Section II

The Transformation of Teaching and Learning at a Distance

Introduction

Terry Evans

Section 2 concerns the ways in which teaching and learning at a distance is being transformed in various international and practical contexts. Arguably, distance education has been characterised by transformation since its earliest correspondence days through to the integration of online media. Tony Bates pursues this latter theme in his opening chapter for the section where the range of new media and their implications and transformative features in distance education and from distance education to mainstream educational practices are discussed.

Distance education, however, is not merely educational which is particularly mediated by communications media; it is also an approach to education in which the educators, designers, support staff and students are engaged differently and often for purposes that have particular social and policy imperatives. As Liz Burge and Jody Polec argue, there are elements of change and consistency for the people involved which can be tracked through the evolution of distance education from its inception. Chère Campbell Gibson explores the ways in which non-formal education in the United States have been transformed by both new technologies and the changing circumstances and needs of the population for non-formal education, especially as lifelong learning.

At a large institutional level, arguably one of the major educational changes of the twentieth century was the conception, in the United Kingdom, of an "open university" and its subsequent development into a form which became one of the most important agents for educational change and educational provision in higher education. Otto Peters's chapter reviews the steps which led to these fundamental transformations in

the provision of education at a distance to millions of people worldwide through that became 35 open universities. To a large extent, these 35 universities have focused on post-school courses, especially undergraduate diplomas and degrees, often followed by coursework masters degrees. Terry Evans considers doctoral education at a distance which has developed, either explicitly or in a de facto sense, both within distance education institutions and in "traditional" universities. This chapter deals with the courses that lead to the highest qualification offered by universities and which are substantially, or entirely, based on the students' own research.

Christine Spratt draws on her own doctoral research in a dual-mode university to explore the tensions that surround the technological change and structural changes as they are experienced by the teaching staff. This chapter shows that the critical intent of much intellectual and pedagogical work in universities sits uneasily with corporate approaches to the implementation and operations of computer-based learning systems that are created from corporatist ideological positions. Katy Campbell and Susan Gibson consider the ways in which assessment has evolved in both education and distance education to measure, sort, distribute and "gate-keep" individuals. They consider the constructive purposes to which assessment can be marshalled in distance education in order to enhance learning.

Peter Macauley and Rosemary Green present an overview and analysis of the development of library and information services in distance education. The impact of new media and technologies on the dissemination, storage, searching and access to knowledge is considered. The connections between these developments and the related technological changes in distance education enable different possibilities for the integration of knowledge management into distance education. Brian Pauling's chapter takes a complementary line through his exploration of the ways in which the new technologies have radically altered the mass media, and the nature of human engagement with the media is a globalising context. The consequences and potential for distance education and its mutations in education are considered.

David Harris closes the section with his critical essay on the transformation of teaching and learning in distance education. He explores the nature of the human and political interests involved in changes to distance education. Using various ideas from social theory, he focuses on specific examples, such as assessment and technology to analyse the transformations in distance education.

Chapter 12

Transforming Distance Education Through New Technologies

Tony Bates

12.1 INTRODUCTION

Technology has always been a defining feature of distance education. Each of the major developments in distance education has been strongly linked, if not driven, by advances in technology. This chapter examines the ongoing, dynamic relationship between technology and distance education.

12.2 THE IMPACT OF TECHNOLOGY ON THE ORGANIZATION OF DISTANCE EDUCATION

Distance education has gone through several stages of development.

Taylor (1999) has proposed five generations of distance education:

- correspondence education;
- integrated use of multiple, one-way media such as print and broadcasting or recorded media such as video-cassettes;
- two-way, synchronous tele-learning using audio- or video-conferencing;
- flexible learning based on asynchronous online learning combined with online interactive multimedia;
- intelligent flexible learning, which adds a high degree of automation and student control to asynchronous online learning and interactive multimedia.

The progression through these stages of development has been driven mainly by changes in technology and educational theory. At the end of the 1980s, Nipper (1989) and Kaufman (1989) identified three generations of distance education. The first generation is characterized by the predominant use of a single technology, and lack of direct student

interaction with the teacher originating the instruction. Correspondence education is a typical form of first-generation distance education, although educational broadcasting is another version. Correspondence education makes heavy use of standard textbooks and the use of a contracted correspondence tutor, who is not the originator of the learning material and often works for a commercial company. Students, however, take examinations from accredited institutions.

Second-generation distance education is characterized by a deliberately integrated multiple-media approach, with learning materials specifically designed for study at a distance, but with two-way communication still mediated by a third person (a tutor, rather than the originator of the teaching material). Autonomous distance teaching universities, such as the British Open University, are examples of second-generation distance education. Second-generation distance education is based on specially designed correspondence texts, combined with standard textbooks and collections of readings from academic journals, and supported by television and/or radio programming. Open universities and distance education units in dual-mode institutions have been associated more with systems-based and behaviourist or cognitive-science approaches to learning. These may be considered more teacher-focused and "industrialized", in that all students get the same material, resulting in considerable economies of scale.

