DOCUMENT RESUME

ED 317 163 IR 014 232

AUTHOR Shaoul, Jean
TITLE Teaching Accounting with Computers.
PUB DATE Apr 89
NOTE 24p.; For related reports and a user guide, see IR 014 231-234 and IR 014 253-255.
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Accounting; *Business Education; *Computer Assisted Instruction; *Computer Simulation; *Databases; Foreign Countries; Higher Education; Instructional Design; Instructional Development; Microcomputers; Models; *Spreadsheets
IDENTIFIERS England

ABSTRACT

This paper addresses the numerous ways that computers may be used to enhance the teaching of accounting and business topics. It focuses on the pedagogical use of spreadsheet software to improve the conceptual coverage of accounting principles and practice, increase student understanding by involvement in the solution process, and reduce the amount of time needed to cover tutorial exercises. It highlights the differences between software designed to solve problems and software designed to teach, and discusses some of the design issues, the exercises that can be set, and the inter-relations between the two. As well as using spreadsheets for demonstrating concepts, illustrations are given to show how they may be used for simulations and instructional games. Finally, the use of corporate databases in courses on information systems, finance, and management accounting is also described. The emphasis is on teaching and learning with computers as opposed to teaching and learning about computers, in order to integrate computing into the accounting curriculum. (8 references) (Author)

Teaching Accounting with Computers

Paper to be presented at

12th Annual Congress of the European Accounting Association

5-7th April 1989, in Stuttgart

by

Dr. Jean Shaoul

Department of Accounting and Finance

Manchester University

England

Tel no: 061 275 4027

ABSTRACT

This paper addresses the numerous ways that computers may be used, in particular spreadsheets and data bases, to enhance the teaching of accounting and business topics. It focuses on the pedagogical use of spreadsheet software to improve the conceptual coverage of accounting principles and practice, increase student understanding by involvement in the solution process and reduce the amount of time needed to cover tutorial exercises. It highlights the differences between software designed to solve problems and software designed to teach and discusses some of the design issues, the exercises that can be set and the inter-relations between the two. As well as using spreadsheets for demonstrating concepts, illustrations are also given showing how they may be used for simulations and instructional games. Lastly, the use of corporate databases in courses on information systems, finance and management accounting is also described. The emphasis is on teaching and learning with computers, as opposed to teaching and learning about computers, in order to integrate computing into the accounting curriculum.

INTRODUCTION

There has been an enormous amount of interest, as measured by the papers presented at conferences and articles in the academic journals, in the use of computers to teach basic accounting concepts and techniques. However it is extremely difficult for anyone embarking on the laborious process of integrating computing into the curriculum to distinguish between the hype and the educationally valuable.

The educational value, in terms of the stated objectives, of many of the computing exercises that have been published, seems negligible, stressing as they do, keystroking and the calculating power of the computer. The quality of the material produced is variable. At best, it is innovating and exciting while at the other extreme, some of the courseware that has been developed only serves to reinforce the very legitimate doubts that are held about the value of computer based education, namely that it is often trivial, time consuming for all concerned and boring, etc. Self, in his critical appraisal of educational software in general (1985), argues that educational computing has been characterised by the misdirection of enthusiasm and the institutionalisation of mediocrity.

In accounting, this is further complicated by the fact that, as Seddon (1987) has explained, there are several, often conflicting, goals - namely the need to teach students about information technology and how to use it (computer literacy), accounting information systems (teaching about computing) as well as to demonstrate accounting principles and concepts with computers (teaching with computers).

As far as the last objective is concerned, there are also opportunity costs involved and an hour spent on a computer can only be justified if it results in greater benefits to the student than an hour spent learning about the concept using another tool or teaching technique. The aim therefore is to set exercises that are big enough to warrant a computer and short enough to do quickly.

While there are these three separate goals in relation to computing and accounting education, they cannot always, nor indeed need they, be kept in separate, watertight compartments. A course that teaches about computers and information systems will necessarily teach students how to use computers, the operating system and some application software. There is no reason why accounting, management and business exercises should not be used to illustrate the use of information systems.

Similarly, if students are using computers as a computational tool to learn accounting concepts, computer practice issues relevant to each exercise can be included to raise the awareness of working in a computerised, as opposed to a manual, environment. This approach is used by Collins et al (1985).

One of the major criticisms of teaching staff who are reluctant to introduce computers into their teaching is that while they can recognise the value of computers for accounting professionals in say, calculating the discounted cash flow of an 'nvestment, they cannot see the educational value, over and above well chosen paper and pencil exercises, for students who have to learn to calculate it manually first. Since most people have only seen programs or templates that solve a problem or have themselves designed such a template, they are assuming that either the students will themselves design a simple spreadsheet to solve the problem, which may be relatively time consuming in terms of mastering the computing involved, or that they will make use of a template that will do the calculations for them.

While both of these methods have their advantages under certain circumstances, the criticisms raised do have validity. The point is that to have educational value, the form and the content of the software presentations have to be very different to those used for normal problem solving. Similarly, the type of exercises themselves may also be very different and may result in changes in the way that the subject is taught. Technology structures the way that we perform tasks and a change in the technology will have an impact not just on the courseware, but also on teaching methods, course assessment, the organisation of teaching, staff-student relations etc. (Shaoul 1988).

The work that is outlined in this paper was made possible by a grant from the Computers in Teaching Initiative Programme (CTI) which was funded by the Computer Board for the Universities and Research Councils (CBURC) in order to encourage the use of computers within University courses in all subject areas. The grant was for the financial resources to provide the hardware and software for a Pc networked laboratory for undergraduate student use within the Department of Accounting and Finance which would enable computers to be integrated into the accounting curriculum. The purpose of the grant was to develop the course materials necessary to integrate computing into the the core accounting courses and to make them available to other Universities. The project is reported more fully elsewhere (Shaoul 1988 op.cit.)

