chapter 7

INNOVATING: TEACHING WITH TECHNOLOGY

> *We cannot ignore the transformation taking place in our world today – the fact that the new technologies and the associated dramatic changes in the relationship between people and information are creating the cultural signature of the world. We are in the midst of a revolution that will profoundly alter how we learn, work, and communicate, and conversations emerge about philosophical considerations inherent in the use of these technologies (Watts, 2003a: 5).*

In this chapter, we examine the innovative potential for enhancing learning and teaching that occurs when new technology is integrated into a learning context. First, we look at a range of frameworks or conceptual dimensions to describe the use of new technology for learning and teaching. Secondly, we explore the diverse range of pedagogical applications for the available communication and information technologies. Finally, we look at how these technologies might be used for extending the learning matrix described in Chapter 2.

INTRODUCTION

Innovation is not constrained to teaching with the aid of new communication and information technologies (Hannan, 2005). Opportunities for

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 180

being innovative can be discovered, developed and seized upon in all the practices and genres of teaching that we describe in this part of the book. Developing reflective teaching practices that address the wider range of needs identified in the learning matrix will require more innovative approaches to teaching. We associate the term with new (and newer) technologies here because the recent upsurge in their use by students provides increasing opportunities for teachers in higher education to be more 'innovative' in their learning and teaching practices.

Certainly, university students today – millennials specifically – are extremely comfortable with technology, and generally view its existence as part of their natural living environment. Computers, the Internet, email and social networking systems (e.g. 'Facebook', 'MySpace') are considered an expected part of everyday life; as such, students may be quicker to experience or see the potential application of new technologies than their teachers (Oblinger, 2003). Students' ease with technology, and seeming impatience with older or outdated technologies, may intimidate faculty unnecessarily. Pressured faculty may either seize on technological 'bells and whistles' in the hopes of catching their students' attention, or ignore technology altogether, clinging to traditional assumptions about learning.

We do not suggest here, however, that technology in itself *transforms* learning, as many faculty and administrators are urged to believe (Surry and Land, 2000). Instead, we suggest that technology, especially emerging technologies, such as multi-media, the Internet, distance education and online learning environments, as well as specific technologies such as student response systems, can *encourage* or *enhance* learning (Hall, 2002; Aravamudan et al., in press). Throughout this chapter, then, we offer a conceptual framework for understanding technology in teaching, focus on the tensions surrounding the successful integration of technology, consider the diverse range of applications and consider how these technologies fit within the learning matrix.

Flexible strategies

This chapter will focus primarily on the potential of new technology for innovative contributions, alongside more traditional lecturing, facilitating and tutoring approaches, but will touch on the implications for distance learning. This may be called a 'flexible learning' strategy (Moran and Myringer, 1999; Khan, 2006) or a 'close-distance education' (Mason, 1998), although as Watts (2003b) has urged: let's take the 'distance' out of education. A flexible learning strategy is applied to teaching and learning

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 181

wherever they occur (on campus, off campus, cross campus); frees up the place, time, methods and pace of learning and teaching; is learner-centred rather than teacher-centred; and seeks to help students become independent, lifelong learners (Moran and Myringer, 1999).

We are not suggesting that fully comprehensive systems of teaching – designed, delivered, assessed and evaluated primarily or fully with new technology – cannot address the full range of 'matrix' issues. There have been some highly successful examples, which have moved from a cottage industry phase and into more wide-scale systematic ventures, most notably the Open University in the UK and the University of Phoenix in the USA (Kirp, 2003) and new strategies in the developing world (Kember, 2007b). Strategies that use new technology as part of a more flexible programme are increasingly characterizing the general evolution of distance technologies (Harry and Perraton, 1999: 9).

CONCEPTUAL DIMENSIONS OF USING NEW TECHNOLOGIES

Although there are faculty who are still suspicious of any technology newer than chalk and board, or simply lack the time or resources required to innovate (Gandolfo, 1998; Bass, 2000; Watts, 2003a), the introduction of new technology in education continues to exercise the educational imagination and to open opportunities within more traditional learning and teaching practices in higher education. It draws upon a variety of ways of speaking and thinking about learning and teaching, generating a substantial and continually expanding body of educational literature.

Lecturers have recently been adding a plethora of new expressions to their learning and teaching vocabulary. A selection of these includes distance learning, open learning, flexible learning, hybrid and blended learning, dual-mode teaching, online education, virtual classrooms, global education, computer-mediated communication, technology-mediated knowledge and so on. The addition of new terms with older ones and the swift ability for writers in the area to develop new permutations of these terms are rapidly increasing this vocabulary. Indeed, even the metaphors we commonly employ to describe certain technologies such as the Internet ('surfing the Net', 'travelling the information superhighway', etc.) may not have a shared meaning for all users (Taniguchi, 2003).