Taylor's third generation (two-way, synchronous tele-learning using audio- or video-conferencing) is based on replicating as far as possible the classroom model through the use of synchronous interactive technologies, such as video-conferencing, and relies heavily on lecturing and questions. This model of distance education is often used by multi-campus institutions, because it saves travel time between campuses for instructors. However, it provides relatively small economies of scale, and little flexibility for learners, because they still have to attend a campus at a set time, and the average cost per student tends to be high. Nevertheless synchronous teleconferencing is popular because instructors do not have to change or adapt their classroom teaching methods to any extent.

Taylor's fourth generation (Kaufman's and Nipper's third generation) is flexible learning based on asynchronous communication through the Internet and the World Wide Web (online learning). This model enables increased student–teacher and student–student interaction at a distance, collaborative group work, flexibility for learners to study anywhere at any time, and economies of scope, in that courses for relatively small numbers can be developed without high start-up costs. However, to exploit the educational advantages and to control costs, the design and delivery of asynchronous teaching must be different from both traditional approaches to classroom teaching and the large-scale design of open university programmes. Kaufman (1989) characterizes this as a progressive increase in learner control, opportunities for dialogue, and emphasis on thinking skills rather than mere comprehension.

Taylor's fifth stage is still experimental, and applied mainly in his own institution (University of Southern Queensland).

Although these are useful classifications of the technological and educational development of distance education, the situation on the ground at any one time is much

more complex. Building on other studies by Cunningham (2000), Dirr (2001), Ryan and Steadman (2002), the Association of Commonwealth Universities (2002), and the OECD (2005), Bates (2005) provided an extensive analysis of the impact of technology on distance education organizations. He identified six main types of distance teaching organizations in operation in 2003:

- public autonomous distance education institutions;
- dual-mode institutions;
- for-profit distance education institutions;
- partnerships and consortia;
- workplace training organizations; and
- virtual schools.

Distance teaching organizations were using a wide combination of technologies, and there were many different variations on the basic six models. Bates concluded (p. 36) that "the most striking result from the analysis is the diversity and volatility of distance education in 2002–2003". Bates identified thirteen different types of distance education organization in 2003, nearly all resulting from experiments with Internet-based delivery.

Bates (2005) also noted that although private universities such as the University of Phoenix Online and Jones International were relatively successful and sustainable, focusing on niche markets and strong business models, nearly all the spin-offs from not-for-profit universities, such as New York University Online and e-Cornell, had "crashed and burned". His analysis also suggested that consortia "seem too cumbersome to work", although "smaller, simpler university to university partnerships, such as the one between UBC and Tec de Monterrey, where just two partners work together to provide a joint international degree" appeared to be more viable.

Bates also found (2005) that in 2002–2003, in the public sector, print and broadcast-based distance education still accounted for almost ten times more distance students than fully online programmes (5 million to 600 000). Bates pointed out though that

> Trends are more important than the actual figures. The overall trend is towards more online courses and fewer print-based courses in distance education. Private suppliers of online learning are increasing. Distance education continues to grow in the public sector, but more slowly than . . . [the] rapid growth in the use of e-learning for company training and [for] support[ing] classroom teaching on university and college campuses.

Bates also commented that

> unlike the 1970s and 1980s when governments created large national autonomous open universities, governments have generally been reluctant to create new post-secondary institutions that are fully online (the Open University of Catalonia is an exception). Instead, governments have tended to encourage consortia of existing conventional universities and colleges moving into online learning for the first time. We have seen though that conventional institutions and consortia have not in general been successful in widening access, increasing quality, or becoming financially sustainable

> through the use of online learning. There certainly seems to be an opportunity for political parties to make their mark by creating new virtual institutions designed from the beginning to exploit fully the potential of the Internet, possibly through a public private partnership.

Finally, Bates commented on the growing role of the private sector in distance education, again mainly as a result of moving into Internet-based delivery.

> The private sector now accounts for almost half of all distance learning globally, mainly through company training. In terms of formal post-secondary education, though, the private sector impact is still quite small, though growing. The large numbers still come from the national autonomous open universities, which account for approximately four million students. [Another million distance learners are in dual mode institutions].
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> However, private sector university and college distance education will probably continue to grow rapidly, especially in Mexico, Brazil, Chile, China, Malaysia, Korea, India and other newly emerging economic powerhouses, where influential and impatient middle classes are increasing faster than the provision of good quality public sector education. Much of this private sector expansion of distance education in these countries will be online.
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> In poorer countries, and for the poor in rapidly developing countries, the large public sector print- and broadcast-based autonomous open universities will continue to be important.