This paper attempts to outline the different ways that computers can and are being used effectively as a learning aid. All the methods outlined rely on prepared courseware which can be developed relatively quickly by the teacher and do not require extensive computer knowledge on the part of the student. Very elementary knowledge of the operating system and the ability to enter data and move around a spreadsheet is assumed. Furthermore most of the methods reviewed do not require the student to spend very much time at the computer.

It draws upon educational and human factors research, work that has been produced by other accounting teachers as well as work that has been developed within the Department of Accounting and Finance at the University of Manchester. It deals exclusively with software that has been developed for Pcs with spreadsheets, dBase III and a language compiler.

This paper does not deal with tutorial packages that are designed to teach a particular topic, which are known variously as computer aided learning, computer assisted instruction etc. In the author's opinion, most of the material reviewed has been of the page throwing variety and as such is both boring to use and necessarily ineffective, at least in terms of the opportunity costs.

Nor does it deal with the use of drill and practice sets which are widely used in the US. An extremely attractive tutorial was developed within the Department using an authoring system to teach trial balance adjustments. However it was felt that such material, in the context of UK accounting education, did not have a major role to play. It could be potentially useful by being made available on an optional basis to those students who wanted additional practice. Relative to the development time by the teacher, there are other more effective ways, including computer based courseware, of teaching the same material.

It is however true to say that increasingly, newer software is coming onto the market that does attempt to teach basic book keeping skills, balance sheet analysis, etc. which is likely to prove to be very useful for University courses in accounting. Such software is however very laborious to develop. The focus of this paper is on software that can be developed and used by accounting teachers with relatively few resources. However it is not enough for teachers to have some knowledge of software tools. A knowledge of software design principles is also essential. One of the reasons for the plethora of mediocre courseware is that it was assumed that a mere knowledge of programming was sufficient. Furthermore, our approach has been to use computers to develop students' analytical, critical and problem solving skills rather than to teach the lower level, technical skills.

This paper deals firstly with the development of courseware both for teachers to use to demonstrate accounting concepts and for students to acquire an understanding of such concepts. The former area is one that has been virtually ignored and yet it is as important as student use of computers. Appropriately used instead of the overhead projector, software may reduce substantially the class time needed to cover certain topics and increase the students' comprehension of the subject. The principles involved in the development of courseware for demonstration purposes are also relevant for the development of courseware for student use.

Furthermore the same software that has been developed for teachers to demonstrate concepts can also be used by students to assimilate the knowledge. In addition, the development of courseware for student use includes the construction of models for student use, interactive games, simulations and databases. The design and use of such courseware is illustrated with examples developed within the Department of Accounting and Finance.

COURSEWARE TO DEMONSTRATE CONCEPTS

The purpose of this section is to describe the development and design of courseware which can be used by the teacher to demonstrate concepts and by the student to acquire the conceptual knowledge. It is important to stress that the development of good courseware does not simply involve the preparation of computer based materials but also includes reworking the way the exercises are set. Since the time taken to perform the calculations is very short, the numerical part (as opposed to the discussive part) of the exercises can emphasise the relationships between variables by requiring recalculations with different values, as well as the technique itself.

However, a full discussion on the issues involved in the design of supporting materials to accompany computer based courseware is beyond the scope of this paper. An analysis of the differences in the kinds of exercises which can or have been set for computer based and non computer based courseware in terms of the type and extent of the coverage of the topic would be useful in assessing the effectiveness of the use of computers in teaching accounting and the way it affects the teaching process, but likewise is beyond the scope of this paper.

This type of courseware is probably of most use in the introductory and intermediate accounting courses which are primarily concerned to impart a wide range of techniques. Teaching at this level usually involves isolating a particular topic, explaining it to the students, giving them exercises to do and feedback as to their performance.

General instructional objectives (Gronlund 1985) will include **knowledge** of the common terms, methods and procedures, basic concepts and principles. Students will be expected to **understand** these facts and principles, interpret the verbal material, charts and graphs, translate the verbal material into mathematical formulas, estimate the future consequences which are implied by the data and justify the methods and procedures. In addition, students are expected to **apply** the concepts and principles to new situations, solve mathematical problems, construct charts and graphs as appropriate and demonstrate the correct usage of the method or procedure. They also need to be able to **analyse** the material, that is to recognise the unstated assumptions and logical fallacies in reasoning, distinguish between facts and inferences, and evaluate the relevance of the data. At a higher level, they need to be able to integrate learning from different areas into a plan for solving a problem (**synthesis**) and **evaluate** the methods and procedures for a given purpose.

The type of courseware that is described in this section is likely to be of most use for the lower levels of cognitive skills, i.e. knowledge, comprehension, application and analysis rather than the higher level skills of synthesis and evaluation. But to a large extent this will depend on the nature of the exercises set, rather than on the computer courseware per se. The point is that novices learn a new task as a series of rules and have to practice the task consciously in as many of its different forms as possible until they have gained enough experience to be able to match the real life situation to the technique automatically. Well designed computer courseware should enable the students to practice the task repeatedly and relatively quickly.

<u>The characteristics of courseware to demonstrate concepts</u>

Most spreadsheet templates which are generated by the user from commercial software to solve problems are of little use for pedagogical purposes since they aim to present the finished solution. All the intermediate steps required are not clearly evident in the solution process, thereby encouraging the student, as many teachers have noted, to passively accept the finished solution.

A spreadsheet presentation requires the teacher to plan carefully the sequence and logic of the solution process, i.e. when and how to develop formulas and calculations. In addition consideration must be given to the theoretical stumbling blocks, calculations, formulas and sensitivity analysis. It has to reflect the thinking process of the user and the individual style of the teacher. It should promote active student involvement in the solution process by requiring the student to check the reasonableness of the answer and encourage students to ask related questions. Thus courseware is quite different conceptually from a template designed to solve a problem.