While it is not feasible to keep abreast of the theoretical nuances and implications of every new addition, it will be useful to have a broad conceptual overview of the area. In this section, we briefly sketch out some of the dimensions characterizing such an overview. We do so in terms of some

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 182

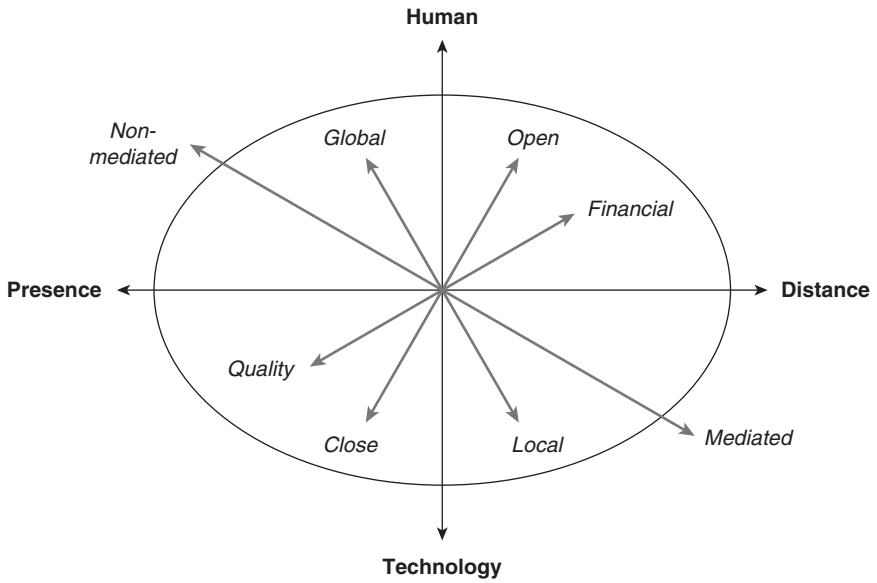

Figure 7.1 *Using new technology in learning and teaching: conceptual dimensions and tensions*

of the important polarities that have come to describe much of the development and discussion.

Figure 7.1 illustrates this conceptual overview in terms of two categories. The first category describes two broad dimensions, emphasizing 1) the technology *v.* human character of this approach to learning and teaching; and 2) its critical role in expanding the physical and geographical 'distance' between teacher and learner. The second category consists of a number of pairs of conceptual tensions which have been associated with new technology.

Engagement and dialogue

The use of technology should not necessarily be associated with increases in distance; much of this new technology enhances traditional face-to-face learning and teaching. Recent technologies, however, have been increasingly associated with their ability to achieve effective teaching and learning at a distance, providing access to expanded and more diverse communities of learners.

These two dimensions are often erroneously conflated. 'Human' is habitually associated with being physically present and technology is increasingly associated with learning at a distance. This association undermines the

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 183

essential 'human' quality of teaching. There is no intrinsic reason why the lack of physical presence should be dehumanizing. The telephone, for example, is almost a universal distance technology and is advertised as a 'humanizing' instrument. Take time out to call a family member, a friend, just to talk. Some people also find it easier to 'open up' and 'speak' with the use of technology. As Hensley (2003) has suggested, too:

> *Technology works best when it is used not as a device to get to some place but, rather, as the destination itself. Technology as a destination is not the only environment for learning, but it is effective as a learning environment when it is applied to the process of learning as the learning place.*

The conflation of these two dimensions can also easily be associated, if we are not careful, with another pair of terms: transmission *v.* engagement models of teaching. It does not take a huge leap of the imagination to see that, if presence is conflated with the 'human', human engagement will follow closely behind. Similarly, conflating distance with the technology consigns engagement to face-to-face modes of teaching, linking new technology to transmission modes of teaching. This would be a critical mistake and undermine its effective use as a mode of teaching.

The 'human' aspect of interaction rests ultimately on why and how we use technology. Its effectiveness in improving learning will depend on whether teachers use it genuinely to engage with students in an intersubjective dialogue of shared meanings or whether they regard it as a medium for transmitting content and through which the student can be avoided.

Aravamudan et al. (in press), for example, found that novice instructors understood the integration of technology as either content-oriented (with the focus on the students' acquisition and organization of course content) or process-oriented (with the focus on the students' ability to collaborate or communicate with others, or to enhance their students' learning). And Ellis et al. (2008) reported contrasting teacher conceptions and approaches to the use of learning technologies ranging from tools for access and information delivery to ways of providing interactive learning opportunities and assisting student to build knowledge. The development of genuine 'human-presence-at-a-distance' engagement is the main challenge that the growth of this new technology presents to learning and teaching in higher education.

