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APPENDIX SURVEY OF ISSUES

PERCEIVED USEFULNESS OF INFORMATION ON VARIOUS TOPICS AMONG
MATHEMATICS AND SCIENCE EDUCATORS (N = 98)

Note: mean values. No sig differences between maths educators and science educators

WHAT WE DON'T KNOW ABOUT C.A.I.

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Studies of Computer Assisted Instruction (CAI) to date, appear to have concentrated on comparisons of CAI with other modes of instruction; differences in time required for completion of lessons; student personality; student attitudes to CAI; and the number of students who can successfully work together on the one CAI task. It is fair to claim that the most important information is yet to come, for there are many other variables of CAI that need to be researched, as the following questions suggest.

1. Are there differences in student performance in groups given a print-out of the CAI lesson on paper, and in those groups who refer only to the monitor? One of the criticisms that has been levelled at CAI is that students do not have a permanent record of the lesson, and thus, at a later date, cannot revise the work covered in a CAI lesson. It could be expected that retention would improve if the students had a permanent record of the lesson. This requires testing, however.
2. Do the graphics and sound capabilities of computers benefit learning from CAI lessons, and in what instances do they exert negative effects? The trend in software currently being marketed for microcomputers has been to display as much graphic information as possible, and to provide associated noises for the duration of the programme. It is possible that over-use of graphics and sound reduces the effects of CAI. This, also, need priority in educational research.
3. Do differing user-interfaces interfere with student performance? Expected sources of interference are the keyboard commands of software packages, and the keyboard layouts of different brand computers. Should there be an effect due to differing user-interfaces then the continued use of CAI necessitates an Australian standard to be established for the keyboard layout, and for the programme commands used by software authors.
4. Are there long-term effects on students' social behaviour as a result of the use of CAI, and if so, up to what frequency of use of CAI are there no negative effects? Feldman and Sears (1970) showed that there were some short-term effects of CAI on student behaviour, but this was with first grade students. The same may not hold for older students, and merits investigation.

5. How should the student's name be used during the lesson? It is no more difficult to use the student's name for every communication, than it is to use it just once, and microcomputer software has tended to use the student's name in both the question and the feedback. Steinberg (1984) suggested, without empirical research to substantiate the view, that over-use of the name is annoying to the user. This would not be difficult to establish.

The answers to such questions posed above are necessary for the effective design of CAI lessons. CAI lesson content and interactions must be completely pre-specified at the time of development, as alterations to a developed program are costly. Currently, small, one-off programmes are being developed for microcomputers, with no planned continuation to other CAI modules. If large-scale development of linked CAI lessons is to be undertaken, then the designers need to know about the effects of graphics, sound, name use, and keyboard commands on the students, and how much time can be spent at CAI tasks before there are negative effects on learner or learning.

HARDWARE DEVELOPMENT

Education is a specialised application of computers. The users of computers usually will not be adults, but students. The computers that have been placed on the market, with the exception of the Microbee computer, were not developed for school use, but rather for general business and home use. The computers that are required by education require large memories, easy access of peripheral devices (such as speech synthesizers and video recorders), standardised keyboards, and graphics displays of high resolution. A 'help' key would also be of benefit. Computers that incorporate these features (such as the Apple Macintosh computer) are beyond the price range of most schools and students, and so schools tend to purchase smaller machines.

SOFTWARE DEVELOPMENT

Software design is a major factor in the success or failure of CAI. CAI has been shown to have the potential in effectively teaching students at all levels of education, but poor-quality software cannot be expected to achieve such results.

An important question is: Who should write the software? Educators are aware of issues in education such as lesson design and feedback, but typically lack the programming skills required to write software that is fault-free and maximises the potential of the computer. Computer programmers, on the other hand, have the necessary programming skills to write visually-impressive programmes, but may not be aware of educational issues. One obvious solution to this problem is that software should be written by a team that consists of both programmers and educators.