If prepared in this way, the spreadsheet combines the sequential solution power of the overhead projector with the ability to present several different solutions depending on the choice of inputs. To achieve this kind of flexibility without using a computer often requires at least two overhead projectors.

Such a presentation requires the use of a portable computer and projection facilities which are expensive. (The cheapest is the Sharp at approximately #800.) Furthermore the equipment does take a few minutes to set up and dismantle which can be a problem when classes are taught in different locations. It is probably easier to have on a dedicated set of equipment permanently set up on a trolley.

While such courseware is considerably easier to develop than say a tutorial package using an authoring system, it does take some time. While it may be possible for teachers to share courseware, differences in individual teaching styles usually preclude this. There may also be difficulties in the same teacher using the same spreadsheet solution for similar courses. The inflexibility inherent in the prepared solution generally requires the same presentation of the topic, which may limit its usefulness for certain topics.

The development of the design process is illustrated with the use of compound interest problems as examples, as outlined by Collins (1988), although the principles are valid across many topics.

1. Select a topic.
Alessi and Trollip (1985) suggest that not all topics are in fact suitable for such treatment. They list and discuss the characteristics of relevant topics which are likely to include all or some of the following: subject matter that is difficult to teach in other ways, has conceptual importance, requires a significant number of calculations, involves a solution algorithm, repeated "what if" analysis to bring out the relationships between the parameters and graphical or some form of visual presentation.

The time value of money is a major topic taught in accounting courses. It fulfils the above requirements by requiring a large number of routine calculations and the repeated use of a few formula. The solution process is easily identified and an understanding of the process is gained by applying the concepts to a number of problems and changing the variables.

2. List the important concepts associated with the topic.
Some of these would include : identification of the variables, the

relationship between the compounding assumption, the payment and the number of periods, the inverse relationship between future value and present value, the difference between a single payment and a number of payments and an annuity, the difference between the number of periods and the number of payments and the difference between an ordinary annuity and an annuity due.

3. Develop a list of learning objectives (Gronlund 1985).
This is absolutely crucial because it both guides courseware development and provides the means by which the courseware can be evaluated and improved. In relation to compound interest, a student could be expected to :

a) identify the variables in the formulas;
b) correctly identify the appropriate formula needed to solve the various types of compound interest problems in financial and/or management accounting;
c) understand and predict the effect of altering one or more of the variables;
d) assess the reasonableness of the answers obtained;
e) make necessary adjustments to the variables to accommodate different compounding assumptions;
f) explain the relationship between future value and present value.

4. Outline the solution process.
This aspect can be difficult since the instructor is so familiar with the topic that many of the steps are taken for granted. Furthermore certain steps have to be stressed to students encountering the problem for the first few times. This is where the teacher's experience is so crucial, in knowing where the student is likely to have problems. The steps involved in solving a problem might include :

a) Does it involve future or present value;
b) does it require one or more than one payment;
c) identify the given variables and the unknown variables;
d) specify the compounding assumption;
e) calculate the answer;
f) assess the reasonableness of the answer;
g) change the variables for sensitivity analysis (if appropriate).

5. Select representative problems and exercises.
Obviously it is important to include at least one basic exercise and one complex example. This is very straightforward in the example given since all the textbooks give plenty of exercises.

There are of course a whole number of aspects to the question of the time value of money, other than the computational aspects. Conceptual questions would normally be included with each exercise because they, not the computation, should be the primary focus of an exercise. Indeed, students should be encouraged to read the conceptual questions before beginning the computational exercises so that they can consider them during the exercises. Sometimes the answers will be found in the text book or will have been discussed in the lecture, but sometimes the questions will raise issues that have not been explicitly discussed.

Since computers are being used as an aid to learning and because they will be using computers so frequently in their working lives, students should be encouraged to become as conscious as possible about the computing issues, eg the design of the spreadsheet, instructions, output layout etc. Questions can be included for the students to think about during the working of the exercise and to answer after completing the exercise. For example, they can be asked about the measures that can be taken to check the accuracy of the templates and whether in the process of so doing, they found them easy or difficult to verify, and why.

Courseware design

There are a number of design issues that need to be considered: data input, the calculation and formulas, the results and "what if" analysis.

Data input

The instuctor must decide whether to use an input screen to handle all the data or to collect the inputs from the user in the context of the solution screens. While the separation of data input from processing is more efficient and enables the user to alter the inputs more easily, this may not be the most appropriate design from the perspective of the learning process. The nature of the application will determine the best approach. In the case of the compound interest example, since the variables are relatively few in number, it is possible to input the data on the same screen as the solution process.

Calculations and formulas

The next decision is whether to include the formula and the calculations in the courseware. While it is desirable that the students be as active as possible in the solution process, in an example such as this where the calculations are very repetitive, or where the students would select and use the appropriate look up table to obtain the answer, or where the formulas have already been explained, or where they are very difficult and lengthy to incorporate correctly into the cell, then it may be more appropriate to include the formula and the calculations.

Solution process

The step by step solution process used when solving the problem manually must be preserved and transparent to the user. Such techniques commonly include :

a) asking and answering a series of questions;
b) using a series of menus to walk through the decision process and direct the user to the various parts of the solution;
c) using a series of successive screens (groups of 20 rows of cells) to present the solution.

But whatever the method, the students should gain an understanding of and reasons for the solution order. One method of presenting compound interest is to develop a series of templates to solve the various types of problems with menus for the student to select the appropriate template for the problem. The selection of the appropriate menu, by emphasising and mirroring the solution decisions, is an important part of the learning process and provides an an excellent opportunity to discuss the differences between the different methods, etc.