Roberts et al. (2007), moreover, found that the meaningful and engaged adoption of new technology in their teaching was determined by a range of factors. Social factors (e.g. peer support, shared values in the department,

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 184

friendship networks and student perceptions), physical resources (e.g. ease and reliability of technology) and personal factors (e.g. interest in enhancing student learning, interest in improving teaching, interest in instructional technology) were all very important in the decision to adopt new technology in teaching. Engaging students in meaningful dialogue and learning experiences with new technology often requires meaningful development and change in teachers, their departments and the institutional resources available.

A set of tensions

These two dimensions are supplemented in the framework by a set of 'tensions' that are not confined to the sphere of new technology, but are highlighted by its expansion. They include:

- financial *v.* quality considerations;
- the global *v.* the local classroom;
- open *v.* closed learning; and
- technology-mediated *v.* non-mediated communication.

This set of tensions is not an exhaustive or defining list. It illustrates the more general themes associated with the development and use of new technology in learning and teaching. There are other closely linked and more specific tensions – such as synchronous *v.* asynchronous learning – which we shall discuss later in the chapter. While we shall briefly consider the above themes individually, as we shall see, they closely intersect one another in a variety of ways and in a variety of different social, cultural, political, institutional and disciplinary contexts.

Financial v. quality considerations

Perhaps the most widely and recently voiced arguments for investing in and developing new technologies in higher education have centred on financial considerations. Financial and efficiency rationales are often a significant force behind the increasing development of flexible strategies integrating new technology within more traditionally taught, face-to-face programmes and courses (Kirp, 2003).

It is clear, however, that the use of new technology is not yet as cost-effective as some might wish it to be. There are substantial upfront investments in the technology, course preparation, teacher training and support, which cannot necessarily be spread over long periods of time as

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 185

each of these needs to be updated regularly. While it provides opportunities to access new markets, real cost savings and other gains in these areas often come at the expense of educational quality (Hannan, 2005).

The global v. the local classroom

The tension between financial and quality considerations intersects here with issues of access at both a global and a local level. While the benefits of new technology – through both its distance and technology dimensions – provide access to both a wider number and diversity of students, accessibility is also paradoxically constrained by these dimensions (Conceiçáo, 2007). They can open the learning and teaching environment and close it down.

The very technology itself, for example, excludes those persons with no or little access to the relevant technology. It also excludes those without the relevant technological skills, people who are not technologically literate. This is particularly acute in many third-world nations where the technology and the associated training are expensive and limited. This may also be true in the local context, even when used alongside traditional face-to-face courses, but particularly when aimed at students at a significant distance.

Open v. closed learning

If the means of studying becomes highly technology-centred – to the point where it is critical to successful completion of the course – more traditional students may also find the course closed to them (Conceiçáo, 2007). This tension of open *v.* closed learning environments which has been a feature of new technology from the beginning extends also to issues of academic, language and cultural considerations.

While new technology opens access to courses previously limited to face-to-face delivery, access is usually only open to those students who have an adequate command of the delivery language and who meet the prerequisite academic standards for entry. This need not always be the case – auditors pursuing open independent study may be permitted access as in many traditional courses – but it requires careful consideration.

Technology-mediated v. non-mediated communication

The fourth tension of the conceptual framework concerns the growing distinction between technology-mediated and non-mediated communication and knowledge. The mediation of information and of the modes of human exchange between teacher, knowledge and learner through new technology transform the nature of both information/knowledge and of human exchange (Watts, 2003b; Conceiçáo, 2007). This does not limit itself to the

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 186

skills of using new technology, but includes closely associated ways of 'writing' to and 'reading' from it – and ultimately of thinking.

What is important in mediated communication is 'that intellectual energy must be devoted to the real task at hand. What matters is no longer to massively store facts, but to sort them, integrate them and reveal their relationships' (Moro, 1997: 73). The learner is empowered to choose that 'knowledge' that is relevant, useful and appropriate and is liberated from the necessity of having to accumulate and 'store' it. Mediation in this context contributes significantly to more autonomous and independent learners: 'Work with new technologies invariably involves the delegation of responsibility to learners and successful learning outcomes will depend on learners' ability to work independently and autonomously from the teacher and, increasingly, to take control of the learning process themselves' (Noss and Pachler, 1999: 205).

