The role of technology in learning: managing to achieve a vision

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Abstract
The paper explores the current context for uses of technology in education, including the nature of work, the capabilities required by employees, and developments in the technology itself. A vision for education is needed: how might students be learning in the future and what role might technology play in this? By making students’ learning needs the focus we can identify the support technology can offer. The issue of student access is discussed—both physical access to technology and the psychological confidence to use it. One major government initiative—the Teaching and Learning Technology Programme—shows the limits of what has been achieved to date. The paper ends by suggesting how changes necessary within the education sector might be better managed.

Context
The recent report “Technology for learning: where are we going?” (Lewis and Merton, 1996) points out that the evolution of a global economy and the intensification of competition are having a profound effect on the pattern and organisation of work. Private and public sector organisations are adopting flatter, more devolved structures that require employees to be more flexible, autonomous and responsive to change, capable of learning fast and making decisions independently yet within a corporate framework. The idea of spending the greater part of one’s working life employed in a single organisation has been rapidly superseded by the notion of adapting to new roles and responsibilities, moving between employers and changing one’s occupation. Hence the importance of independent learning.

As well as developing open attitudes and behaviours, today’s employees need to acquire and enhance core capabilities, such as working in teams, communication and problem solving. They have to operate more remotely, yet at the same time communicate often and purposefully with others in their networks.
The drive for competitiveness in the UK and the rest of Europe requires a modern workforce with graduate and vocational qualifications. Consequently recent years have seen a massive expansion in higher education but, because of constraints imposed on public expenditure, this has not been matched by an equivalent increase in funding. In these circumstances, providing traditional forms of teaching and learning while maintaining high standards is no longer an option. Teachers and learners will thus need to work in different ways and these will include the use of technological applications in the pursuit of learning, requiring the student to learn more independently and in the process acquire some of the habits of self-reliance that employers are looking for.

Alongside the drive for greater efficiency, a new pedagogy more relevant to the twenty-first century has been evolving. What is now sometimes referred to as “constructive learning” has become the core of recent education philosophy. Traditional teaching seeks to transmit fixed, well-structured knowledge with a firm external control of content, sequence and pace of learning; for many this continues to be of value because it is seen to confer rigour and respectability on the learning process. Constructive learning, on the other hand, stresses active, outcome-oriented and self-regulated learning, where meaning is negotiated, multiple perspectives are encouraged and learners map their way through an ever-changing information and knowledge landscape. The flexible and interactive characteristics of multimedia and telematics are enormously supportive of this.

At the same time young people are being brought up in a culture where fast and direct feedback is becoming commonplace. They increasingly use different communications media simultaneously, expecting high levels of interactivity. They require sophisticated presentation modes, deploying pace, colour, movement and sound. They have clearer demands of the quality and outcomes of their learning: skills and knowledge which will give them a firm purchase on the job market.

Meanwhile the technology itself is increasingly accessible, available, sophisticated and effective, putting unprecedented power in the hands of the user. The speed of processors doubles every eighteen months, the price of hardware and software is reduced, cross-platform compatibility is achieved, storage capacity is enhanced. As it does so, curricula and assessment will need to be reviewed; and there will have to be smoother transitions between schools, colleges and universities, with each being reconfigured to form virtual seats of learning.

The very nature of knowledge is being affected by the increased availability of information as television, computers, cables, satellites and superhighways connect learners across the global village. Information is no longer structured only in a simple, linear, logical fashion; it is becoming fragmented, multi-channelled and simultaneous. Education must help the learner make sense of this new information age.

It must be admitted that the context also presents significant difficulties. These include:

- the pace of change, which can be disorientating both to individuals and to organisations
• the speed of technological development, leading to issues of obsolescence and replacement costs
• the uneven spread of computer ownership
• the particular needs of adults and other groups of learners who may lack confidence in using technology or appropriate resources and be apprehensive about learning independently
• assessment arrangements that encourage students to “play the system” rather than engage in deep learning and that make the sensible application of technology difficult
• the poor quality of some educational software
• the information overload to which technology can contribute.

Need for a vision
In spite of these difficulties, technology is now so powerful and accessible that it is even more important than before to be clear about how it can help us respond to the challenges of the present context. At the University of Lincolnshire and Humberside workshops were held to encourage students and staff to visualise how learning will be undertaken in the future environment. Both academic staff and those working in learning centres were included in these workshops, representing a cross-section, not just the idealists and innovators. Participants were encouraged to create pen pictures of learners. The following extracts are taken from the report of the workshops (Healey, 1995), showing the learning lives of three students (of media, administrative management, and history, respectively):

Charlotte is a media student. She enrolled at her university attracted by an electronic prospectus, allowing her to journey through a virtual … landscape resembling a giant, educational theme-park … Now a third level student, she sits at her desk and types in her twelve-digit number. Her first task is to check her personalised timetable … This afternoon her video crew will be in one of the multimedia studios … rubbing shoulders with experienced, short-term contract producers and directors … The projects have not only improved her production skills … but have also provided her with much needed additional income.

