TECHNOLOGY CHOICES

Once the basic educational aims,content and methods of the course have been decided upon, only then should consideration be given to the use of technology, both to enhance the educational process and product and also to achieve other aims. These other aims may be to reduce costs by reaching more students through the use of virtual classrooms or by freeing the course from time constraints. In other words, the educational needs should dictate the selection of the technology not the reverse:

> "What do we want to accomplish in our courses, and can technology advance our teaching goals?" [Creed (1996) *ibid*]

In this regard, it is clear that making decisions about technological enhancement of courses needs to be a collaborative process, involving both educators (including teachers and administrators) and technologists, with effective communication between the two.

A common problem here is that both sets of participants have their own set of technical terms, often viewed as "jargon" by the other. Education, for example is a multi-disciplinary social science that is riddled with esoteric terminology. Similarly technology has its own special language. So teachers and technologists will not necessarily be on the same wavelength. For example, it may be a rare academic who can cope with such technological acronyms as MOOS and MUDS!

With this in mind, it is best to discuss matching educational aims to specific technologies in pragmatic terms, couched in everyday language where possible. This approach has been adopted in the following discussion.

An important distinction to be considered is between the intrinsic and extrinsic features of any technology. Choosing a suitable technology will depend on consideration of both:

- the *intrinsic* nature of that technology and
- the *extrinsic* factors present in the context in which it will be used.

INTRINSIC FEATURES OF TECHNOLOGY

In order to determine suitable technology for use in any course, some basic questions must be asked that focus on the type of educational communication required:

Audience and Direction

Do the features of the technology allow communication with the size and type of audience that must be reached and in the way that educators need to interact with that audience?

The most usual variations of type of audience and interaction will be:

One <u>to</u> a group or groups
where a teacher needs to communicate information to a limited number of students but does not need a reply, and so the communication is one way

One <u>to</u> unlimited
where the teacher needs to communicate information to a very large number of students or all groups of students but does not need a reply

One <u>and</u> One
where a teacher or student needs to interact with one other person to exchange information

One <u>and</u> group(s)
where one person (student or teacher) needs to obtain or exchange information with a group or limited number of groups

One <u>and</u> unlimited
where one person (student or teacher) needs to obtain or exchange information with an unlimited number of people

Group <u>and</u> group
where a group of people needs to obtain or exchange information within the group or between groups of people

Time and Space Sharing

The question here is whether the technology allows for the sharing of space and time in the way that is required.

The usual combinations are:

Sharing real space in synchronous time

This is the conventional classroom situation, where teacher and students are both present in the same physical space at the same time.

Sharing virtual space in synchronous time

This is where teacher and students are separated in physical space but share a virtual space (e.g. through videoconferencing, audioconferencing or chat lines) in synchronous time.

Sharing virtual space in non-synchronous time

This is where the student learning has become space and time- independent, such as the use of bulletin boards for discussion. These can have some specific advantages over interacting in real space:

"class discussions over computer networks leave a record, unlike verbal discussions (every student knows what it's like trying to decipher his or her class noted after a particularly heated debate). If you want to refute a previous point or refer to an early lecture in an essay, they are immediately accessible."

[Nayman (1997) "Getting Connected with Connect Ed." Educom Review Vol 32 No 3]

Sharing real space in non-synchronous time

While this would seem to be rare there are documented cases, such as that of students who had access to a shared social space and, in spite of the ability to use electronic chat lines, would leave each other written messages on a physical bulletin board!

[Knowledge Connection (1996)"Innovations in Course Delivery for a Distributed University: The Evaluation of the Interactive Learning Connection-University Space Network Pilot Project"]

The means of communication & the need for recordkeeping

The educational aims and the preferred type of pedagogy will suggest the need for certain means of communication, and whether or not a record of the communication is required:

Visual Communication

Do participants need to have visual contact in one or both directions? Does there need to be a record of the interaction? Will the educational institution provide the record or will it be up to the student. This has cost implications for both parties. If the visual need is for illustration purposes rather than an aid to personal interaction, the need for real time transmission may be obviated.

Aural Communication

Do participants need to hear each other in one or both directions? If so, does there need to be a record, and who should be responsible for providing it? Depending on the nature of the educational need, once again real time transmission may not be necessary.

Written Communication

Can the interaction take place in writing? Is this in fact better for the educational purpose? Is it better via physical print or electronic format? There are advantages and disadvantages to both options. Physical print is costly to produce and costs are difficult to justify or recoup unless student numbers are very large, and it is also next to impossible keep up to date on a regular basis. Physical print certainly provides an automatic record, but it is now also possible to print from electronic delivery formats.

Record Keeping

Are records required to aid student learning, such as logs of chat lines to be used for review? Are records required by the insitution to keep track of student progress, such being able to determine how long a student spends on a given assignment?

There are many choices of technologies or combinations of technologies that will provide these various means of communicating to students. They range from video- audio- or computer-conferencing, through the use of television, video-tapes, radio and audio-tapes, to good old-fashioned books. All have implications in terms of cost and effective usability for both students and staff.