Such claims, however, need to be tempered by the potential loss attributed to technological mediation. These include suggestions that technology contributes to the breakdown of linear, narrative thinking, of traditional notions of knowledge and truth and associated losses of quality and standards. It has also been argued that technology can diminish our sense of community and undermines our fundamental assumptions regarding identity and free will (Watts, 2003a). As Watts (2003a) suggests:

> *Contrary to the enthusiasts who declare immersion to be inevitable, like the bee's immersion in the life of the hive, technology can be a catalyst that implements our free will. We do have a choice about whether and when to log on, or what to do when we get there. So free will and individual moral responsibility are not virtues that can be ascribed only to Luddites, any more than they are quaint notions to be left behind by the enthusiastic explorers of cyberspace. Responsible choices will lead us into some quarters of cyberspace, and they will lead us out again, enriched, instructed, and better equipped to be agents of constructive change.*

In addition, the very global character associated with new technology has been attacked as contributing to a global homogenization of education, undermining local education initiatives and, even, of generating a new version of imperialism and colonization by western values (Spring, 2008). These potential risks, as well as the enormous benefits of using new technology, present a challenge to teaching in higher education. It is a challenge we should neither ignore nor uncritically pursue. This conceptual overview provides a general map of some of the broad issues underlying

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 187

these benefits and dangers, many of which we shall be returning to later. In the next section, however, we should like to address the kinds and range of available technologies themselves.

INTEGRATING TECHNOLOGY INTO TEACHING AND LEARNING

Given the rapid developments, adaptations and subtle variations in the range of technologies that can be used for pedagogical purpose, we will only be able to touch the surface of the wide and diverse range of the technological possibilities available to teachers in the space available. These technologies are the subjects of continuous research and change. Generally, however, we can group them usefully by their common application and integration into teaching and learning. Although they may overlap, these categories and technologies include:

- organizing course content;
- engaging students;
- fostering communication; and
- assessing learning.

Organizing course content

Course management system

One recent and substantial innovation for instructors hoping to organize and maintain their courses more effectively is the course management system (CMS). While the specific features may vary, most systems provide instructors with basic administrative and record-keeping tools. Most contain course rosters, including relevant student and instructor details, and offer space for instructors to post course materials, assignments, audio and visual materials, and links to websites and other resources, as well as to record attendance and grades (Bongey, 2005). They offer faculty a really rather comprehensive opportunity to providing support for student learning.

As the features of the CMS develop, so too as have how students access and use the system, expanding interpersonal support and encouraging independence. Stephens (2005), for example, has his psychology students use wireless laptops in class to connect directly to the course website during class so that they can organize course information, assignments and materials, and connect their own notes to the class outlines more effectively.

While the CMS may be used most regularly for administrative or management purposes (Morgan, 2003), many instructors are taking more

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 188

advantage of other features offered by the system, in order to support learning, by using online quizzes, discussion boards, peer grouping and other assessment measures (described more fully below). McGee and Leffel (2005), for example, used the CMS to promote ethical decision-making in a business ethics course, which offers both intellectual and social support and promotes independence.

PowerPoint

Essentially replacing transparencies and overhead projectors, slides and carousels, PowerPoint – the most well-known and ubiquitous of presentation software – is almost synonymous in higher education with lecture and organization. In its most basic application, PowerPoint can easily convey the instructor's key points in bullet-point fashion, while at a more sophisticated level can link to interactive websites, play video-clips and manipulate images through custom animation.

Faculty can also provide the slides to students, either as handouts or electronically, before or after the class. This may be valuable for students, especially if they missed a class, but, of course, the instructor needs to make sure that the slides do not make him, or the textbook, obsolete. He might opt to leave some parts of the slides out to ensure that students fill in the missing areas and construct meaning.

Even more importantly, while using PowerPoint has great potential for providing intellectual support, there is danger, too, if the professor simply uses PowerPoint to transmit vast amounts of information to her students, or if she gets so enthused with its tricks and gimmicks that she loses the interest of her students. Despite these concerns, skilful and innovative uses of PowerPoint can, however, be used effectively to improve student learning in the classroom (Craig and Amernic, 2006).

Engaging students

Personal response systems

Instructors from a wide range of disciplines have increasingly sought to engage students through wireless handheld response systems, commonly called personal response systems (PRSs) (known also as student response systems, individual response systems or, more colloquially, as 'zappers' or 'clickers'). The variety of ways that the PRSs can be used is extensive and ever growing. At its most basic level, the PRS can be used simply to determine attendance but, at a more sophisticated level, the PRS can be used to poll students instantly about their attitudes, conceptions, beliefs and

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 189

knowledge in a particular area or about a specific topic (Barrett et al., 2005), providing intellectual support and encouraging independence.