In summary then, the following conclusions can be drawn:

1. Technology has a major impact on the organization of distance education; as new technology develops, new organizational models develop to exploit better the new technology.
2. The large autonomous distance education universities have moved more slowly than conventional institutions and the private sector in adopting the Internet for teaching purposes. This is mainly because of structural rigidities in the large autonomous distance teaching universities due to heavy prior investment in print and broadcast technologies.
3. Although in 2003 in the public sector students in print- and broadcast-based distance education programmes far outnumbered students in online distance courses, nevertheless the trend is towards more online courses and fewer print-based courses, although for large enrolment courses and for students with poor access to the Internet, print- and broadcast-based programmes will remain important.
4. Although conventional universities have moved more rapidly into online learning or e-learning, quality, access, and sustainability remain problematic (see OECD, 2005). Many conventional universities have failed to adopt and adapt the strategies developed by distance teaching organizations to ensure quality, increased access, and sustainability from the use of technology for teaching.

12.3 DEFINING MEDIA AND TECHNOLOGY IN DISTANCE EDUCATION

"Media" and "technology" are everyday words that we use. Their meaning tends to be taken for granted, and the terms are often used interchangeably. However, their role in education is by no means obvious or without controversy. It is important then to define more closely what is meant by "technology" and "media". This distinction becomes particularly important when the issue of whether media actually influence learning is discussed.

Kozma (1994) defines "media" and "technology" as follows:

> *Media* can be analyzed in terms of their cognitively relevant capabilities or attributes (Salomon, 1978). These include a medium's technology, symbol systems, and processing capabilities. *Technology* is the physical, mechanical or electronic capabilities of a medium that determine its function and to some extent its shape and other features . . . *Symbol systems* are sets of symbolic expressions by which information is communicated about a field of reference. . . . A particular medium can be described in terms of its capability to present certain representations and perform certain operations in interaction with learners who are similarly engaged in internally constructing representations and operating on these.
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> (p. 7–8)

Media are means of communication. They require a source of information, a means of transmitting information (including technology and symbol systems), and a receiver, that is, someone who is interested in, has access to, and knows how to interpret the communication. Thus speech, writing, drama, radio, and television programming, computer programming, and Web-based courses are all communications media. In this definition, face-to-face teaching can be considered a medium of communication, even if it does not use electronic technology. Language is the predominant symbol system used in face-to-face teaching, and classrooms, schools, and campuses could be considered the technological components.

Technologies are physical things. Of themselves, they do not communicate. Thus classrooms, books, theatres, cinemas, radio sets and transmitters, cable, satellites, television monitors, computers, computer software, and computer networks are all technologies.

While there is usually an assumption that media will use technology of some kind for the means of transmission and communication, media, though, may not be related necessarily to any specific technology. For instance, although a television programme needs to be recorded and transmitted using technology, a television programme can use several different technologies, such as digital or analogue equipment, terrestrial broadcast, cable or satellite transmission, video cassettes, or digital video disc. Similarly, computer signals can be sent by telephone lines, wireless, co-axial or fiber optic cable, satellite, or any combination. Furthermore, everyday use of the term "media" usually includes the whole organization of a communications industry, such as television, newspapers, publishing, and the Internet, thus encompassing far more than just the technology.

12.4 COMPARING TECHNOLOGIES

Bates and Poole (2003) classified media and technology in terms of the communications functions that impact on teaching and learning. They grouped the media of face-to-face teaching, audio, video and digital, and their related technologies by three main dimensions: broadcast (one-way) versus interactive (two-way); synchronous (same time) versus asynchronous (available on demand); and transient versus permanent. In terms of teaching and learning, there are advantages when a technology can combine multiple media (allowing for richer representation of knowledge), when the technology allows for interaction between teachers and learners, and when the learning material and opportunity for communication are always available to the learner and teacher (asynchronous and permanent). Thus the Internet (including the Web) is the potentially most powerful educational technology because it is the only technology that integrates all these elements, thus providing more opportunities for teachers and learners when designing the learning experience.

Does this then automatically mean that Internet-based teaching is always the best? Not necessarily. There have been hundreds of comparative studies, comparing, for instance, the effectiveness of a broadcast lecture with a face-to-face lecture, or an online course with a face-to-face course. Generally, such studies have not proved very conclusive. From Schramm (1974) through Clark (1983) to Russell (1999), analysis of these studies have shown that there are *on average* no significant differences in learning between different technologies or media (including face-to-face teaching).

The reason for this is that the technology of teaching is only one of many different variables that influence the effectiveness of learning. In particular, the *way* a particular technology is used – more accurately, its quality – is very important. Thus a poorly prepared and delivered lecture will be less effective than a professionally produced television programme – and vice versa. Well-designed teaching using any technology is likely to be effective. However, this should not be interpreted to mean that the choice of technology does not matter. It is important to look at the conditions that lead to the successful or inappropriate use of different technologies. In particular, the appropriateness of a particular technology will depend on the context in which it is to be used. Consequently, much attention has been paid to the design of technology-based teaching.

12.5 THEORIES OF TEACHING AND LEARNING AND CHOICE OF TECHNOLOGY IN DISTANCE EDUCATION

Rational approaches to the design of teaching aim to demonstrate the links between desired learning outcomes, theories of learning, and teaching method (or pedagogy) (see, for instance, Edmonds et al., 1994). This section discusses the extent to which technology developments in distance education map to changes in educational theory, and the extent to which educational theory has influenced decisions about the use of technology in distance education.