The use of the menus will be illustrated using the following problem. Assume that you have just won the pools and must decide whether to accept a lump sum payment of #400,000 or payments of #20,000 per annum for each of the next 20 years. All the cash received can be invested at 8%.

The first menu choice requires the user to decide whether to calculate the future value or the present value of the payment(s). This provides an opportunity to discuss the difference and the relationship between present and future value. Although PV is likely to be the first choice, they can later rework it as a future value problem.

The second menu requires the user to make a further selection based on whether the problem involves a single amount or a series of payments. Having decided to discount the payments, the user then has to decide between one of the annuity (third level) templates.

The third menu requires the user to select whether it is an ordinary annuity or one that is due. Since the problem may not specify when the first payment will be received the students must make the decision, thereby providing them with the opportunity to work the problem both ways and compare the assumptions.

The fourth menu choice requires the selection of the present value amount or the payment amount. Since the payment is known, the amount must be calculated.

It is here that the difference between an efficient program or template to solve a problem and courseware becomes apparent. Templates are designed to achieve the correct answer with the minimum number of user inputs. The data inputs would be checked for completeness and internal consistency etc. to prevent the occurrence of any errors. But courseware should give the student the chance to make the common mistakes associated with compound interest problems and to correct those mistakes after discovering that the solution is unreasonable. eg the mistakes associated with quarterly and semiannual compounding. Hence the courseware requires the student to enter rather more data than would be required by a spreadsheet to solve the problem in the quickest possible way.

To return to the pools problem , the students must make certain decisions about the variables to achieve the correct solution. Since the compounding assumption is not given in the problem, they have to make an assumption. If #50,000 was entered as the periodic payment, an assumption other than annual compounding will produce an incorrect solution. Next the students have to calculate the interest rate per period (the annual rate divided by the compounding assumption). But the last input is the number of payments which raises the distinction between the number of periods and the number of payments, which is often overlooked by students.

Providing solutions and/or explanations

Depending on the application, it may be appropriate to show a worked example, or give an explanation of the solution, its derivation etc. This can be done by including this on a separate screen for the student to compare the answers.

What if analysis

Having gone through the basic problem, the teacher can then do a "what if" analysis. If it has been worked as an ordinary annuity, it can quickly be reworked as an annuity due, which enables the student to see the impact of the time value of money. Next the interest rate can be changed to demonstrate the importance of the rate assumption about reinvestments in the decision process. Students could be asked to explain why the present value of payments at 6% is higher than payments at 8%. Next they can be asked to change the compounding assumption, which also requires them to change the payment amount, the periodic interest rate and the number of payments. Finally they can be asked to reconfigure the solution using future values, which requires them to compute the future values of the single payment and the series of 20 payments using the future value templates, thereby exploring the relationship between present value and future value.

Graphical presentation of the alternative results.

Depending upon the particular application, it may be appropriate to present the alternative results in the form of a graph. This could be incorporated into the main menu. The use of graphs brings out more clearly the difference between different methods of calculating a problem, assumptions and starting values etc.

Evaluating the courseware

After selecting the exercises and problems and constructing the courseware, it is essential to determine whether the material achieved the coverage of the concepts and objectives specified earlier in the development process. All have been covered by the variety of exercises and courseware, except for identifying the formulas for NPV and FV. In the example the formulas were given for the reasons which were stated earlier. The students still have to identify the correct formula by selecting the appropriate menu.

If the construction of the formula is deemed to be important, the formulas could be entered in the remote cells, off screen, and the students could be requested to develop it in the solution process. (The advantage of having the correct formula off the screen is that it permits the correct answer to be calculated and the student's answer to be evaluated, commented upon from within the template.)

Additional questions measure the effectiveness and suitability of the courseware :

1) Does it provide for the solution of several different typical problems and exercises?

2) Does it allow for the changes in the assumptions and facts?

3) Can the students see the entire solution process?

4) Are the students actively involved in the solution process?

5) Does the application lead to conceptual questions?

6) Does it cover the topic more efficiently than traditional methods?

7) Does the application lead to questions about computer practice issues?

A review of the courseware indicates that the concepts and objectives have been covered. It takes less time to present the concepts in class than using the OHP. Most of the time can be spent asking and answering conceptual questions rather than performing routine calculations. Most important of all the students have been involved in the step by step, visible solution process.

From the perspective of students using courseware such as this to acquire the knowledge of the topic area, there are a number of issues raised by this approach. From observations of students' performance in class, where typically exercises are set that require them to do some calculations and then to discuss the issues raised, it appears that they usually attempt the calculations, but if they have had difficulty with the calculations or get them wrong, they are unable (or unwilling to spend the time) to sort it out for themselves before they get to class. Frequently, then, the class time will be used discussing the routine calculations rather than the conceptual issues.

Courseware such as this permits the student to rework the exercises as often as they like and to see for themselves whether they have got it right and to go on until they do get it right. Thus they can come to class knowing how to do it and perhaps even more importantly, having done a sufficient number of exercises to have acquired some understanding of the issues so that they can discuss them in class.

The point is that interactive courseware of this sort provides the student with some feedback as to his/her performance, whereas conventional homework does not. This encourages them to persevere until they have completed the work satisfactorily. It is less easy to give up before having mastered the topic. The nature of many of the exercises that are set (no formal rewards, individual assignments, no obvious "closure" point, etc.) is such that it requires an unusual amount of perseverance to complete it to the satisfaction of the teacher, even though the absolute amount of time may actually be quite short and the exercises themselves are quite interesting, once the students 'get into' them.

SIMULATION

The essence of this approach is to give students computer models which simulate economic processes/consequences so that students can select different input values and compare the outcomes. For example, a process simulation has been developed that calculates the revenue generated from income tax, given different tax rates, tax bands, inflation and unemployment rates. Learning from such a simulation occurs by repeating the process a number of times with different starting values and comparing the results.

