DEVELOPING SCIENCE COURSEWARE USING AUTHOR

by Pat Horan and Lorraine Staehr

INTRODUCTION
Second and third year students in the Bachelor of Applied Science (Computing) course each spend a full year (two semesters) on one or more projects. This experience is a valuable reinforcement of the theoretical and practical work done in other subjects and helps to link the various academic areas and the needs of real clients.

Work done with high school chemistry students suggest that the main benefits of CAI in the teaching of chemistry concepts lie in reinforcement of practical experiments, and in motivation of students.\textsuperscript{1,2,3,4}

Our first contact with lessons produced using Author was the work done by three people at Swinburne College of TAFE. These lessons had been designed and programmed during 1983 for five units in the Certificate of Applied Science course. This course is ideally suited to CAI and testing as students are required to achieve a 70 per cent competency in every aspect of the course. Three teachers at Swinburne were each given leave one day a week for a year to get the system up and running. In that twelve months the lessons and tests for a one semester mathematics unit were completed, with considerably more time than the one day per week officially allowed. The two chemistry units were 70 per cent finished and the two physics units were 60 per cent completed.\textsuperscript{5} Although these lessons and tests were prepared without exact representation of subscripts, superscripts and mathematical symbols, it was felt that the lessons could be improved if appropriate subscript and superscripting could be incorporated.

SOFTWARE CHOICE
As everyone in an academic institution will understand, cost is the most common determinant in the choice of software and the only authoring tool available to us was Author 8.1. (For a discussion of CAI software development, including the selection of an authoring language see Rod Sims paper.\textsuperscript{6})

THE PROJECTS
Two of the projects discussed were designed to assist students to learn basic chemistry concepts — one (Hui Lik’s) at Year 1 level; the other (Robert’s) in a bridging course for intending tertiary science students with an inadequate background in scientific areas. The third project (Claire’s) consists of a tutorial session on cell diffusion and a learning package of seven separate tutorial modules.

Robert’s project intended to provide drill and practice in basic chemical concepts as part of a bridging program for students with poor or no scientific background going into a science degree course. Robert was a second year student, slightly older than average, with no experience of personal computers, his first year computing experience being confined to VAX terminal use. In the initial stages of the project he had no access to Author or a hard disk.

Claire’s project was a stand-alone tutorial cell diffusion for nursing students and a package of seven tutorials on nursing theory.

Hui Lik’s project was intended to prove reinforcement of concepts illustrated by a Year 12 practical experiment on chemical equilibrium, as students find the required concepts difficult to grasp.

Hui Lik was a third year student with some, though not extensive experience with PCs. Most of her experience was with the use of VAX terminals.
WORK COMPLETED
Robert completed two lessons. The first lesson involved random testing of the user's knowledge of chemical symbols. From a base of 150 questions, the student is presented with a random selection of twenty to answer in each session. This lesson was prepared using the Lesson editor, which is basically a word processor but lacks the more sophisticated formatting printing features.

The second lesson involved identification of polyatomic ions. Because of difficulties at this point with representation of subscripts and superscripts this lesson was prepared using the Graphics editor. It was felt that with the type of students involved it was important to show an accurate representation of the ions. As this editor did not allow random choice of questions this lesson consisted of twenty fixed questions of varying format. Robert completed good user documentation for both lessons. He began to investigate a six-part equilibrium package. Animation was investigated and found to be unsuitable so the Graphics editor was used. Only one small part was completed by the end of the year.

Claire completed the four-part cell diffusion tutorial. She began the seven module nursing theory package for health science students but the project was hampered by a change in user requirements. This frequently happens with student projects, as it does also in the outside world. Only one module was completed.

Hui Lik completed two-thirds of the chemical equilibrium experiment simulation initially investigated by Robert. She did not use any of his initial work because past experience with projects has shown this approach to often be unsuccessful. To our knowledge she put in considerably more than the required time on her project.

All three students provided student register and result recording facilities for instructor use. This feature of Author allows checking of results on the lessons for each attempt a student makes. For example, a student who has attempted ten questions of a lesson but has only got four correct has this recorded against his name and this can be checked by the instructor at a later date.

TIME TAKEN
Students spend four hours per week of formally scheduled time on projects. They are expected to also find an equivalent amount of time outside the scheduled time.

All of the students put in at least the required time and were enthusiastic about the projects. Hui Lik, as did Robert, put in considerably more than the required time. They all worked on their project for two semesters. Claire benefited from considerable support and encouragement in her workplace, but suffered some delays and interruptions. Some of these were caused by uncertainty in requirements.

RESOURCES AVAILABLE TO STUDENTS
The students had access to the following resources:
- Hardware: IBM–XT compatible with EGA card, mouse, hard disk and two 5½" drives
- Software: Microsoft Pty Ltd's Author Version 8.1

We, as project supervisor and second assessor had no experience at all of Author. The students did, however, receive advice and encouragement from us and the User Services Staff.

DISCUSSION
Both Claire and Robert had difficulty with subscripts and superscripts as the Author Texts and Lesson editors did not support them. This was overcome by using the Graphics editor but this is not ideal because of the extra disk space required for storage and it is no longer possible to randomly select a number of questions from a bank. An Author font file became available from the Author bulletin board during the period of the projects. This makes the authoring of scientific and mathematical software much easier. However, when Hui Lik used this file she found that the fonts were represented on her screen but were not handled by the printer she was using. This problem needs to be overcome.

The minimum hardware requirements suggested by Microcraft for developing CAI software with Author are not really adequate. Robert began his project using Author on floppy disks and very quickly found the floppy swapping to be tiresome. To achieve professional level graphics-based lessons, access to EGA card and monitor, a mouse and a hard disk is mandatory.

The students did not find the programming itself very demanding. However, a great deal of time was required to practice drawing with the mouse to produce good quality graphics screens.

There was a lack of good user documentation. The Author manual is not very user friendly and at times the students resorted to the expertise we had in our Computing Services Centre. Lack of sample programs in the manual was a complaint common to all the students. This forced them to use trial–and–error methods at times.

The large amount of disk space required for Hui Lik’s project was surprising—fifteen 360 kilobyte disks hold her two-thirds completed project. Each of the five small tests in the experiment had on average twenty-five screens.

CONCLUSION
In summary, an EGA card and a mouse are needed for programs that have graphics screens. A hard disk is needed for ease and speed of operation, and for storage of any reasonably sized lesson. Author Version 9 was due for release August/September 1990 but was delayed and was not out at the time of writing. This new version will include the facility to display Graphic Parts
instead of full graphic screens to minimise disk storage requirements.

The most striking discovery from these projects has been the amount of time needed to get results. This is particularly surprising as all the students were computer literate and had considerable programming experience to begin with. This is also backed up by the Swinburne experience. Certainly, for someone who has had little experience with computers, a task such as one of these projects might easily prove much more difficult and time consuming than expected.

NOTES

REFERENCES

Johnson, J., Swinburne College of TAFE, Personal communication, November 1990.


Johnson, J., Swinburne College of TAFE, Personal communication, November 1990.


Continued from page 7


Mantei, M. (1991), Technological Mindset, Seminar papers, Department of Computer Science, Faculty of Library and Information Science, University of Toronto.