Greeno et al., (1996) have identified three broad perspectives on theories of learning:

- the associationist/empiricist perspective (learning as activity);
- the cognitive perspective (learning as achieving understanding); and
- the situative perspective (learning as social practice).

To these three perspectives I would add two more:

- the constructivist perspective (learning as reflection and dialogue); and
- the didactic perspective (learning as comprehension and apprenticeship).

Each of these main streams of theory reflects somewhat different epistemological roots, but each theory stream provides a rationale that underpins the choice of learning outcomes, the design of learning environments, and teaching methods (pedagogy).

The *empiricist* perspective has strong routes in behaviourism. Mayes and de Freitas (2004, p. 7) state that in this perspective "learning is the process of connecting the elementary mental or behavioural units, through sequences of activity". Underlying this approach is the belief that learning is governed by invariant principles, and these principles are independent of conscious control on the part of the learner. Empiricists attempt to maintain a high degree of objectivity in the way they view human activity, and they generally reject reference to unobservable states, such as feelings, attitudes, and consciousness. Human behaviour is above all seen as predictable and controllable.

The *cognitive* perspective in contrast focuses on the mental processes – internal and conscious representations of the world – that are essential for human learning. Fontana (1981) summarizes this approach as follows:

> The cognitive approach . . . holds that if we are to understand learning we cannot confine ourselves to observable behavior, but must also concern ourselves with the learner's ability mentally to re-organize his psychological field (i.e. his inner world of concepts, memories, etc.) in response to experience. This latter approach therefore lays stress not only on the environment, but upon the way in which the individual interprets and tries to make sense of the environment. It sees the individual not as the somewhat mechanical product of his environment, but as an active agent in the learning process, deliberately trying to process and categorize the stream of information fed into him by the external world.
>
> (p. 148)

The *situative* perspective puts more emphasis on the social aspects of learning by looking at the contexts in which learning takes place. For many educators, the social context of learning is critical. Ideas are tested not just on the teacher, but with fellow students, friends, and colleagues. Furthermore, knowledge is mainly acquired through processes or institutions that are socially constructed: schools, colleges, and universities. Thus what is taken to be "valued" knowledge is also socially constructed. In this perspective learning can take place through communities of practice, where learners with common needs and understandings can share experiences.

Crossing both cognitive and situative perspectives is the *constructivist* perspective. Individuals consciously strive for meaning to make sense of their environment in terms of past experience and their present state. It is an attempt to create order in their minds out of disorder, to resolve incongruities, and to reconcile external realities with prior experience. The means by which this is done are complex and multifaceted, from personal reflection, seeking new information, to testing ideas through social contact with others. Problems are resolved, and incongruities sorted out, through strategies such as seeking relationships between what was known and what is new, identifying similarities and differences, and testing hypotheses. Reality is always tentative and dynamic.

Lastly, the *didactic* perspective is based on the transmission of information by a subject expert through what Mayes and de Freitas (2004, p. 15) call "compelling explanations". This can be summed up by the professor who says to her student, "My job is to teach; your's is to learn." The learner's task is to understand and memorize the expert's knowledge and to learn by example.

It should be noted that although there is a surprising degree of agreement among educators about the existence of these five perspectives on learning, and some elaborate attempts to relate these perspectives to teaching practice and choice of technology, the position on the ground is once again much more complex. Teachers tend to mix and match these different approaches, again dependent on the context and the perceived needs of learners.

Despite this, there has been a close link between educational theory and choice of technology in distance education. Learning by association and that by behaviourism have been the hallmarks of much of computer-based learning in the workplace. Second-generation print-based distance education has been heavily influenced by the empiricist, cognitive perspective. The first UK Open University courses were based on instructional systems design. The use of video-conferencing for multi-campus teaching was usually based on transferring the didactic approach to teaching in the classroom to the video-conferencing environment. Educators such as Harasim et al. (1995) and Peters (2002) have argued that online learning is a "paradigm shift" in teaching. Harasim emphasizes constructivist approaches based on knowledge construction, collaborative learning, and problem-solving, and Peters emphasizes the development of "self-autonomy" and "lateral thinking".

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However, none of these features are unique to online learning; they can be found not only in face-to-face classroom teaching but also in cognitive approaches in second-generation print-based courses. The problem is that in practice, there is a wide variety of teaching approaches, irrespective of the technology being used. Thus one can find constructivist approaches to teaching by video-conference, didactic and behaviourist use of online learning, and cognitive approaches in classroom teaching. Technologies are generally flexible enough to accommodate a variety of approaches to teaching.

Nevertheless, in general, there is a strong argument to suggest that asynchronous online learning has considerable educational advantages over print-based distance education, provided that students have access to the technology. Certainly, the weakness of

print-based or broadcast-based distance education is the difficulty of providing opportunities for student discussion. Expensive and optional arrangements have to be made through local study centres for face-to-face interaction, and in practice these are often used by local tutors for more lecturing, rather than group discussion of the printed material. Thus web-based learning offers a better opportunity to achieve academic goals such as creative and critical thinking, knowledge construction, problem-solving, and collaborative learning than print-based distance education (but not necessarily better than classroom teaching).