Linearity

The desirability for non-linear performance is an important consideration in choosing suitable technology. This feature relates very much to accommodating different student learning styles and tasks. While print can be considered a linear type of activity (i.e. you start at the beginning and go through to the end), it is still possible to browse or dip into a book to find specific piece(s) of information.

This search capability is made even easier if the print is in electronic form. However, there are sometimes limitations in the design of electronic formats for presenting information, and students can sometimes be forced to proceed through an electronic presentation without the ability to stop and review parts unless they go right back to the beginning.

Interaction/Routing

The degree of interactivity is another important issue. While some technologies seem to provide interactivity (i.e. students can receive a response to an input, this is sometimes merely routing rather than true interaction. For example, a student is asked to respond with a yes/no answer. If the answer is yes, they are routed through one section of the structure, if the answer is no, they are routed through a different structure.

True interactivity is capable of dealing with different types and large numbers of responses, and not simply preset procedures for dealing with a very limited set of responses. But it will not always be necessary for achieving a particular course aim.

Cost

The cost of using a specific technology is not so simple to determine as it may first appear. There are a whole variety of factors to take into consideration, and in addition there are two main complications:

- The question of hidden or'' sunk'' costs as opposed to overt costs; and

- The problems of cost distribution, not only between the students and the educational institution, or between departments, but also over the shelf life of the educational course.

For example, planning and support time seems to be a high cost associated with the use of technology, but this may because planning costs are for the first time becoming manifest rather than hidden within the teaching role.

In addition, though technology-rich courses may seem to have high planning costs, the ability of technology to update the course content at lower costs allows the shelf life of a course to be extended, reducing costs considerably over time.

The costs of conventional courses have often become embedded in long existing structures and processes that are no longer open to scrutiny, but this is not true for new technology-enhanced distanced courses, where new equipment, staffing and operational costs are all clearly obvious. Performing a cost-benefit analysis of conventional and distanced courses is therefore not an easy task.

Another problem with assessing cost will relate to the number of students taking a particular course. As technology frees educators and students from space and time, many more students may be able to access a particular course with the same number of teaching staff. This usually means much lower marginal costs. In that situation it is difficult to assess costs until the student enrolment numbers for a course are finally known, and this can make a critical difference to the financial viability of a course.

The whole question of educational costs is, in fact, such a vast subject in itself that within the confines of this report it is not possible to examine it in the depth it needs and deserves. Only some of the issues associated with costs have been raised here and investigations are continuing into cost issues, and assessing methodologies that will allow educational institutions to make more informed decisions on costing their technology enhanced and distanced courses.

Comparing technology-rich courses with more conventional ones, not just in the area of cost but also in efficacy, may be like comparing apples and oranges if the conventional course is no longer viable for nontechnical reasons, such as the lack of a market for space and time-dependent courses that have become dated. Unfortunately, such content-obsolete courses are not as rare as one might expect. While universities have a monopoly on accreditation, the pressure to remove them from the list of required courses is not always sufficient.

The choice of a particular technology or set of technologies is a time-consuming task that requires coordination and communication between teachers and technologists, as well as educational administrators. It is further complicated by the addition of extrinsic factors that also affect the successful implementation of educational courses.

EXTRINSIC FACTORS IN THE USE OF TECHNOLOGY

As technology frees the teaching/learning process from space and time, so the context in which it is used becomes ever more variable, and less and less under the control of the educational institution. This means that very careful consideration must be given to the likely context in which the chosen technology will operate.

This is further complicated by the fact that the context is a moving target, continually affected by new advances in technology, and other social and economic changes. Some considerations that have emerged in this research, which we believe important are outlined below.

Level of Availability

How available is the technological hardware, software, support and user know-how among the population from which the students are likely to be drawn? If any of these are not generally available this can cause problems for a course. For example, there can be a problem in accessing the Internet in the more rural areas, where even a national provider may not be available, unless expensive long distance charges are incurred.

Level of Compatibility

While technology has made great strides in the area of compatibility, there are still problems in this regard, such as the ability to read attachments to e-mails. Different versions of software can also pose problems. While possibilities for more sophisticated activities may be available from newer software, if some students only have earlier versions this may have to be foregone.

User Familiarity

While an increasing number of people are using computers at work, less have them at home and even less use them to access the Internet. Company employees do not generally have access to the Internet, although some may have access to the company Intranet. The likelihood of many students having a good working knowledge of the Internet is probably about one in three or one in two for those between 16 and 34. If Internet use is to become an essential part of a course, thought and planning will need to go into orienting students to its use BEFORE this skill is required to undertake research or assignments.

In addition, the use of a specific technology for EDUCATIONAL purposes may require a specified set of protocols/practices that differ from more casual use. Even experienced technology users may require time for this adjustment.

Then there is the question of the faculty. Technology, with its constant and increasing rate of change, can leave some faculty members unable to keep pace with new developments. This can render them not only over-reliant on old content or skills but also resistent to change.