In contra-distinction to the previous type of courseware, the solution process is not visible to the students. This is quite deliberate. The calculations are very straightforward and very laborious. There is absolutely nothing to be gained educationally from actually performing the calculations. This particular application is completely menu driven. The students are required to input the data and the program checks that the data are internally consistent so that calculations can be performed correctly. In other words, this approach endeavours to ensure that the users cannot make mistakes. If anything, this particular piece of software has been overprogrammed in order to make it fool-proof. The use of the menu forces the student to consciously work through the exercise. No knowledge of Lotus is assumed. In terms of presentation, this type of courseware more closely resembles the more conventional, problem solving software than the type described earlier - albeit it a simplified form.

But once again, its value, in terms of the learning objectives, is determined by the kinds of exercises that are set by the teacher rather than simply the software. It can be used to explore the relationships between variables as well as to set revenue goals and explore the different ways this can be achieved.

Simulations typically have a number of major advantages over conventional exercises. Motivation is usually increased since students can see for themselves the consequences of inputting the different values. i.e. they are learning by doing it for themselves rather than passively reading about it. Transfer of learning is more likely to take place since simulation gives the students the opportunity to try out different combinations of conditions and thus be better prepared. The ability to rapidly perform lengthy calculations means that it is possible for students to get a much greater 'feel' for the inter-relationships than is possible using manual methods.

Most computer simulations can be used in a number of ways, but their use is only incidental to the simulation. Without the computer software there can still be a simulation. With the computer software, the simulation, as the real world, can be faster and more creative.

Another model that has been developed simulates the economic costs to central and local government of a plant closure, given the number of workers to be made redundant, their age, sex, length of service, wage rates etc. This Lotus model employs a different design strategy. It has no menus or error checking procedures, making it much more flexible and easier both to develop and to use. But it does require some elementary knowledge of how to use Lotus on the part of the student.

Such a model can be used in a number of ways, depending on the interests of the teacher. One way might be to compare the costs to the community with the benefits to the firm. This would involve giving the students additional data about the the firm's cost structure in relation both to the plant that is closing and the one to which production is being transferred.

It was used as an exercise to discuss the advantages and disadvantages as a planning aid for central and local government. Software that is available such as spreadsheets, database management systems, operational research techniques etc., are usually seen as decision support tools for managers. It is important that if they are to be used in this way that students appreciate the problems raised by the appropriateness of the data, its completeness, accuracy, assumptions implicit in the formulas etc. If they to be taught to become decision makers it is important that they are given case material that is wide ranging, not simply numbers to manipulate. Too many exercises in decision making stress detached rationality rather than involvement and intuitive and inferential reasoning (Dreyfus and Dreyfus 1986).

Simulation models permit different forms of exercises to be set because of their 'what if' capabilities. Such exercises could take the form of negotiations between different interest groups. Furthermore, the scope of such models and the accompanying supporting materials, often makes it more practical and interesting to assign several students to work together in a group. Thus in addition to changes in performance in the cognitive domain whose objectives emphasise intellectual outcomes such as knowledge, understanding and thinking skills, such exercises also have an impact on the affective domain that emphasises attitudes, responsiveness, appreciation and methods of adjustment.

Such assignments require students to listen to others, be sensitive to the needs of others and accepting of differences. Other objectives include the demonstration of a problem solving attitude, recognition of the role of systematic planning, an understanding of one's own strengths and limitations, co-operation in the group's activities and an objective approach in problem solving. As has been stated earlier, even without computer simulation, there can still be simulation in the classroom, but with computer software the social interaction becomes more necessary and explicit.

INSTRUCTIONAL GAMES

These are powerful learning tools that are becoming more prevalent. Like simulation, their purpose is to provide an environment that facilitates learning or the acquisition of skills. They often simulate reality and usually provide an entertaining way of practising different accounting and management techniques, eg production planning or inventory control.

From a design point of view, these may not necessarily be very different from a simulation (cf. the negotiation process above), although this will of course depend upon the objectives of the instructional game. Elgood (1988) gives a full discussion of the design and educational issues involved. Like simulation techniques, the objectives of such games emphasises the cognitive and affective domain.

One such game has been developed whose objective it is to aid students to understand the economic significance of current affairs and news items and to assess their impact on financial markets. The object of the game is to maximise the return from the portfolio of assets (inherited from a rich uncle and currently valued at #10,000), by analysing a financial journal. Each news item may have some economic consequence affecting asset prices. The fund is to be actively traded to obtain the most benefit from favourable adjustments and equally to avoid costs incurred in unfavourable situations.

The software was designed using the programming language BASIC for portability so that the teacher may add in news items as they become topical etc. However it would have been much quicker and more appropriate to have developed it using dBase.

Games such as this can be used in a number of ways. It was designed so that students would work in groups, competitively against other groups. As such it could be used as an 'ice-breaker' in a tutorial at the beginning of a course.

A hospital management game has been developed to test the user's power of analysis against a menu driven Lotus model that incorporates both the financial and non-financial consequences of decision making. It produces a re-iterative model so that the user can learn and develop his/her skills based on evaluated feedback on the previous decisions.

The game centres around a possible dispute over night catering facilities for accident and emergency staff at a local hospital. Financial data on the various courses of action are provided. The user is asked to consider the possible courses of action together with the various manpower problems that they may cause and to chose his/her preferred option. The option is also given to select from a menu, how to deal with the immediate problems of the various factions of staff (porters, surgeons and nurses). Data on staffing levels and bed occupancy rates for previous years are provided together with wage levels and future staff budgets. The user has to devise a staffing strategy for the next few years based on this data and also other information provided as to how the accident and emergency workload is expected to increase over the next few years. The software produces the accounts for the year end, based on the decisions made.