It can also be used to predict student answers, provide feedback, build student consensus and assess learning, either among individuals or in groups (Barrett et al., 2005). Bode et al. (in press) report on the positive impact of using PRS technology to promoting interpersonal interaction and learning in the teaching of calculus by giving one 'clicker' per group rather than per student. Since student responses can also be kept anonymous, an instructor may also the PRS as an evaluation tool, to gauge teaching effectiveness or to determine student satisfaction about the course or instruction.

This resource can be invaluable, particularly in large lecture settings, where hundreds of students can be easily polled, and the responses tabulated and available for viewing within a matter of seconds (d'Inverno et al., 2003). While simply using PRS does not mean that learning will enhance learning – indeed, a recent study has shown that there is no clear difference between the learning that happens with PRS and that associated with low-tech flashcards (Lasry, 2008) – the PRS has been shown to help engage and interest students in the topic at hand (Martyn, 2007), although its effectiveness likely depends on how the system is used or the types of questions asked (Morling et al., 2008). Moreover, student responses can also be readily stored and retrieved, which allows instructors the option of comparing student answers over time (Lasry, 2008). Box 7.1 explains how one biology professor used the PRS in her large lecture class.

Box 7.1 *Case study: using 'clickers' in class*

Elsa, a professor of biology, was dissatisfied with the level of student engagement in her large lecture class. Mostly passive, her students rarely responded to her questions. To make her course more interactive, she began to use a personal response system – clickers – in her large introductory biology classes. The clickers allowed Elsa to track both individual and group responses to the questions that she posed, but also, as she soon found, they provided her with immediate feedback on her students' learning.

To maintain student interest and to stimulate them intellectually, she varied the types of questions and the activities associated with each question. The questions allowed her to address misconceptions, gauge students' prior or current knowledge of a subject, or to test assumptions or hypotheses. Sometimes, she has her students work together in teams to solve problems collaboratively, sharing one clicker between them. At other times, she asks her students to respond individually and then predict or hypothesize the class responses. By first deciding on a response, and then being able to compare that response with those of their peers, students can assess their own knowledge. Moving beyond the clickers, Elsa often uses the responses as a starting point for more discussion or as a means to clarify lecture content.

Wikis

Another recent innovation with significant pedagogical potential is the wiki. A wiki is a communal, collaborative web-based application which allows

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 190

students to contribute and edit information, collectively building a website on a given subject or set of subjects. Wikis usually allow students to pose questions to one another about the material, as well as comment and revise one another's work.

While there may be some questions about the attribution and understanding of authorship, and how 'accurate' the knowledge created is on a wiki site (Calkins and Kelley, in press), as a pedagogical tool, the wiki has great potential for offering personal and social support of the students' learning, facilitating independence and self-directed learning, and promoting interpersonal and social interactions among students.

GPS applications

An interesting innovation to engage students and support student learning is the use of Global Positioning System (GPS) software, used most often in a lab or field setting. Used most commonly in the geological sciences (so far), students use tracking devices (even their own mobile phones, in many cases) to locate and report the position of different objects (Johnson and Guth, 2002). Students could track, for example, certain types of rocks and then log the information into a central database that tracks plate tectonic shifts. Such innovations can offer practical support and help students to work both independently and collaboratively in groups.

Fostering communication

Email

Email is by far the easiest and the most commonly used communication technology in developed countries where almost all faculty and increasing numbers of students have extensive access to it. Teachers normally tend to use it for one-to-one exchanges with students concerning a range of issues and questions regarding a student's individual study. The facility for attaching documents to email messages is also being used more extensively. In addition, email systems afford the possibility of one-to-many exchanges between teacher and students and of many-to-many exchanges and interactions between students, and can be used in conjunction with many of the other technologies, such as course management systems, described above.

Computer-conferencing systems

Discussion boards, chat rooms and blogs also provide opportunities for students to develop discussion groups and subgroups on a variety of aspects and issues of the course. These may be formally structured around specific

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 191

course assignments, individual and/or group projects and tasks or more informally established and free-ranging group discussion, including real-time chat rooms. In some cases they may require additional client software but can also be effectively established within existing email systems (Pincas, 1999). In addition, course websites and bulletin boards accessed through the Internet provide students access to a range of textual material, such as course and programme details, readings, handouts, notices and so on.

Podcasting

Developed in 2004, podcasting is another new technology whose potential has not been completely realized. At this point, instructors seem mainly to use podcasting to post their lectures to the web, which benefits students by helping them access missed coursework, reinforce difficult course concepts or review for an exam, and which benefits instructors (potentially) by minimizing the re-teaching of a lecture and providing the opportunity to reflect on teaching practice (Roberts, 2008). Podcasts could, however, be used to supplement the course lecture with additional material or to assess student learning by asking students to create their own podcast as a class project (Roberts, 2008).

