Leading Academic Change: Essential Roles for Department Chairs

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TAKING CONTROL: MANAGING TEACHING TECHNOLOGIES

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Introduction

Of all the challenges facing chairs of departments, perhaps the most difficult is the impact of technology on teaching and learning.

The basic university teaching paradigm for most subjects has not changed a great deal for 700 years. Where technology has been introduced in the past, in the form of overhead projectors, slide shows, film, and video tapes, presentational qualities have been enhanced and students see better examples and illustrations, but the basic method of instruction is still unchanged. Rightly such technology has been termed audio-visual aids, an enhancement to but not a replacement for the basic classroom method.

All that is now changing. The new technologies of the Internet and multimedia are not just enhancing the teaching and learning environment; they are fundamentally changing it. These new technologies are having as profound an impact on education as the invention of the printing press.

In this chapter I will explore the nature of these changes and the implications for chairs of departments. The good news is that chairs do not need to be experts themselves in the use of technology for teaching, although a good understanding of the relationship between technology and teaching will be immensely helpful. It is important though that chairs have strategies for dealing with the impact of new technologies for teaching, and this chapter aims to set out what some of these strategies might be.

How technology is changing teaching

New technologies have some of the following advantages over traditional classroom teaching:

- learners are now increasingly able to access high quality teaching and learning at any time, at any place
- much of the information previously accessible only through a professor or instructor is now readily accessible on demand through computers and the Internet
- well-designed multimedia learning materials can be more effective than traditional classroom methods; students can learn more easily and more quickly, through the use of integrated illustration, animation, different structuring of materials, and increased control of and interaction with learning materials
- new technologies can be designed to develop and facilitate higher order learning skills, such as problem solving, decision-making and critical thinking
- interaction with teachers can be structured and managed through on-line communications to provide greater access and flexibility for both students and teachers
- computer mediated communication facilitates team teaching, use of guest faculty from other institutions, and multicultural and international classes.

As a result, new technologies are leading to major structural changes in the management and organization of teaching. These developments are increasingly being referred to in the United States and Canada as "distributed learning", in the United Kingdom as "networked learning", and in Australia as "flexible learning". The Institute for Academic Technology, University of North Carolina has provided a useful definition of distributed learning:

> "A distributed learning environment is a learner-centered approach to education, which integrates a number of technologies to enable opportunities for activities and interaction in both asynchronous and real-time modes. The model is based on blending a choice of appropriate technologies with aspects of campus-based delivery, open learning systems and distance education. The approach gives instructors the flexibility to customize learning environments to meet the needs of diverse student populations, while providing both high quality and cost-effective learning."
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> DEOS-L list serve, March, 1995

Thus these new technologies have the potential not only to enrich existing classrooms, but equally importantly also to allow institutions to reach out to new target groups, such as lifelong learners, people in the workforce, and the physically disabled.

In practical terms we are seeing the following developments:

- an increase in off-campus teaching, not just for "full" distance learners who cannot access the campus at all, but also for many on-campus students who find it more convenient and cheaper to study at least partly from home or the workplace
- substitution in part of "real" laboratory experiments and techniques by computer simulations
- new kinds of courses, such as certificate and diploma programs for those already graduated but needing professional updating
- customized courses for specific clients such as private sector organizations, and multiple use of materials to serve different client groups, such as undergraduate students, lifelong learners, and employers

- the development of partnerships and consortia that share courses and materials, to achieve economies of scale and the necessary investment to develop high quality learning materials; examples are the Western Governors' initiative and the Southern Regional Electronic Campus in the USA
- increased competition, not only from other public institutions enlarging their reach beyond state or national boundaries, but also from new private sector organizations, such as the University of Phoenix on-line programs, and corporate universities.

Thus it is important to realize that the use of technology for teaching is not just a technical issue. It raises fundamental questions about target groups, methods of teaching, priorities for funding, and above all the overall goals and purpose of the department. Therefore decisions about technology need to be embedded in and subordinated to educational goals, while at the same time being sensitive to the potential and opportunities that new technologies can offer. This is why the challenge of technology is so important and so difficult.

Why use technology?

In order to develop appropriate strategies it is important to understand the different rationales for using technology, and to identify which rationale is the most important to the department.

Increase access and flexibility for students. Higher costs to students (fees, living expenses, travel) and fear of ending their studies with a large personal debt has led to a rapid increase in the number of students who are working part-time. With the best will in the world, it is often difficult for such students to avoid lecture timetables clashing with job obligations, but without the opportunity for part-time work, many students will be denied the opportunity of higher education.

The rapid rate of change in the workplace is also requiring all graduates to continue to be lifelong learners. In many professions now it is essential to up-date knowledge and skills on a continual basis. However, the requirements of this target group is very different from those entering college directly from high school and committed to full-time or even part-time studies. Since lifelong learners are already in the workforce, it is impractical for them to attend a campus on a regular and frequent basis. They often do not need full degree programs but short courses, certificates or diplomas, or even "just-in-time" training in small modules at a time. Furthermore, the more specialized the subject area, the less likely professionals are to find the provision of such teaching locally. Also, this target group is often able and willing to pay the full cost of such programs, thus bringing in much needed revenues to a department. The flexible delivery of courses and programs through new technologies has many advantages for this target group.