12.6 A GENERAL THEORY FOR MAKING DECISIONS ABOUT TECHNOLOGY IN DISTANCE EDUCATION

Is it then the educational theories that drive the choice and use of technology? While educational theories and preferred teaching methods have a role to play, they are not the main drivers of technology choice and use. In other words, they are necessary but not sufficient guides for decision-making about the use of technology in distance education.

In 2004, the Institute of Socio-technical Innovation and Research, University of Essex, produced several online reports on effective practice in relation to e-learning (available as PDF files at http://www.jisc.ac.uk/elp_learneroutcomes.html) for the UK's Joint Information Systems Committee. These reports provide a good overview of current thinking regarding the relationship between theories of learning, educational design, and e-learning. Building on the "core" learning theories outlined by Greeno et al., (1996), the University of Essex team designed a grid that identified for each learning theory the implied pedagogies, the power balance between teacher and learners ("desirable role combinations"), learning tasks, the type of interaction, and generic learning activities (Fowler and Mayes, 2004). Using this grid, they then identified "functionality requirements for [e-learning] tools" for each of the learning theories, with general descriptions and mini-scenarios for each row in the mapping table.

The final result is a good example of the difficulty in providing satisfactory guidelines for practitioners in choosing, in this case, technology tools. The further away the analysis moves from the general theories of learning, the more unwieldy it becomes. (The mapping table stretches over twenty pages with sixteen pedagogical perspectives each with nine columns of analysis, without identifying any specific existing tools as being appropriate or inappropriate.) This resembles many of the earlier attempts by instructional systems designers to match media to learning tasks (see, for instance, Reiser and Gagné, 1983). The approach becomes too reductionist to be of value.

Also, similar to the earlier approaches, the analysis focuses only on one set of variables, those associated with teaching and learning. In one of the papers for this study, Mayes and de Freitas (2004) recognize that "many of the decisions that are taken in the curriculum design process depend on pragmatic issues that will not be directly addressed in this document". These "pragmatic" decisions include costs, technical support, quality assurance.

Research by Bates and his associates (Bates, 1995) has shown that some of these "pragmatic" factors, such as access and cost, are better *discriminators* for choosing and using technology than teaching requirements, although the latter are still important. Access and cost are better discriminators because the differences between technologies in these factors are clearer and more easily defined. As a result, Bates developed a decision-making model called ACTIONS (Access, Cost, Teaching function, Interactivity, Organizational issues, Novelty, and Speed) to help choose the most appropriate combination of media and technologies for a particular context. These are listed roughly in order of importance for distance education.

Thus access is the most important criterion for distance education. If the aim is to increase access, and students cannot access the technology, either because it is not available or they cannot afford it, then it is a useless technology, no matter how great the pedagogic benefits. Cost is a more complex factor (see Rumble, 1997, for a good overview), but the core drivers of cost (planning, development, delivery, learner support, student numbers, fixed and variable costs) are now well understood, and in particular the different cost *structures* of different technologies allow for fairly accurate prediction and accounting of the costs of different distance education technologies in different contexts.

In the ACTIONS model, teaching functions include presentational features associated with a medium or technology, the way each technology structures knowledge, and the relative facility for the technology to develop different kinds of skills. Interactivity can be seen as a subset of teaching functions, but is considered significant in its own right, reflecting the different kinds of interaction supported by different technologies. Organizational issues too are important. If an institution cannot adequately support the application of a technology then it is likely to fail. Novelty and speed are of lesser importance. In the ACTIONS model, a set of questions is asked for each factor. When each question is answered within the specific decision-making context, decision-makers then would make a decision intuitively, taking all the factors into consideration, in contrast to using a grid or algorithmic approach to decision-making.

Of course, in practice such rational approaches to decision-making are rarely followed. Typical factors that have influenced decision-making about educational technologies are as follows:

- the availability of spare broadcasting capacity (an important factor initially influencing the BBC's partnership with the UK Open University – see Perry, 1976);
- an offer from technology suppliers of free or cheap equipment or services (for instance, IBM Thinkpads for laptop programs);
- the comfort level of academics with technologies that replicate traditional teaching formats (for instance, video-conferencing); and
- the enthusiasm of a key decision-maker for a particular technology (for instance, a college president influenced by a demonstration at a trade conference).

Nevertheless, the opportunity now exists to take advantage of a growing body of knowledge about the use of technology in distance education when making decisions. These

decisions need to include other factors as well as educational theory if the right choices are to be made.

12.7 SOCIO-ECONOMIC FACTORS INFLUENCING THE USE OF TECHNOLOGY IN DISTANCE EDUCATION

Another way of looking at the synergy between technology and distance education is to step back from educational theory and rational decision-making processes, and to look at the complex relationship between technology, distance education, and socio-economic developments.