Digital-based systems

Digital, video and audio-based systems vary in term of the degrees of the complexity of the technology that may be involved. They range from using videos, audios and DVDs in class, to the more advanced use of conferencing systems for interactive teaching. They also include the use of video on websites and related Internet sites for enhancing and providing wider resources and materials. Again, these technologies provide opportunities for multiple relationships and types of interaction between teacher and students.

There are, however, debates as to how much the visual actually adds to the learning and teaching situation, particularly with respect to the lecturer him or herself. Mason (1994) argues that video contributes to a more social and facilitative learning environment. Taylor and Swannell (1997), on the other hand, criticize the idea of video-conferencing that simply reproduces the lecture in its transmission mode as 'the tyranny of futility'. The debate, of course, raises the important issue of the human/social dimension in the use of new technology.

While access to it through the Internet is still limited for significant parts of the population, particularly in the less developed parts of the world, every passing day sees more and more people connecting up to its broad services. It is also still somewhat limited in terms of the quality and magnitude of

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 192

video and audio segments that it is easily able to deliver. Again, these are technical issues which are continuously being addressed and improved. The ability to download software programs as well as material from the Internet will permit students access to whatever range of course materials in whatever format higher education institutions wish and are able to provide.

Assessing learning

While an online environment can easily support summative assessments, such as traditional exams, virtual tools and techniques can do much to assess student learning more formatively (Rocco, 2007). Indeed, many of the assessments described in Chapter 8 can be readily modified to an online environment to gauge learning as well as the acquisition of key concepts and skills.

Online quizzes and polls

Surveys, polls, quizzes and short classroom assessments can all be administered online, either through a course management system or web-based survey software (Ko and Rossen, 2004). While traditional paper-and-pencil quizzes can also assess learning, there are benefits to asking students to submit responses electronically, including the immediate tabulation of responses for administrative purposes, as well as offering immediate feedback that allows the student and the instructor to gauge comprehension and to predict the responses of the class.

Online intergroup peer evaluation

This method is helpful for assessing students in groups. In an online literature class, for example, students were divided into groups and then asked to comment on an element of a Shakespeare play. Each group can then post critical responses to two other groups, in round-robin fashion (Rocco, 2007) (see Chapter 8 for more details on this type of method). Both the critiques and the responses can serve to help all the groups identify and learn from their collective strengths and weaknesses.

Electronic portfolios

Through web-based software or course management systems, students can use electronic portfolios as a virtual space to compile their course or practical work. These materials might include critical reflections, practice pieces, peer and self-feedback, revised and final drafts or reports. Students and the instructor can follow the student's progress and development as a learner (Jones and Harmon, 2002).

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 193

Simulation

In medical and health-related fields, it is increasingly common to use computer-generated simulations to assess student performance, knowledge and decision-making. In highly sophisticated simulation settings, for example, computer sensors can track a med student's movements and register appropriate pain responses, making it clear whether the patient has been caused undue pain or suffering, without having had to practise on real patients. And, in a meta-analysis of 32 studies, McGaghie et al. (2006) found a strong association between time spent on high-fidelity medical simulations and achievement of learning outcomes.

Synchronous and asynchronous learning

Most scholarship and research on the use of technology in learning and teaching make a widespread distinction with respect to time. If technology provides a more flexible approach to space in its ability to transcend distance within learning and teaching, it also provides a more flexible approach to time. The main distinction here revolves around synchronous interactions in teaching/learning and asynchronous interactions.

In synchronous interactions, teacher and students are present at the same time in the learning environment. The advantages of this kind of interaction are usually described in terms of social and human 'presence'. The fact that the situation is actually 'happening' in 'real time' focuses group energy, cohesion, feelings of community and decision-making. It permits more 'authentic' dialogue, including issues of tone, nuance and emotion, and allows for immediate comments and 'feedback'. It also provides support, discipline and motivation for students to keep up with the course and the group pace.

Asynchronous interactions, on the other hand, are often seen in terms of the student's more personal learning. It provides students with flexibility as to when they access the course materials. It allows them opportunities for going back over and working on the materials both at their own pace and at their convenience. It also provides time for reflection on the material and for integrating it within their working and/or home environment.

The synchronous–asynchronous division is, of course, not unique to the use of new technology. It has always existed. Contrast, for example, the immediacy of lectures and seminars with the asynchronous reading and study which students have traditionally done outside the classroom. For all its advanced paraphernalia and wizardry, new technology does not extend the basic types of human and social interactions through which teachers and students have traditionally engaged (Table 7.1). It does, however,

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 194

Table 7.1 *Types of human and social interactions in teaching and learning*

Types of Interactions	Traditional	New technology
Teacher–learner	Tutorials	Email, voicemail
Teacher–learners	Lectures, seminars	Course management system, video-conferencing, personal responses system seminars
Learner–learner	Projects/lab work	Discussion boards, wikis, blogs, chat rooms
Learner–material	Books, journals, etc.	Websites, CDs, DVDs, podcasts
Learner–others	Open/public lectures	Internet, podcasting

extend and enhance the potential of those interactions for addressing the 'learning matrix'.