As in all the courseware described so far, the user needs only very rudimentary knowledge of computers and spreadsheets. This model was developed in the Department of Accounting and Finance for a post-graduate, post-experience course for hospital administrators and is based on a real crisis at a local hospital a few years ago. The case itself had been successfully used as a training exercise for some time, but lent itself to computerisation for ease of use. A number of approaches have already been made to the author to computerise case studies which are too unwieldly/lengthy to be used in undergraduate classes. It seems likely, given the time taken to develop the software that it is better in the first instance to computerise case studies that are known to be educationally effective.

DATABASES

Another major area of importance for integrating computers into the accounting curriculum is the use of databases to bring information concepts and technology into the functional areas of accounting and finance. There are several ways that this is being done.

One such database is a management accounting database consisting of a set of twelve monthly management accounts (i.e. budgeted and actual profit and loss accounts) for one year to enable the management accounting course to be orientated around a real business and the decisions it has to take. It has been possible to obtain the records (sales and production schedules, costings etc.) of a carpet manufacturing company, long since taken over, which has several product lines, cost centres and two operating plants at different locations. The data so obtained enabled the budgeted and actual profit and loss accounts to be calculated. The idea is that students would themselves select and "pull down" the data they need to solve the tutorial exercises from the computer's database. It would have the benefit of realism, convey the inter-relationship of topics and emphasise interpretation and evaluation.

The students would not necessarily use the computer to solve the problem. The issue, as many accounting teachers see it, is that from an educational point of view, the students have to learn to calculate a particular technique manually, without the aid of a computer in the first instance. In any event, in real life, the problem is often one of selecting the appropriate data in the first place. Until now, teachers have had to give students the data. Such an approach means that not only are students learning about different aspects of management accounting, they are also learning how to use information systems and information technology in the context of an accounting course.

Some tutorial exercise are being designed that make use of the database to pull down the relevant data and export it to the relevant spreadsheet template for basic costing and cost classification, marginal costing and cost-volume-profit analysis, budgeting and control, standard costing and variance analysis, fixed overhead costing, pricing, etc. Each tutorial will have a clearly defined format geared to the teaching of the various topics, and once the tutorial is completed, the student will be directed to the Lotus model for analysis, graphing, etc. This is a major resource commitment and it is expected that it will be of interest and use to others.

A similar management information system has also been developed which allows the user to input all the costings, sales and production schedules, etc. and then generates the budgeted and actual profit and loss accounts on a monthly basis. Such a system is of general use for teachers to show the integrated nature of corporate data and would permit them to use data that they had obtained to develop more realistic case studies for students.

The use of financial databases, such as Datastream, is another area that is being developed in many Finance courses. Models can then be developed to analyse subsets of the data. Students should then more readily be able to grasp concepts in finance by using real data in realistic financial models. Again, the emphasis is on exploring the relationships between variables by making use of existing programs or templates.

The database approach is one that lends itself to most courses in the accounting curriculum, for example, the use of financial statement information in evaluating a firm's performance. This would require a database of a number of firms over, say, a twenty year period and software to retrieve the relevant information and analyse the data. Analyses could include: financial ratios, regression and financial projections. Although there is online access to a financial database, the number of students involved on the course means that is administratively simpler to put a small subset of the data on the students' network which they could then pull down and analyse. Again, menu driven spreadsheets have been prepared for the students to carry out an analytical review, complete with graphical output.

USES OF AN INFORMATION SYSTEM AS COURSEWARE

The purpose of an information systems course is to give students experience in using and designing an accounting information system and to see how it relates to other parts of the accounting and management process. Commercial packages can be far too complex for students, in the time available, to fully comprehend. Designing a new system, *ab initio* is likewise too difficult and time consuming. It was therefore decided to set coursework which involved giving the students a listing of four separate programs which together make up the elements of a very rudimentary inventory recording system.

The first program allows the user to change various fields of a record in the inventory database by means of a menu (figure 1), thereby adding, deleting or editing records. The second program allows the user to ship or receive goods, thereby updating the quantity on hand. Other fields, such as the data of the last transaction, value of the inventory, sales to date, are updated automatically (figure 2). However, the version given to the students does not show on the screen, the record that has been selected for updating, nor does it show the record after it has been updated, as does the database maintenance program. The third program lists all those records in the database where either the reorder point or reorder level is greater than zero. The database itself contains one hundred records, many of which are empty records. The report program flags all those parts whose quantity on hand has fallen below the reorder level (figure 3), counts the number of valid records and the total number of records processed. The latter figure is incorrect. The final program, the audit trail is shown in figure 4 and lists the part number, a code for the transaction type (1 for parts shipped and 2 for parts received) and the size of the transaction.

The students were asked to make the system more user friendly by merging the programs, using a menu, including more helpful screen messages and improving the usefulness of the reports and also to improve the security of the system by introducing password control, data validation checks and more details in the audit trail that logged the changes made to the stock levels. The incorporation of an audit trail is a major, but simple, feature of this system and one that is very relevant to an accountant.

The task, in programming terms, is not very difficult, but fairly time consuming. Most of the changes are cosmetic; error messages, instructions etc. They are not required to alter the basic file structure of the database which is a random access file. The only additional file handling is that of the audit trail which is a sequentially accessed file.

