# 4: Experiences and best practice in the use of learning technology: A personal view

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## *Editor's Introduction*

Alan Sangster has been using LT in his teaching for many years and in this chapter he presents his views on the practical issues that arise from its use and how LT might best be used within the curriculum. This chapter is based on a presentation given by Alan Sangster at an LTDI workshop in December 1995, a workshop directed towards the disciplines of accounting and finance, therefore some of the examples are subject specific. However, the general message of this chapter reflects the experiences of many experienced users of LT and is not specific to accounting and finance.

## *Technology used in the learning environment*

The technology commonly used within the learning environment includes:

- Blackboard
- Whiteboard
- Ohp
- Video
- Laser disc
- Audio
- Computer
- Computer projection
- Video conferencing

While most of these are used solely by the tutor, video, laser disc, audio, and computers are also used by students on their own. Within the context of these student-used learning technologies, the learning environment can take six broad forms:

1. Proprietary CAL, CBL, CBI, CAI, etc.[1]
2. Home-made CAL, CBL, CBI, CAI, etc.
3. Objective test authoring packages
4. Student knowledge engineering
5. World Wide Web
6. Electronic mail

Of these, the first three have been in use for many years. The last three are much more recent developments.

## Proprietary CAL, CBL, CBI, CAI, etc.

Use of these types of packages is now widespread in many disciplines. Within the teaching of accounting and finance examples include the commercial packages PEER, EQL Bookkeeping, ISL, Understand Accounts, and

[1] CAL (computer aided / assisted learning), CBL (computer based learning), CBI (computer based instruction), CAI (computer aided / assisted instruction) are amongst the many acronyms used to describe various forms of computer mediated teaching tools. Definitions are not provided or strictly relevant here.

the TLTP software BITE, and Byzantium. None of these packages existed in the early 1980s, and the TLTP software only started to be released in its final form in 1995. Despite the relatively recent development of these types of materials, use of packages of this type is now widespread, with EQL Bookkeeping, for example, being used in the vast majority of UK university accounting departments.

When use of these types of packages has been unplanned, unstructured, or unintegrated, the impact on the learning environment has been very mixed. Possibly only the most conscientious students spending sufficient time and paying sufficient attention to the material to benefit. However, when their use is planned, structured, and integrated into the learning environment, the impact upon the learning experience can be pronounced, with *accelerated learning*, *increased coverage*, and *learning control transfer* (to the student from the tutor) all being not just possible, but guaranteed if desired and planed for by the tutor.

## Home-made CAL, CBL, CBI, CAI, etc.

While home-made material of this type has existed for as long as computers have been used in education, it has not been until the last few years that the quality has matched the needs of adopters. Thus, take-up of the earlier packages was not marked, most preferring to write their own applications using computer languages like Basic. More recently, there has been a distinct shift towards the use of spreadsheets, due to their macro facilities and the option to incorporate visual basic. However, these require the development of a fairly high level of expertise in the use of software. Skills that would not necessarily be used by the tutor in other work. As a result, many tutors prefer to use software created specifically for the purpose of developing CAL type material. The most used products include Toolbook, Authorware, and Guide.

Similar potential benefits arise as with the proprietary products. In fact, the benefits may be even more pronounced because, as these packages have been developed by the tutor, their use is generally more likely to be planned, structured, and integrated into the learning environment than the use of proprietary products.

Both proprietary and home-made packages of this type can significantly enhance the learning environment when effectively integrated into the curriculum. Integration is vital -- without it, there is little point in acquiring these packages, students will not use them. Buying one, or writing one, and then placing it in the library as a study resource may get 10% usage, but usage is more likely to be nearer to 1%. Even where the package is integrated into a course (for example, by setting aside previous lecture contact time for computer lab access of a CAL package) this control transfer aspect (which should improve and enhance the learning environment) has a considerable downside - as with a course textbook, students will tend to minimise their use of the package unless they perceive that there is a real need to use it. Student motivation is therefore important. One way to address this is through the use of objective testing software.

## Objective test authoring packages

These include proprietary packages like Question Mark and EQL Assessor, but there are many packages available, including some that are free.

Apart from the creation of formal objective tests (OTs) where none previously existed, computer based objective testing can be used;

- to replace paper-based OT exams, both formative and summative[2],
- to provide revision resources,
- to increase the coverage of a course,
- for increased direction by implication, and
- to keep control when CAL is used.

The norm is to assume the first two are the only potential uses, and this is where most of these tests are focused. However, the greatest boost to the learning environment may lie with the other three uses.