The development of second-generation distance education, and in particular open universities, was driven initially by the desire to fast-track access to post-secondary education. This in turn was linked to the desire to move from an elite to a mass higher education system (see, for instance, Perry, 1976). Government support for such initiatives stemmed from two sources, one idealistic and the other economic. The British Labour government under Harold Wilson in the 1960s was anxious to provide a second chance for many adults who had been unable to attend university because of the lack of places (only 8 per cent of the 18-year-old cohort went on to higher education in the UK in 1969). The UK Open University survived a change of government (Mrs Thatcher became the new Conservative Minister for Education in 1971) because the Conservatives saw the economies of scale that distance education based on the mass media of print and broadcasting could achieve.

In other words, as Otto Peters (1965) so astutely predicted, technology would enable the industrialization of higher education. Distance education then can be seen as leading the charge towards the industrialization of higher education, but even more significantly is also now being affected by the move to a post-industrial or knowledge-based society. It is worth tracing these developments in more detail.

12.7.1 Agrarian Organizations

In an agrarian society, a skilled worker was responsible for all aspects of the production, manufacturing, and distribution of a product or service. The wheelwright would collect the wood and the materials required, manufacture the wheel, and transport and market it himself. He would teach his son or a neighbour's son the same skills and the same methods.

Similarly, the traditional university or college teacher is responsible for all aspects of teaching, from selection of content and the method of teaching, to the delivery of the teaching, to the assessment of students. Teaching in higher education generally remains based on an apprenticeship model of handing down knowledge and teaching methods from one generation to the next (which is one reason why the didactic approach to teaching remains so strong, to the dismay of educational theorists). A particular university subject discipline still resembles a closed community or guild, whose admission

is controlled through doctoral study managed by peers. Thus, even modern universities still display many examples of pre-industrial or agrarian organizations. For instance, the semester system with the long summer break reflects the origin of the land grant universities, where students had to return home for harvesting and to tend the crops.

12.7.2 Industrial Organizations

Most manufacturing companies producing physical goods have until recently adopted a "Fordist" organizational model, named after Henry Ford, the car manufacturer. This is characterized by a number of features:

- the production of uniform products;
- economies of scale (initial set-up costs are high, but large volume results in each extra unit having increasingly lower marginal costs);
- a division of labor (work is broken down into different elements conducted by different classes of worker);
- hierarchical management (decisions are made at the top, and passed down the line of command);
- organization of people and processes into discrete, large units (divisions, for example, of manufacturing, sales/marketing, distribution, and administration) which themselves are hierarchically managed (each division with its own Vice-President, with departments such as accounting, payroll, personnel, each with its own level of hierarchy);
- standardized, bureaucratic policies and procedures operating across all divisions, with a high degree of central control, often characterized by company-wide collective agreements with highly organized unions, which reinforce and codify hierarchical structures and divisions within the organization.

The larger, national autonomous open universities in countries such as UK, Netherlands, Thailand, Indonesia, India, and so forth, many of which have over 100 000 students (what Daniel, 1998, calls "mega-universities"), are good examples of this kind of manufacturing organization and structure in education. Organizations such as these were designed from the start as industrial models of education (Peters, 1983).

However, there has also been a rapid increase in the size and scale of "conventional" universities in industrialized countries since the introduction in the 1960s of systems of mass higher education. This has forced even conventional universities and colleges to adopt many features of an industrialized or Fordist organizational model (see, for instance, Campion and Renner, 1992):

- large class sizes (economies of scale);
- a differentiation between tenured (research) professors and graduate teaching assistants, and between academic (professors), management (deans and vice-presidents), and administrative staff (division of labor);
- hierarchical management (Presidents, Vice-Presidents, Deans, Heads of Department), with managerial control increasingly replacing collegial decision-making;

- large, hierarchical, and distinctly separate core organizational structures (faculties, administrative departments, buildings and plant, and so forth);
- bureaucratic procedures, even – or especially – in academic areas, such as closely defined admission requirements, prerequisites, and credit banking, to ensure standardization across the organization.

Industrially organized post-secondary institutions tend to design teaching and learning in ways that suit an industrial economy. Students are organized into large classes and thus get the same material which may be of a high quality in terms of content but tends towards a didactic or cognitive approach to presentation.

12.7.3 Knowledge-based Organizations

In contrast to both the agrarian and the industrial forms of organization, information technology has led to the growth of many knowledge-based and service industries that have a very different structure from the industrial or agrarian models. These newer forms of organization have also been labelled as "post-Fordist" (or "post-industrial") in structure (see, for example, Farnes, 1993).

