultural Economics, Physics and Greek. The courseware for the Greek course is now part of the curriculum and the results are incorporated in the student's year mark. The Research Institute for Education Planning within the Faculty of Education is involved in developing courseware to be used in teacher training in the independent states. Courseware covering the Science syllabus for Standards 9 and 10 Mathematics for standards 9 and 10 has been developed. This project has private funding.

The University of the Witwatersrand

The Departments of Chemistry, Physics and Mathematics at the University of the Witwatersrand developed courseware on the APPLE computer several years ago. This courseware is still used, demonstrating the point that even when the technology becomes outdated, the courseware can continue to be used as successfully as ever. The cost of development of the material can therefore be weighed up against the benefits accrued over a fairly long period. The Department of Computer Science at Wits has a strong interest in Artificial Intelligence and this has resulted in a research project in partnership with the Department of Physics in developing an Intelligent Tutoring System. This project is still a research project rather than anything else, however.

The Medical University of South Africa

MEDUNSA is registered as a PLATO user but does not appear to use the system very actively in its teaching.

The University of Port Elizabeth

The University of Port Elizabeth is involved in a Social Responsibility programme teaching Computer Literacy skills to disadvantaged school children, using word processing, LOTUS 123 etc. Lecturers do not use CAI in their university teaching, however.

The University of South Africa

Despite interest being shown in CAI by staff from numerous disciplines over the years, no use is made of it in the distance teaching at Unisa apart from a few lessons which are available for use by students taking French. The Department of Computer Science intends developing a new first-year course for Computer Users next year and since there will be a registration requirement that these students have access to a computer,
we intend incorporating Computer-Assisted Instruction into this course. Preliminary work has involved development of a set of courseware for training staff in the use of advanced features of the word-processing package DW4 and use of authoring systems (PROPI, QUEST and PCD3).

Outreach programmes

Details of the Outreach programmes, in which a number of universities are involved, are given in the paper "A Review of the Use of Computers in Education in Southern Africa: Primary and Secondary School Education" by M C Pistorius and P M Fallick.

Conclusion

Many of the people from universities who were enthusiastic about using computers in teaching at university level and who delivered papers either at the 1982 Computers in Education conference in Stellenbosch and/or in 1985 at the second such conference held in Pretoria, are still keeping the flame alive. This is so despite the fact that the severe cuts in university subsidies have made any major acquisitions of hardware impossible. There seems to be most support for the use for CAI in bridging programmes and remedial programmes at first-year level, in an attempt particularly aimed at assisting disadvantaged students to remedy the inadequate grounding they obtained in Mathematics, Physics and Chemistry at school. Certain universities have tried, by means of outreach programmes, to assist the schools in solving this problem, at least partially, before the prospective students matriculate.

A remark which is encountered over and over again, is that imported courseware is, for a number of reasons,

unsuitable for use at our universities. The only alternative is to develop courseware locally - a daunting task for lecturers who are already faced with escalating problems. (Typically: Large classes of students, many of whom need as much individual attention as possible; reduced quotas for staff; the loss
of experienced staff through emigration; the difficulty of attracting new staff when salaries are not competitive; increased pressure to do research and publish.) As a result, there is a noticeable effort being made to sell courseware developed at one university to others, to co-operate in the development of courseware and occasionally even to justify the production of courseware by giving away copies to colleagues.

The shortage of funds is resulting in universities, often regretfully, turning away from sophisticated mainframe systems towards microcomputer-based CAI. Authoring languages and authoring systems frequently mentioned in the development of the most recent local courseware are TUTOR on PLATO systems, QUEST, TENCORE and then ordinary high level programming languages such as Pascal.

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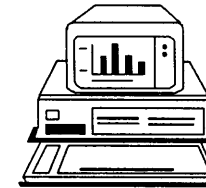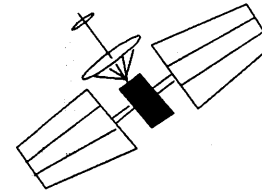
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