We know of at least one faculty that has negotiated with its university that no existing faculty member shall be required to use new technology. *[Young (1997) "Canadian University Promises It Won't Require Professors to Use Technology" The Chronicle of Higher Education October 3]* In the short term this type of defensive measure may protect jobs but, with increasing competition from off-shore universities offering accredited distance courses, it will be self-defeating as students transfer to more techno-savvy educational providers.

In any case the need to train faculty is another factor to be considered. As with students the use of computers for academic research purposes can be very different from using them to teach and training may have to focus on this area.

Place and Conditions of Operation

If a course is to take place in virtual space, the conditions of the physical space from which it is accessed become an important factor in the educational process. This may be a remote site where some students come together, or it might be an individual student's home or workplace. Either way, the educational institution will need to take account of conditions at these sites in its course planning.

What special equipment is needed there? Are staff available to operate it? Are they fully trained in its use? What other facilities are needed? What allowances (if any) will they make for problems that arise from the location? For example, a student using a computer at work may not be able to access the Internet because of a company firewall.

There are also social considerations. Do students need to be able to meet in person? If so should the organization arrange meeting places that are accessible to all students (including those with disabilities)?

If exams are part of the course assessment, does the organization need to provide physical spaces for this, with invigilators, or can the student's home be used for this with the help of technology?

Timing

Many students, especially part-time ones who are active in the workforce, will be attracted to courses that allow for asynchronous response (i.e. free(r) of time constraints). But this is also a factor that must be taken into account when planning the course, especially if teamwork is a course requirement.

Team coursework or assignments that require synchronous communication between team members may be difficult if some students are using computers at work and are available only during working hours, while those using computers at home are only available out of working hours.

Availability of Technical Support

Given the generalized lack of technical know-how amongst some of the likely student populations, not to mention faculty, the provision of technical support is almost certainly an essential part of any technology-based course.

How that support will have to be costed and provided is another important consideration for a course planning team. For example, providing technical support in office hours only will not meet student need in a distanced and continuous educational setting, where most students will be in the workforce and have to study in the shoulder hours. There will be a need to consider what business calls a "24/7" service.

Cost

While it is possible to download costs from the educational institution to the student, this may be self-defeating when it comes to marketing the course. If the student has to acquire expensive new hardware and software, as well as pay the course fees, this will serve to reduce the demand for this type of course. While educational niche markets are pursued by commercial enterprises, the traditional university has still to cater for a more general educational consumer who may be much more cost-sensitive.

Time

A growing number of students, especially those attracted to online courses, are already in the workplace, with severe constraints on the time available for continuing education. This means that the technology must make their time spent on the course more effective rather than less. Having to struggle with unfamiliar technology that adds to their sense of stress can be seriously demotivating. Either the technology chosen must be familiar or technology orientation must be part of the course.

In general the more widely available and well tested the technology the better. Also restricting the course to the use of one or two technologies may be preferable if planning time is at a premium, although this does have implications for catering to different learning styles.

Planning Time

Technology-based courses will certainly take up a lot more planning time than conventional ones. They also require good communications between educators and technologists. The lead time to convert from a conventional to a technology-based course, or to create a technology-based course from scratch, will depend on the resources available, but will not in any event be short.

Careful planning for technology-based courses is essential, but the resources put into planning can repay the institution in the longer term. Customer satisfaction will be higher and this will increase the demand, which can in turn reduce net costs. Added to this, well planned courses can have a longer life, again a cost reducing factor.

In any event, the institution may have no choice but to plan for distanced courses. This is where the growth in educational demand is to be found. In the USA, for example, there can be seen to be 6 distinct groups of students making up the higher education population. *[Twigg (1997) "Notes for NLII-ITP Symposium on Creating and Delivering Collegiate Learning Materials"]* This demonstrates the demand by non-traditional students for post-secondary education in the USA. It seems reasonable to assume that the situation is similar in most of the developed world because the pressures driving the demand are the same. (See table on following page.)

Add to this the fact that, while the traditional student numbers are not rising in most of the developed world (with the possible exception of California, Florida and Texas *[Daniel (1996) Mega-Universities and Knowledge Media Kogan Page]),* the number of non-traditional students is likely to rise significantly, due to advances in technology that require frequent and continued re-training and re-qualification.

In short, virtual education is in growing demand and no educational insitution or corporate training department can afford to ignore it.

Table Showing the Composition of the Post-Secondary Student Population in the USA - Twigg 1997

Group	*Ages*	*Enrolment*	*Location*	*Student type*	*Workforce*	*Numbers*
1	17-24	full-time	campus	trad/1st Degree masters/PhD	not	3.9 million
2	22-34	full-time	campus	trad/1st Degree master/PhD	not	0.65 million
3	17-24	part-time	campus	semi-trad	non-career 1st Degree	2.9 million entry level
4	22-34	part-time	campus	semi-trad masters/PhD	career (on-campus)	0.48 million
5	25>	full/part	on/off	non-trad 1st Degree	career workforce	5.3 million
6	25>	full-part	on/off	non-trad masters/PhD	career workforce	0.88 million

Totals:	Full-time traditional	4.55 million
	Part-time semi-traditional	3.38 million
	Full/part-time non-traditional	6.18 million