To improve the quality of teaching. It is my experience that in large research universities this is the major reason for using new technologies. Level or reduced public funding combined with increasing enrollments, and higher operating costs as faculty become older and receive salary increments, has forced most universities and colleges to increase class sizes to balance budgets. Also, in order to protect research time, increasing use has been made of untrained and often inexperienced teaching assistants.

Increased teacher to student ratios, increased teaching loads, use of inexperienced or pre-doctoral teaching assistants, and the lack of interaction and reduced contact between tenured faculty and students at an undergraduate level, are leading to growing dissatisfaction with the current classroom teaching environment. The use of technology is seen as one way of easing or alleviating some of these problems.

To reduce costs. This is a rationale more likely to come from politicians, the business community, government officials and senior managers than from faculty or departmental heads. It is also for me the least convincing of the rationales for using technology.

The introduction of technology is likely to lead to increased rather than reduced costs, at least in the short term. There are several reasons for this. First there is a high cost of investment in both technological infrastructure (networks, computers, technical support staff) and staff development. There is a steep learning curve which demands a heavy investment of time from all staff, a point that will be addressed in more detail later in this chapter. Furthermore, technology is changing rapidly. The average life of a computer is often less than four years. In particular, software that facilitates the development of course materials, such as WebCT, Toolbook and Director, is constantly being introduced, up-dated and improved. Even when faculty become skilled in using technology, they need constantly to up-date and improve their skills.

While technology can replace some aspects of teaching, and can enhance or facilitate communication between teachers and students, good quality teaching in higher education still needs high levels of teacher-student interaction if creative, critical and analytical thinking, and good communications skills are to be achieved. Higher education, therefore, is likely to remain "people-intensive". In a knowledge-based society, there is no point in merely reducing cost if it also leads to lower quality graduates.

Improved cost-effectiveness. While technology is unlikely to reduce absolute costs, it can improve the cost-effectiveness of operations in higher education in several ways:

- by enabling institutions to reach out to more and different students
- by using technology to reduce or eliminate those activities currently carried out by instructors that are best done by technology, thus freeing faculty for more productive use of their time
- by using technology to improve the quality of learning, either by enabling new skills and learning outcomes to be achieved, or by enabling students to achieve existing learning goals more easily or more quickly.

However, we shall see that increased cost-effectiveness in higher education needs more than just the investment in new technologies; it will require radical changes in teaching methods and organization. In particular, we need to ask what activities technology is replacing, if it is to be used cost-effectively.

Technology and teaching

As mentioned in the introduction to this chapter, there are basically two different approaches to the use of technology for teaching. The first is to use technology as a classroom aid; the second is to use it for distributed learning. They should be seen as two points on a continuum rather than as necessarily discrete approaches.

Classroom aids: e-mail. Perhaps the most pervasive use of technology currently in higher education is to use e-mail to supplement regular classroom teaching. Thus, e-mail is not only used for administrative purposes, but increasingly for communication between teachers and students.

Many faculty are replacing office hours, which require a set time and place for students to contact them, with a bulletin board or e-mail service. A bulletin board enables announcements to be made by an instructor for all students in a class; e-mail allows for individual communication between an instructor and a student, or between individual students.

Some instructors have gone even further and established list serves, which enable all students and the instructor to have on-line discussions about relevant or contemporary issues associated with the course. An on-line "chat" facility allows instructor and students to communicate in real time. Some instructors are also allowing students to submit assignments by e-mail.

In all cases, however, these tend to be supplements to classroom teaching, although this use of technology may well replace some other activities, such as office hours or the physical delivery and collection of assignments.

In general, though, most instructors report that this use of e-mail tends to increase rather than reduce the amount of time they spend in contact with students, which may be good for the students but can lead to work overload for instructors. Also, student expectations of instructors' availability and speed of response may become unreasonable. It is a good idea to set down standards, which give students some expectation of when they can expect a response, and protects instructors from constant harassment for immediate responses.

Lastly, a point I shall return to later, the use of e-mail requires both instructors and students to have access to e-mail through computers and an Internet account. Without explicit policies regarding networking of instructors and students, some students may be severely disadvantaged by lack of e-mail access, as indeed may some instructors.

Classroom aids: presentational software. The use of presentational software such as Microsoft's PowerPoint is another pervasive use of computer technology to enhance classroom teaching. PowerPoint is a relatively easy piece of software to learn, although the skill level needed for the incorporation of graphics, animation, charts, video and audio clips can escalate rapidly. Furthermore, design skills in the choice of fonts, the layout of the screen, and the use of illustration make a big difference to the quality of the presentation. The use of presentational software needs a little more time in preparation than a chalk and talk lecture, but may in fact lead to savings in time where complex overheads or slides were previously used.

The major requirements are adequate training in the use of the software, a personal portable computer for the instructor, and the provision in lecture theaters of data projectors that can be quickly and easily hooked up to the instructor's portable computer. These require substantial capital investment, some training, and a limited amount of technical support. While the benefits often appear obvious, they are in fact difficult to quantify.

Classroom aids: video-conferencing. Video-conferencing is used primarily to increase access and to spread limited subject expertise over a wider area. It is particularly popular in multi-campus organizations, such as state university systems in the U.S.A. For instance, a small rural campus may have only two or three students who want to register for a particular course. These students can be linked to a larger class in the major urban center without the need to hire an additional instructor.

