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Computer Based Accounting Education Techniques: A Response to a Dynamic Information Technology Environment

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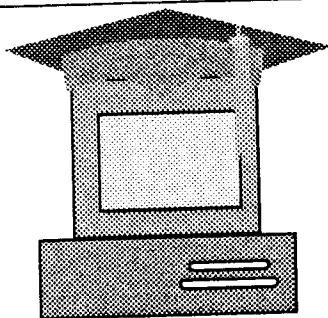UNIVERSITY OF WOLLONGONG

DEPARTMENT OF ACCOUNTANCY

COMPUTER BASED ACCOUNTING EDUCATION TECHNIQUES: A RESPONSE TO A DYNAMIC INFORMATION TECHNOLOGY ENVIRONMENT

by

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ABSTRACT

The dynamic environment created by increasingly sophisticated digital technology has provided a means to improve the quality of accounting graduates and the potential to reduce the amount of time required to assess student achievement. This paper outlines the approach adopted in the Department of Accountancy at the University of Wollongong to maximise the use of this technology with a view to providing our future graduates with a competitive advantage and academic staff with more research time.

INTRODUCTION:

Digital technology is progressively making its way into almost every aspect of society. Accounting is no exception. Indeed accountancy was one of the first professions to utilize computer applications for data management. With the advent of the microcomputer, accounting could almost be said to be rapidly becoming a PC profession.

Accounting education should follow this trend. It is not sufficient that students have basic computer training. They should also have accounting specific computer training. In addition, accounting educators need to be seen to be keeping up with digital technology in their teaching and student assessment techniques. If accounting educators do not make full use of the technology available both in their presentation of material to students and providing relevant training for future accountants, they will be denying themselves and their students a competitive advantage in an increasingly automated society.

USES OF DIGITAL TECHNOLOGIES IN ACCOUNTING EDUCATION

1. LECTURES

There is a variety of presentation software available such as Powerpoint and Freelance for Windows. This software allows the preparation of either computerised slideshows or photo-produced slides. Both of which can be in colour but have the disadvantage of being inanimate. Alternatively, a liquid crystal display unit or barcode reader may be used to produce an animated visual display. The addition of a sound-blaster card will permit the incorporation of sound. A video port will allow computerised video images to be integrated in the display.
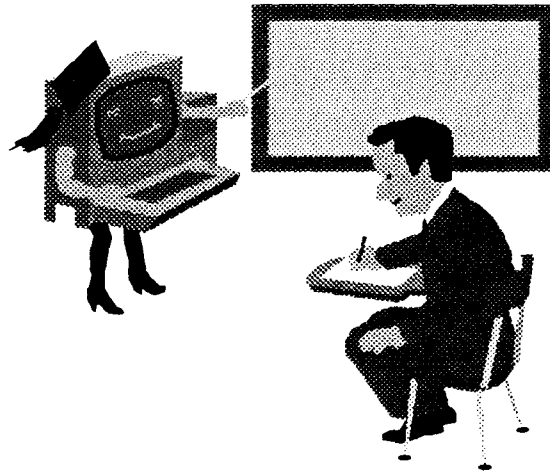
2. COMPUTER AIDED LEARNING (CAL)

Figure 1

CAL should supplement other forms of learning.

CAL is rapidly being recognised as an efficient learning aid in many disciplines including accountancy, nursing, engineering, physics, mathematics, languages, computing and medicine (ASCILITE Conference 1991). Ideally, it should be used to complement and supplement the traditional learning modes of lectures, tutorials, laboratories and workshops. However, where necessary, for example, distance learning or where resources are scarce, it can be used as a primary learning method.

CAL can be used in a number of ways. A simple question and answer approach may be adopted whereby students answer questions posed by the computer. The questions should be based on materials covered in lectures, tutorials, textbooks, etc. If an incorrect answer is given, hint windows can be built into the program to allow students an opportunity to determine the correct answer. By giving a progressive achievement score, students are able to assess their understanding of a particular topic. If details of this assessment are made available to teaching staff on a regular basis, problems may be more readily identified and remedial actions taken. This can

be achieved by having students complete CAL tasks in controlled computer laboratories with results being automatically recorded for teaching staff.