Li arrives home after a long day’s work as PA to the managing director of a highly successful telecommunications company in Singapore. She is completing her studies for an MA in Administrative Management as an off-campus, distant learner. After her meal, she logs on to her workstation, using her voice recognition password, and accesses the Business School’s interactive video library in the UK, via the satellite link. She completes the self-assessment exercise associated with the project management part of her current unit and is pleased to see that the learning system has not only marked her assignment but has authorised release of the next relevant case study task. Tonight Li sleeps comfortable in the knowledge that not only has she passed a crucial stage of her course but that the Internet search she has initiated before retiring will provide her with further research material to sift early next morning.

The Sycorax is two hours out of Rotterdam and heading into a force nine gale on its trip across the North Sea. Angus, snug in the smoke-filled fug of the ship’s telecommunications centre, taps away at his 686 laptop … His shift pattern … allows him both to study at sea and attend regular tutorials on land … Angus pushes his laptop to one side and turns to the Sycorax’s own computer. This … gives him direct access to the Internet via the ship’s satlink. Not only can he access the School of History’s database but every other major history database throughout the world.

These are diverse pictures, all showing that learning will increasingly take place off-campus and in dispersed environments. Students’ lives will increasingly be characterised
by the need to take many decisions over their learning, requiring the exercise of considerable initiative within an open environment. Contact and companionship are not eliminated, but sustained in the main by electronic means. The UK Joint Funding Councils Libraries Review Group report (1993) includes similar scenarios, focusing this time on a typical day in the lives of members of staff. The scenarios are realisable given management will to achieve them: the question is not whether or not the technology can perform but whether staff and systems can change quickly enough to take advantage of its power.

**Starting with the student’s learning needs**

One way of addressing technology’s role is to consider what needs to be in place for an individual to learn. These requirements include:

- explicit information (for example, on content to be covered, skills to be learned, how performance will be measured, learning methods to be used)
- recognition for existing achievement (for example, credit for previous qualifications or experience, opportunity to follow an individual route through the curriculum)
- flexible access to resources and facilities (such as books, libraries, computers, multimedia software, audio and video tapes, discussion areas, work placements)
- flexible access to on-course support (for example, encouragement and resolution of difficulties)
- opportunities to practise skills and apply knowledge
- feedback on practice, assessment of progress and the opportunity to respond through dialogue
- choices over learning (for example, over content, method, medium, time, place, pace, mode of assessment)
- an attractive and motivating learning experience and environment.

Dearing suggests that we should be “led by educational imperative and not by technology” (Dearing, 1997, 13.2); in other words we should ask how technology can help students undertake the various processes involved in learning. Current activity at the University of Lincolnshire and Humberside suggests what this might mean.

The University is developing a “learning system”: a suite of programs and facilities that will support all learning functions, across dispersed environments. The first area of the curriculum to use this integrally is the University’s Skills and Capabilities Curriculum, which occupies 20% of the students’ time (and assessment) at each of their three levels of study. Level 1 addresses learning skills; Level 2 develops employability and career planning; and Level 3 supports students as they embark upon an independent study of their own choice—a key stage on the route to lifelong learning.

The Skills and Capabilities Curriculum is fully supported by the University’s intranet, which provides the following:

- profiling tools (for self-diagnosis, feedback, action planning)
- self-diagnostic tests for IT (again with built in feedback and leading the student to plan any necessary further study or practice)
automated assessment for IT (summative assessment with feedback, and the opportunity, if necessary, to take the assessment again)

information on the skills curriculum (including information on content, learning outcomes, assessment, use of time, resources available)

electronic materials delivery (of a range of materials, including those that support open learning)

access to a range of databases and web-sites.

Such systems benefit tutors as well as students. They offer information that enables tutors to manage their interactions with students. Subject departments can be encouraged to customise the electronic materials to suit their students and the nature of their subjects, offering considerable flexibility. Additional tutor notes can also be made available on the intranet for tutors who wish to use them.

We need to remember that these facilities will increasingly be needed in a wide range of locations. A university needs to consider all the locations in and from which its students will learn. These may include:

- its own campuses
- the campuses of partners
- student halls of residence
- student homes
- the workplace.

Two aspects of student access need to be reviewed: physical and psychological; the latter includes building the confidence needed to take a proactive approach to using technology. The technical implications need to be followed through accordingly.

Access to equipment is obviously an issue. Dearing discusses this in section 13 of his report and points out that there needs to be a period of managed change involving “subsidy and gradual migration to user provision” (Dearing, 1997, 13.39). Sections 13.43–13.49 of Dearing discusses the role of the student portable computer and the implications of this for the learning environment. The technology infrastructure of a university (including access from remote points) will increasingly influence students in their choice of institution.

Some institutions show how, given management resolution, a great deal can be achieved. For example, the numbers of students using technology as an essential tool for learning on their Open University courses is growing dramatically year by year. This has extended even to foundation course level, with students on the Technology course required to have home access to computing technology, to enable them to communicate electronically with their tutors and peers and carry out other educational tasks essential to assessment.