The developers of software cannot assume that the students who will be using the CAI packages are experienced computer users, or that they will not make mistakes in pressing keys. CAI programmes will be easier to use if they are as self-contained as possible. A manual should not be required for the operation of the programme, as ideally, all information would be available to the user from within the programme. User errors can cause a programme to stop running, and the user is then presented with a message (such as "FILE NOT FOUND") that is meaningless in terms of assistance, and over time would be a possible source of irritation and frustration. Authors aware of these problems would design software so that the user is neither required to memorize a manual, nor be confronted by error messages.

Software that is sold for microcomputers is typically not trialled in a school before it is released for sale. Schools purchase software largely on the claims of advertisements or recommendations of other schools. Before software is released for sale it should be tested in schools for effectiveness. Just as a panel of experts in the NSW Department of Education annually previews live drama and recommends (on the basis of graded evaluation) that which is appropriate for pupils of various ages, so guidance can be offered on software.

The piracy of software has caused software publishers to alter the codes of programmes so that copies cannot be made. Schools are thus placed in the potential situation of students damaging the only copy of a programme. Schools need reproducible software so that the master copy need not be used unless the back-up is damaged.

TEACHER EDUCATION

The effectiveness of CAI in a classroom will be dependent upon the approval of teachers. The demonstrated benefits of CAI are not perennial. Lack of use of computers in schools, or uninformed application of CAI, will do much to prevent the use of computers as instructional devices. CAI is not intended to replace teachers, but, rather, to supplement other modes of instruction. It is a medium, not a message.

Not all teachers support the use of computers in education. Magidson (1977), on approaching a lecturer about the possibility of using CAI to supplement the lecturer's lessons, was informed that the use of computers is dehumanising to both lecturers and their students. Two possible sources of teacher disapproval are a lack of familiarity with computers, or a fear that computers will replace them. Such views are based on ignorance, which can be dispelled by teacher education at both the inservice and preservice levels.

Issues that need to be covered in teacher education include:

1. The effectiveness of CAI as compared to other methods of instruction. In what specific instances has CAI been shown to be more effective?
2. The evaluation of software.
3. The evaluation of hardware.

4. The perceived CAI threat.
5. Other uses of computers in education, such as word processing and mark or grade storage. These uses have not been included in this paper as they are not components of CAI. However, they are appropriate uses of computers in education, and are increasingly being utilised in schools. Negative experiences with the computer in these tasks may predispose teachers to oppose all educational applications of computers.
6. The alteration of marketed software to suit classroom needs.
7. How CAI can be integrated into the curriculum.
8. Changes that CAI will impose upon the classroom.

ATTITUDINAL CHANGES

Computers, as initially marketed, were extremely expensive to purchase and operate. Until the late 1970's, the ownership of a computer would have been beyond most individuals (or even small businesses). Microcomputers have put the ownership of computers within the reach of most people, with relatively cheap machines, such as the Aquarius from Dick Smith Electronics, being available for less than one hundred dollars. Attitudinal changes in users and potential users are sure to result from easy access to computers. Computers will become less of an oddity as the numbers in use increase dramatically, and they may be viewed as just another piece of machinery.

The effectiveness of CAI may decrease as attitudes towards computers change. Perhaps children will become to regard computers in the same way as they now regard books, and television. Nonetheless, CAI should maintain student interest, given the enthusiasm that children have for computers (as noted by several authors (Gagne, 1982; Rothbart & Steinberg, 1971). Hopefully, as student interest in the novelty of computers wanes, it will be countered by improved CAI materials that will maintain student interest. Student approval can be transferred from the computer to the lesson materials.

CONCLUSION

Computer Assisted Instruction provides the teacher with a tool that is both fast and efficient. However, teachers will still need to provide the majority of instruction, not only because there are objectives of education (such as values education) that cannot be provided by CAI, or because of the limitations of computers, but because there is a professional responsibility to do so.

There is a large core of research within education indicating that CAI should be successful in the transfer of specifiable knowledge. This view is supported by research in the area of CAI. There are benefits in the use of CAI (such as the decrease in the required time for instruction, and the provision of individualized instruction), but there are also negative associations with the use of CAI (such as the need for pre-specification of the lesson, and the use of poor-quality software), indicating that CAI needs to be used with caution.

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