The use of video-conferencing for the regular delivery of teaching requires a substantial investment in capital (not so much for the equipment as for room reconstruction and adaptation), in networks to carry the video-conferencing signals, and if several campuses are linked, in leasing or buying switching equipment. There are several different arrangements for budgeting for video-conferencing. Sometimes departments are charged for use; other times the service is considered free, since infrastructure costs are often paid for on a state-wide and/or institutional basis. Nevertheless the local equipment, technical support and preparation time of instructors are all direct costs on an institution, and the money for infrastructure comes out of the system somewhere.

The major attraction to faculty is that there is relatively little change in their normal teaching methods, although video-conferences generally result in more time being spent in preparation. Video-conferencing also tends to be quite stressful, particularly if the instructor tries to use interactive techniques to include remote as well as local students. Class size also increases, so the amount of interactivity for an individual student tends to diminish.

While video-conferencing may enable additional students to have access to courses in their more immediate neighborhood, it increases instructors' work-loads, adds overall cost to the system, and the marginal cost for each additional student served is high (Bates, 1995).

Classroom aids: the World Wide Web. Many instructors are now using the World Wide Web both as a presentational tool in lectures, and as a means of making lecture notes conveniently available to students at other times. The World Wide Web has the additional advantage that through Internet links, instructors can access other World Wide Web sites from all around the world, and bring materials from these sites into the lecture. Another use of the Web is to create databases of slides, photographs and illustrations that can be drawn on for a lecture, and/or made available to students for on-line access.

The disadvantage of using the Web is that it requires the use of a special if simple computer language (HTML) to create Web pages, and the maintenance of a Web server (host computer) for the site. The Web is therefore more time-consuming and requires either substantially more technical skill and preparation time from an instructor, or significant technical support, often provided by graduate students funded from small teaching grants, who convert lecture notes into Web pages. Also the Web works best when the host site is on a UNIX-based server. This probably requires a specially dedicated computer for a department, and technical staff support, with both capital and operating cost implications.

Furthermore, we shall see that just using the Web for lectures fails to exploit many of its unique features.

Classroom aids: multimedia/CD-ROM. A relatively small number of instructors (less than 10% in the United States and Canada) are using multimedia or CD-ROM technology to support classroom teaching. Language laboratories, computer-aided design in architecture, simulated science experiments and large research databases containing multimedia resources such as graphics, compressed video and audio are examples of the main uses of multimedia and CD-ROMs to support classroom teaching.

Multimedia and CD-ROM's are usually used in computer laboratories (where desktop personal computers may be networked to a local server) or on stand-alone computers using a CD-ROM. (Currently multimedia materials with video and audio clips generally require too much bandwidth for convenient delivery over public Internet systems.)

Some faculty are beginning to use multimedia to develop problem-solving and decision-making tools based on expert systems. An experienced subject expert will enter various data and criteria necessary for problem-solving and decision-making into the computer database, which will also contain a large database of facts and information. The subject expert, usually working with a computer programmer, will also enter decision rules or chain decisions to certain outcomes. There may also be numerical calculations predicting for instance the probability of different outcomes. Students "explore" the computer environment so created and try solutions to problems and make decisions, and the computer program "predicts" the likely outcomes of their decisions based on the underlying expert system provided by the subject expert.

The development of such uses of multimedia generally requires a combination of subject expertise, computer programming, and graphics and computer interface design skills. It also requires investment in sophisticated and high cost multimedia hardware and software both for development and for student use, a high level of teaching skill, and a high level of computer expertise.

As a consequence, good quality multimedia learning materials are extremely expensive and time-consuming to produce (in the order of $100,000 to $500,000 per CD-ROM, towards the higher end if subject expert time is included). To justify the high level of expenditure, extensive use of the material is required with large numbers of students, or clients able and willing to pay high prices for sophisticated learning materials must be found. To cover the high cost of development and to ensure widespread use of the developed materials, consortia of universities may need to get together to develop materials for joint use, or it may be necessary to form partnerships with private sector organizations such as publishers to share the risk.

Consequently, although the number of commercial CD-ROMs suitable for application in higher education is increasing, it is still often difficult to find the right kind of material that will meet a particular instructor's needs. Furthermore the relatively few instructors willing to use off-the-shelf CD-ROMs generally prefer to customize or select materials for their own use, rather than use the CD-ROM as a substitute for classroom teaching. As a consequence the use of multimedia to support classroom teaching is still relatively low in higher education.

Classroom aids: some issues. One reason for the rapid take-up of newer technologies such as video-conferencing and the Web is that these have been easily integrated with traditional classroom teaching methods. No major re-thinking of traditional teaching methods has been necessary. However, without changes in teaching methods the use of technology merely adds to both the work of faculty and to the study load of students. We are adding more cost for relatively small additional benefits.

Thus, for financial reasons it can be seen that the more sophisticated one becomes in using technologies, the more it becomes essential to replace other activities to justify the investment. In particular, once information and learning activities are codified in a technological format, some thought needs to be given to the rationale for the teacher being present at the same time as the students. The highest cost in the use of technology for teaching and learning is instructor or subject expert time. Can some of that time be found by replacing or more likely by reducing traditional activities such as lectures, wet laboratories or seminars? Can face-to-face teaching time be concentrated on those aspects of teacher-student communication that is best done in a face-to-face mode? If so, what are those aspects, and what is the best way to organize for this? This leads us into a discussion of distributed learning.

Distributed learning. This can also be seen as a continuum. At one end is the use of technology to supplement face-to-face teaching, but with significant elements of the learning conducted independently by learners through technology, and much reduced requirement to be regularly at classes.