OTs can be used to increase students' coverage of material by testing all aspects of a syllabus, thereby encouraging students to consider all the material, rather than attempt to 'spot' topics. Through their topic focus,

[2] Summative assessment being assessment that counts towards the course result, formative assessment providing feedback to students on their progress / understanding of course material.

OTs can indicate to students which aspects of a syllabus are important. In conjunction with CAL material, they can be used to ensure that material is studied by students. The use of a CAL package without parallel OTs can be pointless. Even a summative exam question on material covered solely using CAL can be ineffective, particularly if students can elect not to answer it. Hence, students may have little incentive to use the CAL package.

Student-controlled use of a CAL package needs integrated testing if it is to be an efficient form of learning. A compulsory formative OT linked to each topic is a step in the right direction, though some students may still choose to do no more than superficially use the CAL package. If the OTs also have a minimum performance standard linked to permission to sit the summative exam, students will use the CAL package and the tutor can be reasonably confident that material taught only through that medium is not being omitted by students.

Similarly, and just as effectively, a series of formative OTs which are released for practice after each test is completed, followed by a summative OT covering the material included in the formative OTs will ensure students make full use of the OTs. (Practice versions of the OTs should include answers and explanations.) The difference in this approach is that the OTs themselves will be used by the students to learn the material. The students are likely to see the OTs as the main instrument of instruction, referring to their textbook, CAL package, or lecture notes only when they do not understand why the given answer is correct. If a CAL package is being used in conjunction with this form of OT integration, the OTs must be very carefully designed to ensure they effectively cover the material. Once the practice version of an OT is released, students will not tend to be inclined to refer again to the CAL package. Consequently, it is worthwhile requiring all students to achieve a minimum standard on a formative OT (after multiple retakes if necessary) before making a practice version OT available.

In fact, use of OTs in this way can also be applied to material taught in conventional ways, underlining the enormously undervalued potential benefits of OTs. Students can be encouraged to study, are immediately rewarded for doing so (through the feedback they gain on the OTs), and achieve better summative exam scores as a result. Tutors can identify both topics that are causing difficulties and students who are experiencing difficulties. Furthermore, because OTs concentrate upon knowledge and application, students form a more solid base of knowledge and understanding than is typically achieved in a more conventional learning environment. This enables greater depth of topic coverage and greater evidence of analysis and synthesis in student summative essays. This is even more evident through the use of another form of educational technology -- *student knowledge engineering*.

## Student knowledge engineering

*Student knowledge engineering* involves students in building their own computer-based representation of the subject material. As a concept, this is not based on anything new. Students have always written essays, sometimes long essays on specific topics. Where it differs is that this approach entails students constructing expert systems (computer packages that emulate the output of an expert) using packages called ‘shells’. The most commonly used (and very cheap) expert system shells are *Crystal* and *VP-Expert*. In order to write one of these expert systems, students need to understand the topic in depth. They can start with superficial knowledge but writing the expert system will highlight flaws in their understanding and lead them to improve the accuracy and depth of their knowledge and understanding.

Effectively used, this can lead to accelerated learning (students learn very quickly as they are constantly being corrected), deep understanding, and results in complete control transfer to the student in a far more controlled manner because the student not only has to complete the project, but knows when the knowledge is flawed. The software is very easy to use, taking no longer to learn than it takes to learn how to make basic use of a spreadsheet. [For detailed coverage of this topic, see all of *Accounting Education*, Volume 4(3), 1995.]

## World Wide Web

This is *the* future environment of educational technology. Distance learning will use little else, and students based locally to their institutions will use it from home, leading to most students learning, at least in part, in a quasi distance learning environment. Software currently in use for viewing material on world wide web includes Netscape and Mosaic, both of which are free. Virtually any software can be used to create material for world wide web and, although sophisticated page design requires some (but not a lot of) expertise, a basic web page can be constructed by a beginner virtually instantly using some of the free facilitating software available on the WWW. It is currently possible to present text, graphics (still and video), and sound, and it will not be long

before the viewer software will be able to present documents prepared for other environments (e.g. Powerpoint slide-shows) in screen windows at the click of a link.

The educational potential of world wide web is vast. It can, for example, be used;

- to deliver course material
- to provide revision resources
- to provide an environment for assessment (a web version of Question Mark is available, for example), and
- to develop IT-awareness

It can also be used for another form of student knowledge engineering -- *student knowledge identification and dissemination* -- with a focus on knowledge discovery, collation, and presentation, rather than knowledge clarification and understanding.