Figure 1: Database Maintenance Program

```
RUN
Enter part number of record to be changed or -1 to quit ? 109


PART #       PART NAME                         Q ON H    C/P    C/VALUE
  S/P        S/VALUE              P/DATE        S/DATE           SUPPLIER
REORDER P    REORDER QTY          TOTAL SALES   LEADTIME
--------------------------------------------------------------------------
 109    MISCO DESK                                 0    0.00       0.00
  0.00               0.00         01-01-1980    11-14-1988       ROCK1
     0               0                    0         0
--------------------------------------------------------------------------
    Field to change :
       0 No change (Press RETURN key)
         (Part number may not be changed)
       2 Part name
         (Quantity on hand may not be changed)
       4 Purchase price
         (Purchase value may not be changed)
       6 Selling price
         (Selling value may not be changed)
         (Date of last purchase may not be changed)
         (Date of last sale may not be changed)
      10 Supplier's code
      11 Reorder point
      12 Reorder quantity
         (Sales to date may not be changed)
      14 Lead time

                                         Your choice? 4
New purchase price ? 125


PART #       PART NAME                         Q ON H    C/P    C/VALUE
  S/P        S/VALUE              P/DATE        S/DATE           SUPPLIER
REORDER P    REORDER QTY          TOTAL SALES   LEADTIME
--------------------------------------------------------------------------
 109    MISCO DESK                                 0  125.00       0.00
  0.00               0.00         01-01-1980    11-14-1988       ROCK1
     0               0                    0         0
--------------------------------------------------------------------------
    Field to change :
       0 No change (Press RETURN key)
         (Part number may not be changed)
       2 Part name
         (Quantity on hand may not be changed)
       4 Purchase price
         (Purchase value may not be changed)
       6 Selling price
         (Selling value may not be changed)
         (Date of last purchase may not be changed)
         (Date of last sale may not be changed)
      10 Supplier's code
      11 Reorder point
      12 Reorder quantity
         (Sales to date may not be changed)
      14 Lead time

                                         Your choice? 6
New seling price ? 150
```

```
OK
RUN
```

Figure 2: Record Transactions

```
Enter transaction part number (RETURN same part, -1 to quit)? 107

PART #     PART NAME                        Q ON H     C/P     C/VALUE
   S/P     S/VALUE              P/DATE      S/DATE            SUPPLIER
REORDER P  REORDER QTY          TOTAL SALES LEADTIME
-------------------------------------------------------------------
107  TANDON XT 20MGBYTE H/D                    3  500.00      1,500.00
 850.00        2,550.00      11-08-1988      06-26-1988          FAIR1
     5         10                   7          1
-------------------------------------------------------------------

Transaction type :

     1 - Parts shipped
     2 - Parts received
     3 - Discontinue this transaction

                Your choice? 1

                           Number of units? 10
Transaction reduces quantity on hand below zero
Press RETURN to continue?

PART #     PART NAME                        Q ON H     C/P     C/VALUE
   S/P     S/VALUE              P/DATE      S/DATE            SUPPLIER
REORDER P  REORDER QTY          TOTAL SALES LEADTIME
-------------------------------------------------------------------
107  TANDON XT 20MGBYTE H/D                    3  500.00      1,500.00
 850.00        2,550.00      11-08-1988      06-26-1988          FAIR1
     5         10                   7          1
-------------------------------------------------------------------

Transaction type :

     1 - Parts shipped
     2 - Parts received
     3 - Discontinue this transaction

                Your choice? 2

                           Number of units? -1999

PART #     PART NAME                        Q ON H     C/P     C/VALUE
   S/P     S/VALUE              P/DATE      S/DATE            SUPPLIER
REORDER P  REORDER QTY          TOTAL SALES LEADTIME
-------------------------------------------------------------------
107  TANDON XT 20MGBYTE H/D                -1,996  500.00   -998,000.00
 850.00      $-1,696,600.00  12-22-1988      06-26-1988          FAIR1
     5         10                   7          1
-------------------------------------------------------------------

Update is confirmed
```

Figure 3: Inventory Report

```
Ok
LOAD"b:report
Ok
RUN
---------------------------------------------------------------------
PART #    PART NAME                                     Q ON HAND
LAST ORDER DATE                            REORDER P    REORDER Q
---------------------------------------------------------------------
 101  Floppy Discs Ve 'batim DS/DD               4  10.00        40.00 *
   20          80.00   06-26-1988        09-26-1988    Ben12
   10          10               196      5
 102  Epson LX-80 Printer                        0 199.00         0.00 *
  250           0.00   11-14-1988        11-14-1988    AN107
   10          10               261      5
 103  Epson FX-80 Printer                       90 250.00    22,500.00 *
  350      31,500.00   01-01-1980        11-14-1988    1n105
  100         150               110      5
 104  HP Laser JET cartridges                  110   8.50       935.00
   11       1,155.00   11-14-1988        11-08-1988    1e108
  100       1,000               100      30
 105  IBM PC                                     6 500.00     3,000.00
1,000       5,999.40   11-14-1988        11-08-1988    IBM15
    5          10                 5      2
 106  IBM PC AT                                200 500.00   100,000.00
  950     190,000.00   11-08-1988        11-14-1988
   10          10               800      3
 107  TANDON XT 20MGBYTE H/D              -1,996 500.00  -998,000.00 *
  850  *-1,696,600.00   12-22-1988        06-26-1988    FAIR1
    5          10                 7      1
 108  TANDON AT 40 MGBYTE H/D                   30 650.00    19,500.00

  950      28,500.00   01-01-1980        11-14-1988    FAIR1
    5           5                75      1
                                                12 450.00     5,400.00
 110  amstrad
  650       7,800.00   11-14-1988        11-14-1988    ROCK1
   10           5                 3      5
                                                13 199.00     2,587.00
 111  BBC Micro
  299       3,887.00   11-14-1988        11-14-1988    FAIR1
    5           0                 3      1
                                             1,000 500.00   500,000.00
 112  Zenith H/D
  750     750,000.00   11-14-1988        00/00/0000    FAIR1
   10          25                 0      15


Number of stock items :           11
number of records processed :     201
```

Figure 4: Audit Trail Report

```
Ok
 LOAD"b:trail
Ok
RUN
Read audit trail program
----------------------

 101        1        10
 101        2        100
 102        1        10
 102        2        61
 102        1        121
 102        2        100
 103        1        50
 103        2        100
 109        2        100
 108        2        100
 101        1        175
 102        1        90
 103        1        10
 104        2        110
 105        2        1
 106        1        100
 110        2        5
 110        1        1
 111        2        6
 112        2        1000
 107        1        2
 102        1        10
 108        1        10
 109        1        100
 108        1        10
 108        1        10
 108        1        10
 108        1        10
 108        1        10
 108        1        10
 176        2        10
 110        2        10
 111        2        10
 110        1        2
 111        1        3
 101        1        1
 107        2        -1999
End of audit trail
Ok
```

In addition they were asked to provide documentation, i.e. to write a user manual and a detailed program specification, including flow charts, test data and sample output, and to produce a report reviewing the controls within the program.