At the other end of the continuum is delivery of courses and programs totally at a distance from the campus (distance learning).

One of the key elements of distributed learning is the use of communications technology as part of the teaching and learning experience. Students do not so much interact *with* the technology, as *through* the technology with teachers and other learners. This can be particularly useful where the subject matter requires students to apply concepts or principles to their own context. On-line communication is also useful for areas of knowledge where there are ambiguities or where different values and interpretation are considered legitimate, and particularly for the development of collaborative learning, where students often remote from one another can work together on common tasks.

The main value, though, of distributive learning is its flexibility and the opportunity to widen access, allowing teaching and learning to extend well beyond the campus of the university. For instance, in my own university we are offering post-graduate courses over the Internet that are available not only to our on-campus Masters students, but also to students registered with Monterrey Institute of Technology in Mexico and Simon Rodriguez Experimental University in Venezuela. We also offer the same courses to participants from all other parts of the world registered with the University of British Columbia for continuing professional development. The courses are delivered using a combination of the World Wide Web, printed textbooks and articles, and video-conferences. The same course material, assignments and marking schemes are used for all the students, although Monterrey Institute of Technology is responsible for marking and accrediting its own students.

These courses are not only very popular, with between 200 - 300 enrollments per course worldwide, but also make a reasonable profit for the university after all costs have been met. Such courses though require radically different approaches to the traditional classroom model. Courses are developed by teams of subject experts, instructional designers, and computer and graphics specialists. Learners access a great deal of the information required from the Internet. The main role of the course instructors is to research and select appropriate content, to develop a Web-based course study guide, to provide discussion topics, to encourage and moderate widespread and high quality student participation in on-line discussions, to mark assignments, and to provide feedback and guidance to learners.

Student support and administrative services also become critical when students are scattered around the world. Simple issues such as ordering textbooks and paying fees become much more complex when students are based in another country (see Bates and Escamilla, 1997, for a fuller discussion of these issues).

Not all courses are suitable for this approach. International competition is now fierce and widespread for courses over the Internet. An institution wanting to go global with its teaching must have strong competitive advantages in terms of the reputation of its teachers or its overall excellence, and the quality and reliability of service it provides to students, wherever they are. Not all subject areas or learning goals are suitable for technology delivery, although technology is able effectively to meet more learning goals than most traditional teachers believe.

Defining the role of the departmental chair in technology decision-making.

Key tasks then for a department chair are to help a department:

- define priority subject and topic areas for the use of technology
- identify new target groups that could be reached through the use of technology

- identify areas of support available elsewhere in and outside the institution, and determine the organizational and support staffing for technology-based teaching that needs to be provided by the department
- identify the role of and priorities for face-to-face teaching in an increasingly sophisticated technology-based learning environment
- decide on key areas of investment and resource allocation for technology-based teaching.

The remainder of this chapter sets out some strategies for meeting these requirements.

Developing a teaching plan

The most critical strategy is to develop a three to five year teaching plan for the department that covers all forms of teaching, including regular face-to-face teaching, technology-based teaching, extra-sessional studies, and "pure" distance education. In other words, all the teaching needs of the department should be addressed in an integrated way. This means relating teaching methods to the needs of different target groups, the interests and areas of expertise of the faculty, and the resources likely to be available over a three to five year period. In developing such a plan, it is also important to be aware of the potential for new revenue generation by using new methods and reaching new target groups.

Note that this is not specifically a technology plan. The use of technology needs to be embedded within the overall teaching plan. Technology is a means to an end, not an end in itself. The teaching plan I am suggesting is also different from (but might be integrated with) a plan for curriculum development and renewal. A teaching plan focuses not so much on *what* to teach, but *how*. Some possible steps to developing such a plan are suggested below.

A strategy for inclusion and buy-in. No plan will work without the support of faculty and students. It will be essential then to explain to staff and students the reason why a plan needs to be developed, and to seek their maximum participation in the process.

This is not likely to be an easy task, especially in a research university. It may be seen as just another exercise by the bureaucracy to reduce expenditure or resources; it may be seen as diverting staff from current teaching and research activities; or it may be seen as extra load or work, especially for key participants. There may be fears that even if developed, the plan will not be implemented.

However there are counterbalancing arguments for maximum participation. The plan is likely to impact every faculty member, so it is in the interest of each faculty member to participate. A well-designed plan could in fact relieve current major areas of concern or avoid difficulties for faculty and students in the future. Teaching is a critical part of the work of the department and needs to be organized in the most effective way. Staff and students will be able to identify their needs and influence priorities for the department.

Some way should be found, through departmental meetings, sub-committees, task forces, and so forth to involve every faculty and staff member in the department, including administrative support staff, such as secretaries, and a wide range of students. Spreading the load can make each individual's commitment to the planning process more manageable in terms of time.

Scanning the environment In developing a teaching plan, staff and students will need to address some of the fundamental issues facing higher education today and how these are likely to impact their day to day work over the next five years.

A task group should be established to identify the external and internal "environment" in which the department is likely to work over the next five years. The task group should identify among other things:

- the likely financial scenario over the next 3-5 years
- expectations on enrollments from both the public and the university or college administration
- new trends in subject matter and teaching, including the impact of technology on teaching and different approaches to teaching and learning the key subject areas within the department
- inter-disciplinary developments
- the activities of potential competitors
- the department's current strengths and weaknesses
- future opportunities and threats for the department.