This is the environment where CAL material will be based, where OTs will be conducted, where videos will be viewed and listened to, and where information of relevance will be sought and acquired. The software is so flexible that it can be applied to a local area network just as easily as to the wide area network in which it is perceived to belong. Hence the likelihood that all computer-based instruction and learning will move to a standardised interface using world wide web software.

Students like this environment. They enjoy the challenge of discovering the unknown, of the discovery that people other than their tutor have made material available on the topic in which they are interested, and they enjoy the freedom it gives to control their own educational discovery process. They do not enjoy the slow speed at which it can operate. Therefore today's academic adopters and integrators of Web technology into their courses may need to make local copies of as much of the material they intend to use as possible. The Web is also, incidentally, ideally suited to obtaining a wide variety of project submissions from very simple assignment definitions.

## Electronic mail

Electronic mail (e-mail) is the most underrated and yet most freely available of all the electronic technologies. There are many different software packages available -- Eudora, Simeon, Elm, Pine, for example - and most e-mail operates seamlessly across all the various networks and interfaces currently in use. All that is required is an interface to the network, and electronic mail is available. Netscape has its own mail software integrated within it, as do Microsoft Windows for Work-Groups and Windows 95.

E-mail is not merely a device for conveying messages, it can also be used;

- to operate class-wide support,
- to administer assignments,
- to facilitate access to tutors, and
- to develop computer confidence.

Responses to frequently asked questions can be circulated to all students in a class instantly; students can be sent a reply to any query they may have on the material they are studying, irrespective of whether the tutor or the student is on-campus or not (and all their colleagues can received anonymised copies); errors, omissions, administrative information, assessment assignments, assessment results, reasons for absence, notification of illness - all can be relayed to whoever is appropriate instantly. Course administration becomes much simpler, students gain a sense of personal contact with tutors that is impossible face-to-face with the increasing pressure on staff time currently being experienced. Where part-time tutors are used on a course, taking tutorials for example, e-mail enables them to become far more integrated into the course as a whole, far more aware of the various issues being raised by students (and staff), and far better placed to respond to any issues that arise during their contact with the students.

If objective testing software is the route to effective integration of CAL in the curriculum, electronic mail is the route to significantly increased effective use of staff time. Large courses will run far more efficiently and smaller courses will become far more group-oriented as students and tutors get involved in e-mail discussion groups. Students generally like the immediacy of e-mail and the anonymity of the interface. They do not feel so

concerned about approaching a tutor for advice electronically as they do about doing so face-to-face. As a result, problems tend to be solved more effectively when an e-mail forum exists, and overall student performance enhanced as a result.

More than any of the other five resource types, e-mail should be being adopted among educators as an indispensable learning technology. There are no programmed risks in using it, no possibility that students may suffer from using it (as they might, for example, as a result of using a faulty piece of CAL, or as a result of an error in OT software). In short, it is a 'must-be-used' tool. Unfortunately, it is currently very under used, but this is changing with its use as a piece of educational technology very much on the increase, particularly in the US.

# *Requirements for successful IT-integration*

In order for IT-integration to be successful, a number of factors must be present:

## The integrator must have 'ownership' of the approach to integration

The integrator must believe that the method of integration adopted is appropriate. Otherwise, corners can be cut and compromises can arise in the integration, with any problems or difficulties being shrugged-off as someone else's fault; and the integration as a whole may be undertaken with insufficient care and attention.

## Patience

Integration always takes longer than anticipated before it is 'right'. In fact, it may never be possible to get it completely 'right', as software and hardware are constantly changing. The integrator must be aware of problems when they arise, and must be willing to redesign the process time and time again, until it works. In order to achieve this, the end result must be monitored extensively, student feedback gathered as often as practicable and feasible, yet not so often as to interfere with the student learning experience.

## Time

It will always take longer than expected. It does not take hundreds of hours to prepare one hour-equivalent of CAL material, but it will maybe take tens of hours to do so. For the preparation of Powerpoint presentation slides for lectures, allow something between a 3:1 and 6:1 ratio, time:lecture hours. For a twenty question OT, allow between two and six hours for preparation, but expect errors, which will add further time to the process of getting it right. (Many of these errors will only appear through use, and will often be pointed-out by students, some of whom will not be very happy at having found them.)

## Firmness with students and colleagues

Some students will always resist the use of technology in the way intended, some because it does not suit their learning style, others because they are unwilling to adjust even though the medium would suit their learning style. These students must be coaxed even, hard though it sounds, coerced into using the technology in the designated manner. They will all ultimately use it and all, even the strongest opponents, will benefit from doing so if what has been integrated has been thoughtfully done and is educationally appropriate. Any sign of weakness on the part of the integrator, indication that use is not, after all, required, will result in significant non-use, to the point where it undermines the educational impact and seriously disadvantages those students who avoid use.