The CAL programs can be made more useful to students as learning aids by incorporating subject notes into the program. These notes should not introduce new material but be based on lectures or other materials used in the subject. However, they should not duplicate those materials. The idea is to provide an additional avenue for learning. Therefore, the major points which the lecturer wishes students to understand in a subject should be presented in summary form. For maximum effect, material should be divided into topic modules which follow the same sequence as lectures. This means that students can work through the program as new topics are introduced. By using a menu driven program, this approach also facilitates revision as students are able to select topics at random to re-enforce knowledge where necessary. Information provided for each module can also be used as the basis for quizzes which may be placed at the end of a module or, if it is a large topic, at logical breaks within the topic. This allows students to assess their understanding of the subject matter of each module. If a students score in a quiz is not satisfactory, the program can be designed to either prevent them progressing within a topic module or to the next topic and/or advise them to work through the topic again and repeat the quiz until a satisfactory result is achieved. The program can also be designed to provide hints and or direct students to the relevant section of their textbook for additional clarification of a point.

CAL need not be restricted to lecture materials. It can also be used effectively to provide hints to students on assignment preparation, examination techniques and use of library facilities.

3. COMPUTER MANAGED LEARNING (CML)

CML, as the name implies, manages the learning process including recording marks, and, at its most sophisticated, automatically assesses computer-based assignments and examinations. CML is also a form of CAL which, by using computer-based assignments simulating the student's future work environment, provides them with both computer and accounting skills.

a. *COMPUTER-BASED ASSIGNMENTS*

Computer-based assignments can range from the very simple to complex and can include calculations and the preparation of journal entries, posting to ledgers, trial balances, worksheets, financial statements for individual organizations as well as groups. Assignments should be selected for completion using a spreadsheet. This gives students experience with accounting specific computer programs and also facilitates the assessment process.

b. *COMPUTER-BASED EXAMINATIONS*

Instead of sitting for formal written examinations, students can take the examination at a computer terminal. Examinations can take various forms including multiple choice, true/false, matching, completeness or short answer questions. Because availability of computers is usually limited, it is often necessary to conduct computer-based examinations at a number of venues at a variety of times. For this reason, it is probably desirable to use a bank of questions randomly generated using the students identification number. Alternatively, all figures in a calculation type question can be converted using a mathematical algorithm based on each student's identification number. Thereby, each student completes a unique examination. This approach was successfully piloted in 1991 in the Department of Applied Computing at the University of Tasmania, Launceston (Godfrey, 1991).

c. COMPUTERIZED ASSESSMENT

This probably represents maximum use of computer technology in education at the present time. Machine marking of multiple choice questions is, of course, not new. However, automated marking of detailed assignments is a break through. Students complete their assignments, as outlined in a. above, and submit them on disk. A specially designed program marks the assignment, writes the result to the student's disk and provides a print out of the student's name, identification number and result for the lecturer's records. The program will mark calculations, journal entries, worksheets and financial statements.

This approach is also suitable for the marking of computer-based examinations.

BENEFITS OF CAL AND CML

1. *STUDENTS*

The benefits of CAL and CML to students will, to a certain extent, depend on the level of their computer expertise and the manner in which the material is presented (this will be returned to later in the paper). At a general level, it can be said that CAL provides students with an additional source of learning and, in a first or second year accounting subject, their first experience with a computer. If run time programs are used, CAL disks are stand-alone and therefore can be used by students where and whenever they have access to a computer. Help is therefore, potentially available at the students' fingertips and may reduce the necessity of consulting academic staff for assistance.

If care is taken in the design and preparation of CAL programs, even the complete computer novice should readily feel at ease with them and the computer.

CML has the potential to provide students with a competitive advantage on graduation by giving them both accounting and accounting specific computer skills. In an environment which is becoming increasingly automated, this can only be benefit.

CML and CAL also allows students to control their learning. They are able to work through CAL at their own pace. CML provides them with an opportunity to revise both their accounting and computer skills.

2. ACADEMIC STAFF

The benefits to academic staff lie principally in a potential reduction in staff-student consultation time and marking time. Because students have an additional avenue for learning, simple problems may be resolved by reference to the CAL or a combination of CAL, textbook and lecture notes rather than by consultation with teaching staff.

Computerized assessment has been found to substantially reduce the amount of time teaching staff spend on marking assignments and examinations. At the University of Tasmania (Godfrey, p.237) a computerized examination reduced the marking time from 20 hours to 8 hours. The examination comprised 10 short answer questions completed by 126 students and visually marked on computer by 2 teaching staff members. A more dramatic reduction in marking time was achieved by the Department of Accountancy at the University of Wollongong where 400 students completed a detailed consolidation assignment which was submitted on disk and marked by the computer. Total marking time was 13 hours as opposed to an estimated 133 hours for conventional marking time. The marking program has since been refined and it is anticipated that the marking time of 13 hours will be more than halved.

Reductions of this nature obviously provide academic staff with more time to undertake research.