A useful feature of this coursework is the way it can be added to from year to year. For example, these inventory recording programs which formed the basis of the students' projects have themselves resulted in 160, more sophisticated versions. A few of these can be used in the subsequent year's course in several different ways. Students can be asked to review a few of them, thereby learning for themselves what constitutes a user friendly, useful and secure management information system. They are given suitable test data and criteria for evaluating the software. The following year's project might require them to add several new modules to the system.

The second part of the course requires the students to make use of a inventory database of a small engineering company that has the same file structure as the one they have been working on, to predict, say, future sales, inventory requirements, cash flow etc. That is, to make use of information derived from a control system for planning purposes, using dBase in enquiry mode and Lotus. An alternative exercise requires them to analyse the inventory currently held and to present a report to the manager. The purpose is to illustrate the integrated nature of corporate data, the concepts of file interrogation and transfers and the use of internally generated data for planning and control. Thus the course covers most aspects of the use of information systems in accounting.

Although such a course is primarily concerned with teaching about computer and information systems, courseware of this type means that such a course can be much more closely integrated into the core accounting curriculum and its relevance becomes more apparent to the students. It is also the course where the students learn the basic computer skills required for using the computer based courseware on the other courses - the Trojan Horse.

CONCLUSIONS

This paper has attempted to describe the different ways that computers can be used effectively within the accounting curriculum. It has described the features of software to be used in a pedagogic environment which differ from those used in the business world, even though the software tools themselves may be identical. Emphasis has been placed on the fact that additional supporting materials and new exercises will need to be designed to go with the computer courseware, and that it is these factors that will be crucial in determining the educational effectiveness of using computers as a teaching/learning tool.

The examples that have been given have been used to illustrate the generic type, the characteristics of the software and the exercises, in order to draw out the design issues and educational implications of using computers. Our conceptions of how they can be used have changed as collectively the academic community at large, not just accounting teachers, have gained experience in their use. There is greater attention being paid to the use of simulation, databases, computer based case studies where the emphasis is on the interrelationships between variables, as opposed to the early enthusiasm for self teaching tutorial packages, drill and practice sets. Even in these areas, our conceptions of how these may be designed for increased effectiveness has developed and new tools are becoming available, such as Hypercard, (for the Macintosh), which will make self-teaching packages more useful and interesting.

Not only has our understanding of the objectives and design principles of computer based courseware changed, but also our knowledge of the most efficient software tools. For example the portfolio management game was developed and written using the BASIC programming language. It would have been very much quicker to have used a database language. Similarly, the tax revenue generator was coded in Lotus, but could have been done much more efficiently, from the developer's point of view, using dBase.

While several illustrations have been given about the ways that computers can be used as a learning aid, it should be borne in mind that computers are only one of a wide range of the newer technological tools that have educational value. It is not intended, nor would it be desirable, for the conclusion to be drawn that all aspects of the accounting curriculum should include the use of computers.

As with any educational resource, to make effective use of commercial software to develop courseware, teachers must be attentive to the pedagogical concepts involved in the learning process and create an active rather than passive student role in the solution process.

This paper has drawn attention to the ways that computers can be used in teaching the core accounting subjects. It is noticeable however that many of the most innovative uses of computers are actually in subjects such as marketing, management and economics, courses which are usually optional or subsidiary courses, although there is some degree of overlap. There are therefore a number of potential sources of educational computing expertise.

The point was made earlier in the paper that there are three distinct reasons for introducing computers into the accounting curriculum - for students to be able to make effective and efficient use of computers when the need arises, for students to be able to understand how accounting information systems work and how they may be used and finally for students to have access to another educational tool, in the same way that they have access to books and journals, as an educational resource. While the paper has focused on the latter aspect, an approach such as this is attempting to provide a cohesive framework for introducing and integrating computers into the accounting curriculum.

REFERENCES

Alessi, S.M. and Trollip, S.R. "Computer Based Instruction - Methods and Development".
Prentice-Hall, 1985.

Collins, Don E. "Using Electronic Spreadsheets to Develop Accounting Courseware". Paper presented at the International Business Schools Computer Users' Group, at Miami University, Oxford, Ohio, July 1988.

Collins, Don E., Waldman, Loren K., Nikolai, Loren A., Bazley, John D. "Intermediate Accounting", Kent Publishing Company, Boston, Mass., USA, 1985.

Dreyfus, Hubert L., and Dreyfus, Stuart E., "Mind Over Machine." Free Press, New York, 1986.

Elgood, Chris, "Handbook of Management Games." Gower Press, Enngland, 1988.

Gronlund, Norman E. "Stating Objectives for Classroom Instruction". Macmillan Publishing Company, New York, 1985.

Seddon, P. "Computing in the Undergraduate Curriculum - Three Distinct Goals". British Accounting Review, Vol 19., pp. 267-276, 1987.

Self, John, "Microcomputers in Education: a Critical Appraisal of Educational Software." Harvester Press, Brighton, England, 1985.

Shaoul, Jean E., "Integrating Computers into the Accounting Curriculum Using an IBM Pc Network", Interim report to the Computer Board, Department of Accounting and Finance, Manchester University, England, June 1988.