The resistance-to-change of colleagues can also be a significant hurdle, and the integrator must develop a fairly strong detachment from the comments that may be encountered. Colleagues who feel strongly about this issue may not be averse to airing their views in public in front of or directly to students, and it is here that the integrator's resolve is most tested.

## Self-belief

Without strong self-belief, all the opposition from students and staff will take effect and the learning experience will be effectively diluted as a result.

### A willingness to assess effectiveness

How else will an integrator ever know if integration was successful unless time and effort is expended assessing it? It must be done, or all the resistance, and all the criticism will ultimately succeed in having changes made, as the integrator has no objective idea whether the approach has succeeded or not. Time must be used to assess effectiveness, to gather information that can inform the process of adjustment, and to ensure that the method of integration is appropriate.

### An ability to overcome frustrations

Many unforeseen problems are liable to arise, from double-booked computer labs, to different versions of software available in computer labs, to computer network crashes, to PC projection equipment failing at the most inopportune moments. Any of these could lead the less relaxed integrator to abandon the enterprise on the basis that it is infeasible. Anyone undertaking the integration of educational technology must be prepared for every eventuality, or the integration is liable to be ultimately abandoned.

### A thick skin

Overall, an integrator of educational technology must have or develop the ability to brush off unwarranted criticism and work around unwelcome barriers. It is a high profile activity and an easy target for its many, more traditionally focused, opponents.

## *Depressors of successful IT-integration*

### Software bugs and hardware problem

*Software bugs* and *hardware problems* are obvious depressants, as is a continuing, though diminishing, level of *computer illiteracy* among both students and colleagues.

### Crackers

This is a growing problem. These people who delight in causing havoc in computer systems are becoming more and more prevalent and can cause problems that the best planning in the world could not have foreseen. For example, OTs held in a date-stamped and password protected file at one university recently had their date stamp and password protection removed, resulting in an exam that was not due to be sat for a further four weeks being freely available to the students throughout that period.

### Red-tape

Many potential barriers can exist, depending on the rules that apply within an institution. It may be possible to implement integration virtually immediately, or it may take six months to gain approval through a series of committees, and then it may take a further three months before a place in the queue is available for the relevant software to be mounted on the network. It is important that such barriers be identified early and that steps are taken to minimise their potential impact as soon as is practicable.

### Lack of resources

Many of the best CAL packages, in accounting at least, are proprietary. As a result, they cost money, maybe as much as £5,000 for enough licences to make integration of the material a viable option. Yet, money is not readily available in UK higher education to purchase software on this scale of cost, and a number of institutions currently prefer to invest money in in-house developed material.

This short-sighted insistence on the reinvention of the wheel encourages inefficient use of staff time and resources and the development, in some cases, of material that is inferior to what was available in the market at a fraction of the in-house cost.

It is wiser, in these circumstances, to insist on purchasing the proprietary product. In fact, in the case of some products (for example, taxation CAL packages) complexity of the topic may mean it is the only feasible way in which the material could be acquired. Delay experienced while resources are obtained is a small price to pay for access to an appropriate standard of product.

## No recognition for the effort expended

All integrators of educational technology have long since realised that there is unlikely to be any recognition by peers or superiors of the extent of the effort expended. It must be seen as a labour of love and all thoughts of promotion, or increment advancement as a result of all the effort invested must not be looked upon with any element of expectation, or disappointment and frustration will be very likely to arise. There have been exceptions, but they are few and far between. For the majority, the best that can be hoped for is an improvement in student performance, student satisfaction, student feedback, and staff satisfaction -- not a bad group of rewards in most educationalists' eyes! But potential for irritation at the lack of recognition will likely still remain.

## *Best practice for successful IT-integration*

There are some simple rules that should be followed if the integration of educational technology is to be a success:

- Know your software.
- Plan well in advance.
- Test everything where it will be used.
- Be open with the students.
- Be open with colleagues.
- Avoid re-inventing the wheel.
- Do not panic.
- Use it for educational benefit, not because it is there.

## *Benefits of successful IT-integration*

Successful integration will lead to:

- Students learning more.
- Students learning better *how* to learn.
- Increased computer literacy among students (and staff).
- Increased computer confidence among students (and staff).
- Greater variety in the learning environment for both students and staff.
- Better pass rates.
- More interesting work.

## *It is worth the effort!*