3. GENERAL BENEFITS

Computerized assessment reduces paper usage and storage space as both questions and answers are on disk. Questions on disk can also be readily modified for future use. Answers to questions are easily found because the format is fixed. Bad handwriting is not a problem. Full security measures can be built into all programs by use of file encryption, passwords and locking edit functions.

Development Strategies for CAL

A four stage process for CAL software development has evolved. [Figure 1] This process, which includes a software shell, is appropriate for the development of CAL in a wide range of teaching and training areas.
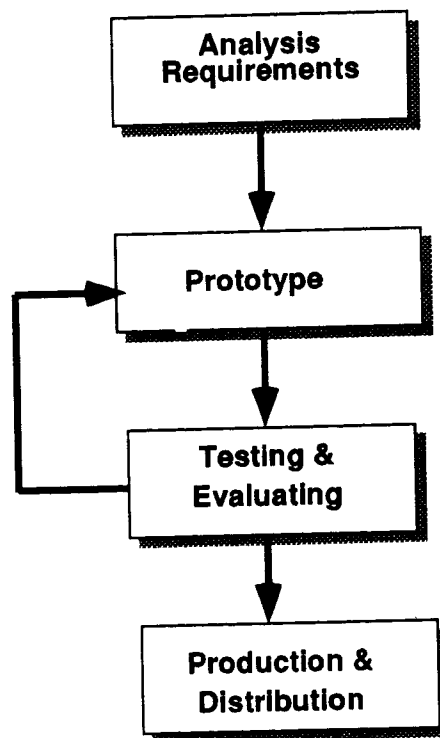
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Analysis
Requirements
    |
    v
Prototype  <--+
    |         |
    v         |
Testing &     |
Evaluating ---+
    |
    v
Production &
Distribution
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Figure 2 CAL

Development Strategies for CML

A six stage process for CML utilising
spreadsheet software is being applied.
This process is suited to any application
requiring the development of a
spreadsheet for teaching purposes and the
subsequent marking of that particular
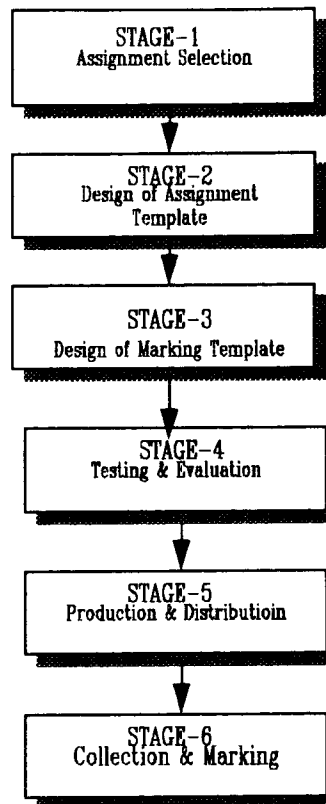spreadsheet by computer.

Figure 3 CML

First and foremost, it is essential to be professional. This extends to selection of
content and a consideration of the capabilities of users which, in turn, raises issues of
the appropriate use and design of programs including the use of colour, graphics,
animation, audio and menus.

a. *SELECTION OF CONTENT*

As a starting point, do not duplicate other material. CAL and CML should add to
available learning aids not replicate or replace them.

Selection of CAL Materials:

When selecting CAL materials avoid the temptation to provide large volumes of
information on a single screen. The computer screen is a source of light and it is

difficult to read when too much information is presented on one screen. Students are likely to prefer printing the screen and reading the hard copy instead of the computer screen. It is better to provide summary information and make use of margins and other layout techniques to break up the text to avoid eye fatigue and make the presentation of the information more appealing to the user.

To extend this idea further, colour, graphics, animation and sound can be used to present material in a more interesting and appealing way. Research (Trumbley, Arnett and Martin, p.14) suggests there is a relationship between attitude and the assimilation of knowledge or information. Colour, graphics, icons, illustrations and animation can be used to attract the student's attention to important items and improve assimilation of the material presented (Russell, p.541). They can also be used to reduce the amount of text necessary to convey ideas. The usefulness of such techniques varies with the experience of the user. For example, Trumbley, Arnett and Martin (p.11) consider the use of colour to be less important for material presented to experienced users than for novice users.

Selection of CML Material

Materials for computer-based examinations are a matter of preference and depend on what the examination is intended to achieve, for example, consistency with formal written examinations as opposed to multiple choice or true/false type questions.