EXTENDING THE MATRIX

In terms of the learning matrix, the development and use of new technology are most commonly characterized by an *independence* context of learning and teaching. It involves, as we mentioned earlier, the delegation of responsibility to learners and is highly reliant upon their ability to work autonomously and independently from teachers. While it provides opportunities for developing *interpersonal* contexts, it is probably least effective at present for students requiring highly *support*-oriented contexts. A significant number of students who take courses that are primarily self-paced and asynchronous end up contributing rarely, and quickly falling behind with exercises and tutorials.

The optimum student profile for *independence*-structured courses employing large degrees of new technology will be those who are highly motivated independent learners, good at self-pacing, employment focused, computer literate and interested in technology-mediated environments (Conceiçáo, 2007). This should not exclude other students who do not match this profile from profiting from new technology. It does suggest that teachers designing courses offered to students who require more support will need to recognize the potential pitfalls when developing their designs. One of the chief challenges to the future expansion of the use of technology in learning and teaching will focus precisely on this issue – devising more clearly developed systems for supporting students online (see below).

Before we look at some of the issues involved in the design, it is worth looking at the role which new technology might play with respect to the four main dimensions of our learning matrix: intellectual, practical, personal and social. Table 7.2 summarizes some of the positive and negative attributes with respect to these dimensions.

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 195

Table 7.2 *Positive and negative effects of new technology on four learning dimensions*

Dimension	Positive	Negative
Intellectual	Promotion of interactive learning Increased written output Access to a wider range of material Opportunity for reflection/revision before contributing Access to multiple frameworks/discourses/ perspectives	Slowness in decision-making Less reading Reduced feedback Loss of impetus to reply
Practical	Acquisition of computer skills Opportunities for 'learning by doing' Management of multiple perspectives Language skills enhanced through activity in the new technical and disciplinary 'literacies'	Over-focus on computer and keyboard skills at the expense of others
Personal	Removal of time and space constraints to learning Opportunity to take control of one's learning Empowerment of learner Opportunity to develop self-skills: self-discipline, self-motivation, self-confidence, self-disclosure	Contextual deprivation Information overload Techno-stress Dehumanization of learning Aloneness factor
Social	Opportunity for dialogue with wider groups Increased collaboration between teachers and learners and between learners Increased participation by minority groups Opportunity to develop multiple 'voices' within rapidly changing discourses	Need for a skilled moderator to facilitate (or control) dialogue 'Flaming' Lack of accountability Reinforcement of existing inequalities

Source: Adapted from Peterson, 1997

Many of the negative effects associated in Table 7.2 with the use of new technology are concerned in some way with losses related to face-to-face human contact. Thus 'flaming', or expressions of rage and the use of inappropriate language, linked to feelings of anonymity, isolation, 'techno-stress'

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 196

and information overload, are less likely to occur in face-to-face situations. The human aspect of communication needs to be emphasized.

On the other hand, this technology offers positive learning experiences for students along all four learning dimensions. It is also worth stressing the potential it offers students for developing capacities to engage with and manage rapidly changing multiple frameworks. This includes both different ways of thinking about a discipline or subject, or even multiple subjects, and developing diverse ways of handling the varied 'knowledge' and 'understanding' associated with these range of frameworks. The comprehensive access to a wide range of frameworks afforded by new technology (including its own developing discourses) provides a platform for teachers to challenge their students.

DESIGNING FLEXIBLE COURSES

In designing a flexible course, it is critical to explore beforehand the extent of the role which new technology might play in delivering a course's overall aims and objectives, including, where appropriate, the negotiation of those aims and objectives with the students. Which aspects of the learning matrix will it focus on and which aspects are better left to other forms of teaching? And how will this be integrated with the rest of the programme? Will the use of technology play a relatively minor role, providing, for example, social support – e.g. social chat rooms for informal discussion between interested students – with a reduced role for delivering on intellectual and practical objectives? Or will it play a substantial role in delivering aims and objectives encouraging the intellectual, social and practical independence of students by integrating, for example, online seminar and project groups with video-conferencing, extended website materials and so on?