This can be done in a variety of ways, including brainstorming, a small group researching and writing a report, invitation of external speakers, and so forth. It is important though that this is done before the main planning activity starts. The environmental scan should also be done quickly, since the main trends should be relatively clear, and honestly, so that major problems or difficulties are not swept under the carpet.

Developing a vision for teaching. Since I live on the Pacific West Coast, I often notice some quizzical looks from colleagues when I start discussing the importance of developing a vision for teaching. The assumption is that I am talking about something vague or idealistic.

Nothing could be further from my mind. I am influenced by the work of Robert Fritz (1989), who defines a vision as a set of concrete scenarios reflecting exactly what we would really like to be doing in the future.

Applying this to teaching and the use of technology, the aim is to develop through a group process detailed descriptions of how the department will be teaching in five years time. The scenarios should reflect what it would be like to be a faculty member teaching, what it would be like for a variety of different kinds of students to be learning, and even what ideal student support services would look like. Part of the scenarios would also be a description of how technology is being used in teaching and learning.

It is important that such scenarios identify ideals in concrete terms, and take into account the possibilities now available through technological and other means. This has to reflect what we really want, not some compromise to meet existing limitations. The aim is to develop scenarios that almost everyone in the department really wants, through a process not of compromise or bargaining but brainstorming and creativity.

One value of such a group exercise is to clarify in practical terms what colleagues mean when they talk about improving teaching and learning, or being learner-centered, or of developing research skills, and so forth. Another value of the process is that it should provide some clear goals and targets to drive the planning process. The defined vision in fact is unlikely ever to be realized and will change over time. It is primarily a process for getting staff seriously thinking about and discussing teaching methods in concrete terms, and getting them to think beyond current limitations and reality, so that quite different goals and objectives can be identified.

The process could involve input from specialists from outside the department, such as innovative faculty from another institution, a vice-president responsible for external relations, and specialists in educational technology, distance education, or faculty development. The main purpose of such external input is to bring in new ideas or perspectives that may challenge the status quo and offer alternative approaches.

Discussions about technology must be a key part of such a visioning process, because technology can change the whole nature of the teaching/learning context. The visioning process is a way to explore the many opportunities and challenges that can be met through the intelligent use of technology. "Visioning" also provides a process and context for involving a critical mass of people within the department in discussing the advantages and limitations of different technologies for teaching. The debate that occurs through the visioning process makes it easier to identify priorities for the use of technology, and provides a basis for making difficult decisions about technology that are nevertheless likely to be supported throughout the department.

Setting goals and priorities for the next five years. Once a strong and detailed vision statement has been developed, the process becomes more like a traditional strategic planning exercise. Having set a vision for the next three to five years, what are the key actions that the department needs to take to move towards these goals? What are the likely constraints, and what resources can be found to move in these directions? What current activities could be changed or abandoned in order to meet the stated goals? It is in this context that a sub-plan for the use of technology for teaching within the department can be developed.

The need for an overall teaching strategy in order to decide on appropriate uses of technology cannot be too highly stressed. Far too often the use of technology is influenced by the latest technological developments, whether or not they are appropriate to the department's teaching or learning goals. Often technology choice is influenced by individual faculty enthusiasms, resulting in a lack of technical support at a level needed to attain and sustain high quality learning, and duplication of effort and facilities. A lack of a departmental strategy for technology can result in students being unsure about the importance of technology, purchasing inappropriate equipment, having to change computers from course to course, or feeling frustrated by the lack of professionalism in a department's teaching.

Student access to computing.

A critical part of any teaching plan must be a clear policy regarding student access to computers. There are several different approaches to student access to computing.

A "**laissez-faire**" **policy** is common and probably the worst. In a laissez-faire policy, each instructor is left to make his or her own decision about the use of technology and whether a student needs to use a computer. There are many problems with this approach. Students taking different courses within the same department may purchase a computer for one course then find it unsuitable for another. A student may have to make a substantial financial commitment for computer purchase and Internet access, only to find that the use of a computer is not essential for the course, or that subsequent courses do not require computer use. Students may have to learn specific computer skills or software for one course then find in another course the same functions require different software or skills to be learned.

If the department provides access to computers through a computer lab, and different machines and software are specified for different courses, technical support costs rapidly escalate. Institutions should no more tolerate a laissez-faire approach to student computer access than they would tolerate open access to any classroom at any time for any instructor; the result is chaos.

Student computer laboratories. Another common strategy is to have departmental or faculty-wide computer laboratories where students can access the Internet and teaching software. This can enable some standardization of equipment and teaching approaches and removes the responsibility from students to provide their own computers.

However, there are major disadvantages to this approach. One is the very high cost of installing and maintaining computer laboratories. When the use of computing for teaching and learning is marginal, and student use is low, the cost of computer laboratories is not such an issue. When it becomes widespread however, and most courses and students require some use of computing, an enormous investment has to be made in space, machines, software and technical support. Furthermore, given rapid technological change in hardware, software and networks, the maintenance and replacement costs for laboratories are also very high.

Another limitation is that the requirement to use laboratories reduces access and flexibility. Students still have to come on campus and may have to reserve computer time if use of the laboratories is extensive.

Students provide their own computers. In many universities in the United States and Canada, a majority of students will already have their own computers on entering college. At my own university, 70% not only have their own computers but also have Internet access.