Computer-based assignments, however, should test both the student's accounting ability and computer expertise or at least provide students with experience in the use of accounting specific computer packages. Assignments which lend themselves to completion using a spreadsheet are ideal. They force students to become familiar with spreadsheet packages and their great potential. Formulae should be marked to ensure that students are not simply be using the computer as a word processor and not taking full advantage of the computer's capabilities. In the Department of

Accountancy at the University of Wollongong where these methods have been used extensively in some subjects, students complete computer-based assignments in compulsory computer laboratories where tutors are available to assist students with the use of spreadsheets. Students, therefore, are not left to sort out computing problems without expert assistance.

The use of a spreadsheet also facilitates automated marking which not only searches for correct answers but also formulae.

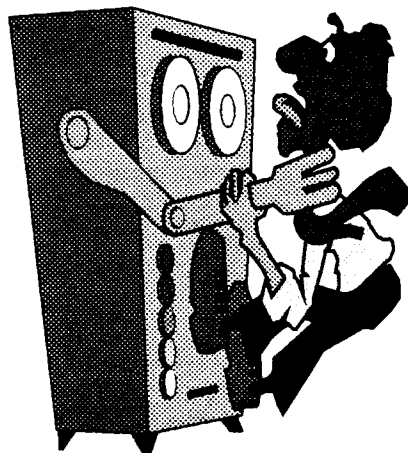## b. USER FRIENDLINESS AND ACCESSIBILITY

CAL

Figure 4

Computers do not have to be frightening.

CAL should be tailored to users abilities and computer expertise to the extent that this is possible. In general, it is advisable to adopt the KISS principle (keep it simple stupid) by the use of batch files and menu driven programs. All that is required is for them to select the appropriate drive and type GO, START or some similar command. This approach caters for students with varying degrees of computer skills. Students, therefore, do not need special programs to run CAL. Menus allow students to readily select the topic they wish to study.

Hot keys, introduction, title and topic screens incorporating paging techniques add to the user friendliness of CAL. Introduction screens are used to demonstrate the layout used in the CAL and allow students to experiment with hot keys which will allow them to move around within the program, for example, return to menu or the previous screen, take a quiz or exit the program.

Title screens should be used to introduce each topic so that students can readily ascertain that they have correctly selected the topic they wish to study. Title screens should use a combination of colour, shapes and animation to draw the students attention to important points to be covered in the topic.

Topic screens using a paging technique similar to turning the pages of a book allow students to read the information on each screen and, when ready, press enter to progress to the next topic screen. Again, topic screens should use graphics to highlight key points.

Hot keys, title screens and paging techniques allow students to control their learning and progress through the program at a rate suitable to their needs. These attributes combined with batch files and menu driven programs allow students to become familiar with the workings of a computer while they are learning accounting. If their first experiences with computers are agreeable, they will be less hindered by a fear of technology. This will give them confidence when the transition to CML or other more sophisticated uses of the computer are made.

CML

Obviously CML programs need to be more demanding in terms of computer skills as the aim is for students to acquire not only accounting skills but computer expertise as well. Students need to be able to select the appropriate drive and program and use

commands to retrieve and save files. Where spreadsheets are utilized, students also must learn the use of formulae. However, user friendly attributes such as menu driven programs can still be utilized to reduce difficulty.

When using CML, it is necessary to not only consider the computer skills of the students but also that of academic staff who will be using the programs to assess assignments and record results. Again menu driven programs and batch files are ideally suited to this purpose. Batch files allow the marker to select the appropriate drive and type MARK or similar to activate the marking file and bring up a menu. The marker then keys in a password to retrieve the student's assignment file. The disk is marked by activating a combination of keys. The emphasis is on simplicity.

ACCESSIBILITY: SELECTION OF COMPUTER PACKAGES

Packages used for CAL and CML should be readily available to students. In other words, expensive or less well-known packages should be avoided. Ideally, CAL should work off DOS and, thereby, be *stand alone*. However packages such as WINDOWS can also be used to good effect providing students have access to them. *Run time* programs are suited to CML as these are readily available to students.