How elaborate such a programme should be will depend to a large degree on the institutional resources available (Hannan, 2005). More specifically, the evidence available from experienced practitioners suggests that online courses need to observe a number of indispensable principles:

- Staff and students are trained in the relevant technology.
- The course is clearly structured.
- The course provides access to collaborative activities.
- The course both caters to individual and group student needs.

Relevant skills training

While the first of these appears obvious, teachers and course designers often underestimate its importance. Basic skills are often assumed, as are

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 197

skills in more than one technology. Students, themselves, are often not the best judges of their own abilities, frequently not realizing the complexity of either the technology or their own access to that technology. Many teachers and faculty members also mistakenly assume they have the requisite skills for a course to which they have agreed to contribute.

Many courses recognize that not all students will have the whole range of technological skills at the outset of a course, including, crucially, the collaborative and team-working skills associated with technology-mediated programmes. Therefore, many programmes now integrate training and development in the relevant educational technologies alongside the actual content of the course.

Course structure

Technology-mediated learning needs substantially more structure than was originally assumed. Mere access and arranged provision for discussion groups, for example, are not sufficient to develop a shared sense of community or substantially to engage all students. While some may actively thrive, other students lurk, remaining in the background, observing without actively contributing. In addition, unstructured or under-structured discussion groups without the 'presence' of the teacher often lack rigour, leading to a corresponding reduction in the quality of the learning.

Collaboration

Ways of providing structure centre primarily on the organization of online groups and might include:

- setting collaborative tasks for students in pairs or small groups;
- establishing discussion groups around specific topics, readings, activities;
- assigning a specified number of students to groups to prevent overloading;
- reviewing group composition and changing composition if necessary; and
- providing opportunities for peer leadership and facilitation.

Balance

In designing group work, teachers will always need to strike a balance between the level of structuring involved and the flexibility it provides for the student. In this, Pincas (1999) suggests that the main factors to take into consideration are as follows:

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 198

- There is a purpose and good reason for working as a group.
- The students understand a specified outcome at any stage.
- There is a facilitator (usually the tutor but occasionally a student).
- There are options (as far as course regulations allow) – e.g. the time in the week when they do their work, the length of required work, the number of contributions expected, the knowledge they bring and so on.

Guidelines

Finally, as with traditional courses, it is important to give students clear information and guidelines about the programme or course, especially the relationship between online and non-online elements:

- What, for example, are the overall aims and objectives of the programme?
- What are the primary methods of delivery and the methods of assessment and evaluation?
- What is the credit rating of the programme?
- What provision is there for student support, advice and counselling?
- What access to technical support and help-lines will be available?
- Are there any hidden costs associated with provision?

Two key areas unique to online provision which will need to be specifically spelt out concern guidelines for:

- face-to-face contact that students might expect and/or be entitled to; and
- encouraging students to consider fully, in the light of a full programme description, how they will organize and adjust their study and approaches to study to the requirements of the course.

Are they fully prepared to engage with the course intellectually, practically, personally and socially, given its particular parameters?

CONCLUSIONS

Many commentators exploring developments in technology to enhance learning and teaching in higher education have focused on three essential features it offers. These include its potential for developing learner-focused approaches to teaching; its capacity for promoting collaboration and team-work; and its central role in encouraging autonomous, independent learners. These features are not unique to new technology but, rather, powerful outcomes of its imaginative and innovative use.

Light & Calkins-3857-CH-07:Light & Calkins 2/10/2009 7:16 PM Page 199

Innovation, here, does not therefore simply rest in the new technology, nor does it arise through its educational application. It consists, rather, in the new and creative ways in which technology can be used to develop, support and extend student learning in the myriad ways described by the 'learning matrix' described in Chapter 2. Innovation embraces a wide and diverse range of inventive and resourceful 'flexible' strategies for integrating traditional and new methods of educational delivery. It appreciates the intrinsically 'human' character of technology as being essentially concerned with the development of 'dialogue' and community.

Finally, however, it recognizes that new technology is not another way of extending educational delivery, but is itself a defining cultural and social feature of our increasingly unpredictable, changeable and contestable world. Its very application is now a necessary part of higher education's role in preparing students for the culture and challenges of the future, as it rapidly becomes the present. In this way, innovation, itself, becomes 'knowledge content' in the higher education curriculum – its very use a model for students critically and creatively to reconstruct for themselves through their own learning.

Final questions: while thinking about integrating technology into their teaching at the broad level, teachers might ask themselves: how do the different tensions surrounding the use of technology play out in my teaching context? How may I seek to resolve or reconcile these tensions? What types of technology, for example, might best meet the learning goals of the course? But, more specifically, they may want to reflect: why am I opting to use this innovation? How do I ensure that I am not just adding 'bells and whistles', which may look stunning but have no impact on learning? Is the innovation actually hindering or helping learning?