Furthermore, each cohort of students will bring a new generation of computers with them, allowing the teaching to adapt to the increasing multimedia and communications functionality of computers. Students with their own computers and Internet access have much more flexibility and opportunity to study with their own computers.

There is always likely to be a need for computer laboratories in specialist areas such as computer aided design or for advanced computer courses, and a need to provide financial support and assistance to students who may have real difficulties in providing their own machine. There is also a need for students with their own machines to have easily accessible ports and power points on campus where they can plug in their machines.

Nevertheless, it is likely to be a better investment to ensure that students can easily access the university or college networks on-line through widespread modem access and high-speed networks, using their own computers, than to depend on extensive and very expensive hardware installations on campus.

Academic computing policies

Whatever the preferred policy for student *access* to computers, it will still be critical for departments to have a clear *academic* policy regarding the use of computers for teaching and learning. The teaching plan should clearly indicate for each program or set of courses what the expectations are regarding student use of computers, and these policies need to be consistent across disciplines.

This does not mean that every course should require a computer. If a computer is required though, there should be a clear statement indicating:

- what kind of computer requirement (for example Pentium or Macintosh PowerBook, with Netscape Communicator and Internet access), including peripherals (for example a CD-ROM player) and network access
- why a computer is needed (the teaching purpose, or the value added to the teaching through the use of the computer)
- any specialist computer skills (for example the use of attachments to send assignments, Excel spreadsheets) that the student may need

to take the course, and opportunities for developing those skills outside of the course.

In general, the simpler and the more basic the standard, the more manageable the policy will be. For instance, for all our distance education courses, we require students to be able to access and operate Netscape 3.0, and they must be able to send documents in Rich Text Format; that is our only technical standard. For students on-campus, higher standards could be set, but this would then limit access and the potential target groups for courses.

You can be sure that different faculty will demand different standards. Those that want to go outside the generally agreed departmental standards should have to bear the cost of providing specialist laboratories and software from within their own discipline budgets.

Developing this kind of policy can be a major source of dissension within a department. Chairs of departments have a critical role to play in getting faculty to develop policies for the use of computing for teaching that are consistent and student-focused. They also have a critical role in influencing institution-wide decision making about technology infrastructure so that campus infrastructure and technology services strengthen rather than work against the teaching goals of the department.

A departmental teaching plan based on a strong visioning process will make it much easier to reach agreement on common standards and to provide guidance to chairs on university-wide policy requirements for academic computing.

However, setting three to five year goals for teaching and choosing technologies to support such strategies, while essential, is not sufficient. The department should also deal with the issue of how the technologies will be managed.

Managing technology-based teaching

In most countries, faculty have considerable autonomy with regard to teaching. Consequently, the most common approach to encouraging the use of technology, at least in universities in the United States and Canada, has been through earmarked grants to individual faculty, with general infrastructure support for networks and desktop equipment funded centrally.

Some universities have also invested in central multimedia production services or training facilities, but this is more the exception than the rule. A study in the Australian Graduate School of Management (1996) found that centralized technology teaching support units were more common in smaller and newer Australian universities, but uncommon in the large, divisional research universities.

Consequently the main approach to the use of new technologies in higher education has been to provide individual faculty members with small grants that provide for funding of a part-time graduate student and some equipment. This is what I have called "the Lone Ranger" approach (Bates, 1999).

The value and limits of Lone Rangers. There are several advantages of using small grants to encourage faculty to use technology. First, it can get a wide range of faculty started on using new technologies for the first time. It provides opportunity for experimentation and the development of faculty skills in using technologies. It avoids having to make difficult decisions about long term investment in technologies that may prove ephemeral. It allows graduate students to develop computer skills that can be applied to their area of subject expertise. Lastly, it maintains the autonomy of faculty to decide on the teaching method which best suits them.

However, on most university and college campuses, the Lone Ranger approach means that amateurism rules in the use of technology. Standard classroom methods, such as lecture notes, may be carried across to a Web site, failing to adapt to the requirements of the medium, and more importantly failing to exploit the many unique features of the technology.

A characteristic of many Lone Ranger projects is that often there is never a final product that can be used on a regular basis in a teaching context. This is because the project drags on, being constantly up-graded or improved, or has to be re-designed as a result of inappropriate technology decisions in the early stages of development. The initial funding is often inadequate to complete the job, and much effort is spent seeking additional funding to continue the project.

Often the graphics and the interface are poor, compared with commercial products with which students are familiar, and the potential for high quality learner interaction with the multimedia materials and other students is often missed. Products when finished have limited applicability because they are not of high enough standard in terms of graphics and interface, or sufficient in volume, to become a commercial product.

In other words, Lone Ranger materials usually lack quality in the final product. There are several components of quality in technology-based educational materials. The first is the quality of the content, which is where the status and research capability of an institution becomes critical. Is this unique or valuable teaching material for which there is a need or demand? This is not usually an issue in most research universities, but may be an issue for some two-year colleges. Do they have the staff or reputation to compete with the local research university that may also be offering similar courses over the Web? If so, why not use the university's courses, and free up faculty for other activities that can best be done locally on a face-to-face basis?

The second component of quality is the standard of media production. Are the graphics clear? Are the screens easy to read? Are the sound and video easy to hear and see? Are the unique features of each medium (video, audio, text, computing) fully exploited? Is the material well assembled? Is the screen designed in such a way that students intuitively understand the range of activities open to them and how to accomplish them (interface design)? Can they navigate their way through the materials easily?