Knowledge-based organizations are characterized by the following:

- heavy dependence on information technologies (telecommunications, computers);
- customized products and services tailored and adapted to needs of individual clients;
- workers directly networked to clients: rapid and immediate feedback used to modify products and services;
- workers who are encouraged to create and develop new knowledge and new ways of doing things, or who transform and modify pre-existing information;
- decentralized, empowered, creative workers, often working in teams;
- "core" workers are well paid, well trained, and educated on contracts, often with ownership in the company through stock options, and are highly mobile; "non-core" workers and functions are often "outsourced", and lack secure conditions of employment;
- strong leadership characterized by clear but broad vision and objectives; senior management plays an integrating, co-ordinating, and facilitating role;
- often small-scale and specialist; dependent on partnerships and alliances with other organizations with related and complementary competencies;
- rapid development and change: post-Fordist organizations are dynamic and move very fast; and
- operate on a global basis.

Knowledge-based business sectors are often chaotic and characterized by new players, new amalgamations, and the unpredictable emergence of dominant technology-linked organizations. Examples of knowledge-based organizations are Apple Computers, started originally in a garage in California; Microsoft, which has the same revenues as Sony and Honda combined, but whose direct workforce is one hundred times smaller

than each of those companies; and Google, whose stock is now valued as greater than General Motors.

12.7.4 The Post-industrial University?

We have not yet seen any advanced and sustainable form of such an organization in higher education. Nevertheless, despite some of its "agrarian" and "industrial" elements, there are certain features of a traditional university which are compatible with the new knowledge-based organizations. Despite its hierarchical organizational structures, a university is in practice an extremely decentralized organization. It has a large and highly creative "core" of staff, faculty, who are able and willing to operate relatively autonomously, are concerned with the creation and transmission of knowledge, and have the power to develop and implement new ways of doing things, if they wish. Furthermore, they have a research capability that enables them to generate new knowledge in a wide range of subject areas that can be assembled and disseminated through the use of technology. Lastly, the better-established research universities have the advantage of what marketers call "a strong brand image".

AU3

Since 1995, universities and colleges have been moving more and more into the use of information technology and computers for teaching, more commonly called "e-learning", driven mainly by the development of the World Wide Web. One rationale for e-learning is that it is not only a product of a knowledge-based economy, but also a means by which to develop appropriately skilled workers for a knowledge-based economy. E-learning develops appropriate IT skills and, in particular, trains or educates students to find, analyse, apply, and evaluate information appropriately within each field of study or discipline. As we have seen, there has been an emphasis on constructivist approaches to online learning, with a focus on knowledge construction, problem-solving, collaborative learning, critical thinking, and autonomous learning, all skills considered to be essential in a knowledge-based economy. It has been argued that e-learning lends itself to economies of scope, enabling teaching to be "tailored" to individual needs, with increasing responsibility and control placed on the learner/consumer, reflecting another feature of knowledge-based economies.

AU4

We also saw earlier that conventional universities have moved more aggressively into e-learning than distance education institutions or departments. This move by conventional institutions into e-learning is beginning to have a profound side effect on the organization and management of distance education. As King (2005) states,

> the impact of technologies on the delivery of face-to-face education enable any educator to replicate many of these dimensions of off-distance delivery that previously required a specialist infrastructure to provide. On-campus delivery has become more like distance education and – in so doing – undermined the distinctive contribution to overall provision of ODL practitioners.

Thus King is arguing that distance education is increasingly seen as just another way of doing e-learning, and since e-learning is becoming a central activity of academic departments, there is no need for a separate organization to manage distance education.

Thus we have seen in some jurisdictions the closure of dedicated distance education organizations (such as the Open Learning Agency in Canada) or attempts to close distance education departments in dual-mode institutions (such as at the University of British Columbia, also in Canada). This may also explain the reluctance of governments to create new institutions based on e-learning and to favour consortia and collaboration between existing institutions through mechanisms such as those adopted by the South Eastern Regional Board in the USA, the Open Learning Agency of Australia, and e-learning BC Campus and Alberta, all of which enable students to pick and choose online courses from a variety of institutions. AU5

Nevertheless, despite these moves, there are still some concerns about treating distance education as merely an extension of classroom-based teaching. First, students who take fully online courses tend to be older, want to study part-time and in short bursts of activity, and require specialist off-campus support (for example, "24 × 7" access) that regular academic departments find difficult to provide. Academic departments tend to AU6 underestimate the learner support issues, and are more focused on the needs of the full-time student on campus. It is interesting to note that at the University of British Columbia, after three years' planning to decentralize the distance education department's functions to the faculties, the decision was reversed at the last minute when the Dean of Arts at last realized the implications of having to manage another 4500 distance course enrolments. There is clearly a strong argument for having a department or division that focuses on lifelong learners and their needs.

Secondly, many of the pedagogical approaches found in distance education departments – such as instructional design based on educational theory and advanced pedagogy, project management, team work, business cases, and quality assurance processes – have not yet been generally accepted or adopted in campus-based e-learning. On-campus e-learning still in many institutions resembles more of a cottage industry managed by individual academics than a re-structured knowledge-based operation. Quality remains an issue.

12.7.5 Implications of the Three Economies

The successful introduction of technology always requires changes in the organization of work, and both conventional and distance education institutions are no exception to this rule. New forms of work organization are needed to ensure that technology-based teaching is cost-effective. So far, few sustainable organizational forms reflecting AU7 the flexibility of knowledge-based organizations have yet emerged in post-secondary education. The main examples are the loose consortia that are being developed to share courses across institutions, and the two fully online universities of the Open University of Catalonia and the University of Phoenix.