PROGRAMMING

Obviously, complete details of programming CAL and CML in the Department of Accountancy at the University of Wollongong cannot be disclosed. However a general description of one successful approach can be given.
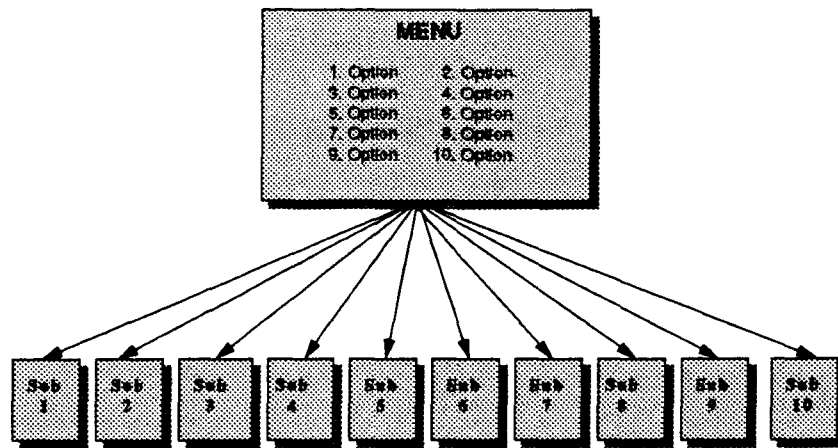
CAL

Figure 5

Software Shell

Different programmers use different approaches. However, one method which has proved successful and can be used in a variety of areas is the development of a special software shell. The shell comprises a dummy menu linked to empty sub-programs with quiz options. Each topic to be covered becomes an option on the menu and the summary information for each topic and quizzes are entered into sub-programs. Enhancements in the form of pop-up windows, colour and animation are then added. The use of hot keys. paging techniques and menus are incorporated as this is consistent with professional programs. Therefore, students have the advantage of becoming familiar with features of software programs similar to what they will be required to use on graduation.

CML

Assignments are designed for completion using a spreadsheet package. An assignment template is then designed and the appropriate layout for the solution to the question determined by completing the assignment using a spreadsheet package. The spreadsheet is then broken down into components with each component becoming an option on a macro driven menu. Numerical cells are then replaced with zeros and cells containing formula are replaced with a highlighted label indicating formula is

required. Formula cells are defined numeric so that inexperienced students do not use empty cells in formulae which will result in incorrect answers being recorded by the marking program. All headings and their cells are protected and columns and rows locked to prevent students altering the spreadsheet . Because the disks are automatically marked, it is essential that the spreadsheet not be altered in any way. The marking template is then designed.

CML MARKING TEMPLATE

SPREADMARK 2000 is a fully computerised spreadsheet marking program which evolved from the need to mark the increasing number of spreadsheet assignments set by lecturers. The program is fully menu driven and has built-in virus protection to allow for known and unknown virus contamination.

The marking template is completely separate from the template distributed to students. It consists of a series of macros specifically designed to search for the correct answers in the students completed assignment. To ensure the students are using formula and not merely typing in their answers the marking program looks for formula as well as a numerical answer. Each correct answer encountered by the marking program is added to a progressive score, the final score is written to the students disk and printed on hard-copy for lecturers records.

EVALUATION &TESTING

The software then undergoes extensive testing both by the authors and independent teaching staff to check for completeness and accuracy of content as well as major hardware and software testing procedures. It is tested under various network configurations and systems software, stand alone PC's and laptops.

RESULTS

The benefits of CML in terms of reduction in marking loads have already been indicated. However, the extensive use of CAL and CML as a learning aid is still relatively new. Therefore, it is difficult to state categorically what the overall impact on student performance has been. However, at the Griffith University where a controlled study of an investigation of the effectiveness of CAL for teaching mathematics was undertaken, CAL was found to be " a cost effective instructional technique" (Bryant & Bishop, 1991, p55). Surveys at QUT indicate that CAL has been well accepted by students and is considered to be a useful leaning tool. (Winn, 1919, p.711). A more detailed study is due to be released in March 1992).

At the Department of Accountancy at the University of Wollongong reactions to CAL and CML have been similar to those at Griffith University and QUT. In addition- use Tasmanian paper.

FUTURE DEVELOPMENTS

The next step is to move into the area of intelligent authoring systems whereby a students level of expertise can be determined by a computer program which will tailor the CAL and CML to their level of expertise. This approach is an expert system which utilises Artificial Intelligence (AI) whereby the computer can learn by students' mistakes.

CONCLUSION

Our aim in using CAL and CML is to produce highly qualified, computer literate accountants equipped to fulfil the business requirements of an increasingly automated field. Failure to recognise and utilize them would be to deprive our students of a competitive advantage in the employment market and relegate ourselves, as accounting educators to the realms of provincialism.
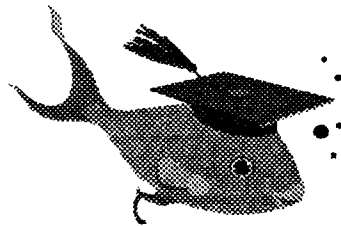

Figure 6

Our students are not considered

"fish out of water"

when it comes to applying technology

in a business environment.

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