The third component of quality is instructional design. Are the learning objectives clear? Does the material result in the desired learning outcomes? Does it have the appropriate mix of media to achieve the learning outcomes in the most efficient manner? What is the quality of the interaction between student and learning materials? What is the role of the tutor/instructor relative to the technology-based learning? Is the material well structured and well organized?

The fourth important factor is the quality of delivery. Are the materials easy for the student to access? Can learners ask questions or discuss materials with other students? Who gives feedback? What happens if students have technical problems? At what times is help available?

Fifth, there is the issue of project management. Timelines and budgets need to be established, teams created, meetings organized, materials produced, distributed and maintained, deadlines met.

Lastly, and perhaps critically, there is the question of resourcing and priority. Are there enough resources to do a proper job? Does the instructor have enough time, through the reduction of other activities, and enough help from other professionals, such as graphics designers, to produce a good quality set of materials? Is the project considered of sufficient priority to get the support needed for the job to be done well?

Too often technology-based projects are treated as research and development. There is a big difference though between R&D and regular teaching activities. The technology has to be reliable, so that wherever a student may be in the program it performs the way intended. The multimedia material has to be accurate, comprehensive, and related to clear learning outcomes. The multimedia material has to be designed so that it fits into an overall course structure. Budgets and timelines must be maintained or students will not get the material in time.

All the above factors contribute to quality in technology-based teaching and learning materials. New technologies then are likely to remain marginal, despite high levels of capital investment, and will merely add costs to the system, if we do not implement procedures and methods to ensure the professional management of technology-based teaching.

Project management. It has already been argued that there is a great deal to be learned about how to exploit fully the new technologies for teaching and learning. The challenge is to encourage instructors to be innovative while at the same time maintaining quality control and cost-effectiveness in the delivery of teaching.

While new technologies require new educational applications, a great deal is already known about the <u>process</u> of producing high quality, cost-effective multimedia learning materials. This knowledge has been developed both in the large autonomous distance teaching universities, and also in private sector multimedia companies in areas such as computer games, advertising, and film and television making.

The process is known as project management. Each course or teaching module is established as a project, with the following elements:

- a fully costed proposal, which identifies
    - the number and type of learners to be targeted (and in particular their likely access to technology)
    - clear definition of learning goals or outcomes
    - the choice of technologies
    - a carefully estimated budget (including staff time, copyright clearance, use of media production resources, as well as cash)

- a team approach, involving (depending on the design of the project) a combination of the following:
  - subject experts/academics
  - project manager
  - instructional designer
  - graphics designer
  - computer interface designer
  - text editor
  - Internet specialist
  - media producer
- an unambiguous definition of intellectual property rights and a clear agreement on revenue sharing between the university and the design team
- a plan for integration with or substitution for face-to-face teaching
- a production schedule with clearly defined "milestones" or deadlines, and a targeted start date
- a process for project evaluation and course revision and maintenance
- a defined length of project before redesign or withdrawal of the course.

Project management is still the exception rather than the rule in most universities and colleges, especially for Web-based courses. The Center for Distributed Learning for the California State University system (www.cdl.edu) is one of the few higher education organizations that is extensively following a project development model. However, its approach is to develop self-contained multimedia modules that can be integrated by instructors into their own courses, rather than develop whole courses through the project management model.

In the Distance Education and Technology unit at the University of British Columbia, we operate a five-stage approach to project definition. This process could easily be adapted for use on a departmental or Faculty basis. Individual professors or discipline areas are invited once a year to submit a short proposal (usually two to four pages) requesting funds or assistance. We provide a short questionnaire to help the process at this stage.

One of our senior managers (an experienced instructional designer with project management training) then works with the lead academic to develop a fully costed proposal. This is a critical stage of the process, where objectives are clarified, alternative modes of delivery are explored, and resources are identified.

The project proposal then goes in competition with all the others to a committee of academics for adjudication. A set of criteria for selection has been developed, including the number of students to be served, strategic positioning in terms of the faculty plan and technology innovation, potential for revenue generation, and so forth.

Following allocation of funds, a detailed letter of agreement is drawn up between the academic department and the Distance Education and Technology unit, which clearly sets out responsibilities on both sides and ties down production schedules, intellectual property, and sharing of revenues.

Once the project is funded, DET managers track progress, schedules are re-arranged to take account of changing circumstances, budgets are sometimes changed (but more likely re-arranged) as a result, all by mutual agreement.

Project management is not necessarily limited to the use of technology for teaching. Indeed there is a logic to treating all courses or programs as projects, whatever the balance between technology-based and face-to-face teaching.

However a project management approach has major implications for how funding is handled in a department. If all courses are considered projects then they should be resourced accordingly. Resources include both cash and staff allocations. Thus each year a department's total teaching resources would be allocated across a range of projects that would constitute the department's teaching program each year, but ensuring there are adequate resources carried forward or committed for future years to continue and maintain the courses. Project leaders would be expected to work within the resource allocations and deadlines assigned to each project.

The differences between the Lone Ranger and project management approaches are really a matter of timing and purpose. To encourage staff who are "novices" in using technology, and to encourage research and development in the use of new technologies, a "weak" criteria approach to funding, and the encouragement of Lone Rangers, may be best. Instructors with little experience in using technology usually prefer the privacy and control of the Lone Ranger approach.