Furthermore, in most economically advanced countries, access to conventional higher education has increased. For instance, in 2003 in Britain, approximately 37 per cent of a cohort went on to higher education, with a target of 50 per cent being set by the government over the next 10 years. In North America, access rates have always been high, with over 60 per cent of the high-school cohort going on to higher education in 2003 in Canada. This has reduced (but not eliminated) the demand for open access.

Instead, one feature of a knowledge-based economy is the need for workers to continually learn and improve.

Thus the demand has subtly shifted from providing initial degrees through distance education to providing already well-qualified lifelong learners with additional opportunities for study. For instance, in 2005, 70 per cent of the graduates from the Open University of Catalonia already had a first degree before applying for admission to the university (Cabrera et al., 2005). These are learners whose post-secondary education has already been state-subsidized, who are in reasonably well-paid jobs, and who are often able and willing to pay the full cost of lifelong learning programmes because of their immediate economic benefits.

In all countries, agrarian, industrial, and knowledge-based economies exist in parallel. Thus the large-scale industrial distance education institutions based on the mass media of print and broadcasting are still likely to be needed in countries where the industrial base is large, or where access to post-secondary education is restricted. (It is interesting to note that in Spain, both UNED and the Open University of Catalonia successfully exist side by side, but serving subtly different markets. However, enrolments are dropping at both UNED and the conventional universities, but increasing at the Open University of Catalonia). In countries, though, where the knowledge-based economy is significant and where Internet access is high, online distance education – sometimes mixed with small chunks of campus-based teaching, delivered by small, flexible units using market research, business plans, and programmes tailored to the needs of individuals – is most likely to succeed.

AU8

12.8 WHEN WILL IT ALL END?

This is not so much a question about distance education but a desperate plea from a distance education manager about technological change. The answer of course is that it won't. The technology continues to evolve. At the time of writing, proprietary e-learning platforms such as WebCT and Blackboard were merging into one large global product. However, they will be challenged by the development of open source software that will allow institutions to build and customize their own platforms. New tools are being added, such as blogs, wikis, e-portfolios, and learning objects. M-learning, based on mobile technology such as wireless, cell phones, and PDAs, has already made its entrance in several projects (see, for instance, Alexander, 2004; Knight, 2005). Synchronous technologies allowing audio over the Internet through VoiP (Voice over the Internet Protocols) are resulting in tools such as Skype and Wimba being developed for online real-time discussions. Completely new online tools are now becoming available almost on a daily basis.

How will this rapid technological change impact on distance education? First of all, we will see not only a convergence of technologies, with synchronous and asynchronous tools being used together, but also a convergence of operations, with even more blurring between on-campus and distance activities, as a result. We will also see more student empowerment. Students will want to use the online tools themselves to create and manage their e-portfolios, to design Web-based assignments, and to manage their own

blogs and online discussions. As a result, we will also see new course designs emerging, with more student choice and more tailoring of material. Thus we can predict constant development and change in distance education over the next few years.

The main challenge will be how to manage these rapid technological developments. Several things, though, are now becoming clear. First, institutions will need to choose software applications that operate to open standards. This will allow new tools to be plugged into existing platforms or learning environments. Second, portals that can offer a wide range of online tools will become more and more important, so that designers and students can plug and play as required, thus integrating, for instance, synchronous with asynchronous learning. Course design then will also need to be more flexible, allowing alternative routes and alternative approaches to learning, to suit the different needs of individual instructors and individual learners. Content management will become critical, so that digital materials can be easily created, stored, and retrieved. (This goes far beyond creating learning objects.)

In short, we will see a great deal more experimentation in teaching, and those distance education programmes that do not move with the new technologies will become increasingly obsolete, because the appropriate application of technology not only will be expected by learners, but will lead to learners who are skilled in operating in a knowledge-based society. However, appropriate use of such technology will depend on matching technology to appropriate teaching methods and learning outcomes – in other words, instructional design supported by pragmatic decision-making procedures for the choice of appropriate tools.

12.9 CONCLUSIONS

There has been a symbiotic relationship between distance education and technology. As the technology has changed, so has the structure and organization of distance education. Educators have found it difficult to control and master the impact of technology, because of factors to some extent outside their control, such as broader changes in society and economies. Distance education is now struggling to keep up with technological change, and as a result risks losing its unique identity and function. Nevertheless, distance education has developed procedures and practices which are valuable in ensuring the appropriate use of technology in teaching, and it would be a tragedy if this knowledge and experience is lost because of failure by distance and conventional educators to learn from one another.

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AU1	"Cunningham et. (2000)" has been changed to "Cunningham (2000)" in order to match with the reference list. Is this OK?
AU2	Is the change made OK? Or are "Learning by association" and behaviourism" are discussed as two different entities? Please check.
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