However, as a department moves to regular teaching with new technologies, as more experience is gained by instructors, and as students become more experienced in using the technology for learning, the more important it becomes to move to a project management model, to achieve high quality materials and teaching, and to ensure that deadlines and budget targets are met.

Centralization vs decentralization. The project management model requires a team approach which includes not only subject experts but technology specialists and instructional designers. Where should such critical support staff be located and how will they be paid for?

Whether support staff are located centrally, serving the university as a whole, departmentally, serving all disciplines, or are located within a specific school or subject area, will depend on a number of factors, and in particular the size of the institution. The larger the organization the greater the opportunity to decentralize even specialist activities.

However, even in cities with a well established high tech industry, there are probably no more than a handful of interface designers with expertise in designing high quality educational computer interfaces. These need to be hired on a contract basis as and when needed for high priority and well-funded projects.

Graphics designers are more common, but it is still difficult to find such people with good experience in using technology for education. These could be employed centrally on a permanent basis to work with different departments and faculties to establish the overall look and feel for their projects and to design specific templates for Web-based courses that can be used as a model for detailed course design. Certainly with the growth of technology-based teaching most Faculties in a large research university could justify employing their own instructional designer and/or faculty development officer.

Lastly there is probably a need for every Faculty (at least in large universities and colleges) to have at least one general technology support person who can do basic work such as Web design, and who can provide technical support for networks and computer laboratories, and so forth. However, this person should also be able to draw on other units and departments for more specialist help.

The extent to which a department needs to staff up with technological support people should be determined in the light of the department's teaching plan, which would establish goals and priorities for the use of technology. Project management allows for the establishment of temporary teams that can be reconstituted at different times on a flexible basis and such arrangements can accommodate a variety of different organizational arrangements. Chairs need to work with other department chairs to identify resources that can be shared, and to work with their deans to identify university wide support requirements for both faculty development and course production and delivery.

Some difficult decisions, though, will have to be made about the balance of teaching and support staff. In general, priority tends to be given to academic staffing. As a consequence, one now hears complaints from faculty in universities and colleges across the continent about the lack of technical support staff.

Furthermore, there is a severe shortage of good quality technology support people. They can usually earn considerably more in the private sector. To recruit and maintain good quality technological support staff, higher education institutions will need to offer such staff regular positions and a good management framework that determines priorities for their work and ensures reasonable work loads. While there are short term advantages in using graduate students as helpers, it may do them no good in the subsequent job market. Although work experience is valuable, it is no substitute for proper training.

To use technology successfully it will be essential to find ways to provide adequate technology support staff, and in times of limited resources this may mean reducing some areas of teaching to ensure high quality in others.

Faculty development and buy-in

I have deliberately left this issue until last. It is not uncommon to see the issue of the effective use of technology as one of faculty development. I would agree that if technology is to be used successfully, there needs to be fundamental changes in the way instructors work. This may well require some professional development activities if attitudes are to change and if the benefits and limitations of using technology are to be fully appreciated.

However, the issue is usually framed differently. It assumes that faculty need to learn how to develop technology-based materials themselves. I believe that this is a big mistake. It suggests that faculty are the problem, and they need to be trained out of the problem. It encourages the Lone Ranger approach and results in highly paid subject experts doing work that would be better done more cheaply by someone else. I see the problem quite differently. I see more and more faculty anxious to use technology, but desperately frustrated by lack of resources and in particular technological and specialist support.

I would prefer to see faculty working in teams, respecting the professional input of other professionals, such as graphics and instructional designers, but with faculty concentrating on academic policy, research, subject matter content, and overall teaching methods. Although a working knowledge of different technologies is always an advantage for an instructor, faculty need to communicate their ideas and needs to the other professionals in the team, and trust in their expertise to create collectively learning materials that not only meet the expectations of faculty, but surpass them.

While the provision of skilled professionals from other fields to support faculty may appear to be an expensive policy, it is a lot cheaper than diverting highly qualified research and subject matter experts into technical fiddling and fixing.

Conclusions

You may have decided by this point that the use of technology for teaching has too many difficulties associated with it, too many uncertainties, and certainly too much stress. This is a pretty fair assessment. The problem is that the issue is not going to go away.

Students from high schools currently entering our universities and colleges are now the first generation that has been brought up all the way from early childhood with computers in their home, or at school. Secondly, more and more students are having to pay their way through university and college. They are going to become more critical and more demanding, and they will expect technology to be used appropriately for teaching. Thirdly, employers are looking for students who combine information technology skills with subject expertise. I find it hard to imagine even an English literature graduate who would be considered adequately educated these days without some knowledge of how to use the Internet to further her studies or interest in literature, if only to be able to order books on-line. Lastly, there are many competitors, private as well as public, more than willing to use technology to recruit students to their courses from under our noses.

The task of a department chair is to ensure that these realities are fully understood within the department, and to provide strategies and support for helping faculty develop appropriate policies and practices for the use of technology in teaching. This cannot be done in isolation from the curriculum and teaching approach of the department and disciplines as a whole. It will also require some very difficult resource re-allocation decisions to provide the necessary support, either at a central or departmental level.

However, more and more instructors are themselves ready to increase their use of technology. There are genuine educational benefits to be gained by its intelligent use, and the use of technology can provide a strong platform for faculty development and renewal.

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