Technology thus potentially confers a number of benefits, including:

- flexible access to suit the learner;
- sensitivity and responsiveness to the profile of the individual learner;
high learner control (for example the capacity to replay on demand, to re-administer tests, to vary the ways in which content is presented);

- consistency and quality in presentation, developed using national and international experts, piloted, and not dependent on the local performance of a teacher who is “on form”;

- the opportunity to practise in a safe context skills that would otherwise be sensitive or resource-intensive.

The speed and flexibility of technology’s response to individual needs, combined with the attractiveness of its presentation, can create a powerful learning environment.

The UK Teaching and Learning Technology Programme

Unfortunately so far most work on applying technology to learning has been very limited. In particular, instead of taking a broad view of how technology can support learning, it has concentrated merely on the presentation of curriculum content. One example of this is the UK’s Teaching and Learning Technology Programme (TLTP). The evaluation report of this programme is particularly interesting, as it poses some serious questions about the processes involved in liberating the power of technology for use in learning (Coopers and Lybrand, 1996). Here are some of its key points (all references are to paragraphs in the Executive Summary):

- the use of technology has to be appropriate: “the opportunity … was exploited to computerise material that was being taught or could have been taught adequately in other ways” (para. 30)
- some of the material produced was closed, “often lacking in imagination” (para. 5)
- curriculum design tended to be “naïve”; only “a small minority” of projects had “taken account of pedagogic issues in any systematic way”; those inspirational materials that did emerge resulted from a genuine team approach—“a synthesis of computing, subject discipline and educational expertise” (para. 7)

- in the majority of cases evaluation was limited and “there was no framework or mechanism whereby project evaluations could inform the overall direction of the programme”; the “low profile” played by evaluation thus “represents a missed opportunity” to learn from what was a significant expenditure (paras. 25 and 26).

The external evaluation of the Teaching and Learning Technology Programme also illuminates two key issues requiring resolution if technology is to play its proper role in learning: cost-effectiveness and the management of change.

Cost-effectiveness

The purposes behind the use of technology are often unclear: is the main objective efficiency gain or learning gain? TLTP seemed driven initially by the former; in practice, though, those who received development funding seemed to concentrate on the latter. In this context paragraph 17 is revealing:

“An original TLTP objective was to make teaching and learning more productive and efficient. Our fieldwork suggests that this objective became less prominent as the programme progressed; the emphasis instead has increasingly been placed on quality improvements. The academics to whom
we have spoken have certainly been much more comfortable with the concept of working towards improving quality than improving efficiency.”

Technology has, in other words, been used to add to the array of learning resources rather than as substitution: we have yet to see the anticipated efficiency gains. The sector will be unable to resource continued additions; as MacFarlane pointed out “a major redistribution of resources between face-to-face teaching and learning resources” is needed (MacFarlane, 1992, 19, my emphasis).

The TLTP evaluation also points to the need for “more shared curricula” across the sector, to enhance the transferability of software and thus make efficiency gains more likely (para. 14).

More recently, the Dearing Report gives cautious support to the notion that technology can achieve both efficiency and improvement gains—with the big proviso that the education sector learns how to use technology appropriately. Dearing stresses the key continuing role of direct human contact between students and tutors, thus perhaps removing a major objection of academics (that technology will be used to replace them); on the other hand, it is inevitable that the successful use of technology will require teachers to change their roles to a significant extent, and this is picked up in Dearing’s ninth recommendation: “we recommend that all institutions should ... review the changing role of staff as a result of Communications and Information Technology”.

Staff roles
Dearing reminds us that consideration of technology must also involve a review of staff: their roles, and the training, support and development needed to fulfil these roles. Even given the wide-ranging and rapid changes around them, most teachers continue to discharge their role in a conventional manner: as sources and transmitters of knowledge to students in a classroom or lecture hall. The expertise of the teacher continues to be defined as a mixture of mastery of knowledge and classroom management; it is not defined as understanding how students learn and enabling them to do so. This conventional view of the teacher’s role is undoubtedly a major brake on the transformation to a new learning environment in which technology is fully used to support the learning process. Therefore developing a model of learning with the pupil or student at the centre is key to setting the foundations for change.

In what is currently a low-trust, low-energy education service, teachers’ stance towards technology is characterised by a suspicion that is in practice unfounded. In those institutions which have embraced technology it is evident that the teacher’s importance has not lessened: rather, there has been a change in the ways in which this is expressed. Paradoxically, the systematic use of technology actually upgrades and enhances the teacher’s role, at least for those who seize the opportunities it offers. Technology potentially frees up time for teamwork, curriculum development, adaptation and development of materials, forging links with employers, action-research and evaluation, and more creative management of the learning environment. Technology can change the nature
of relationships with students, providing closer contact with individuals and small
groups and less with larger classes. These new and enhanced roles need to be clarified
within each institution.

Management of change
The TLTP evaluation report states quite clearly: “Without a basic level of institutional
resourcing, expertise and commitment, the uptake and integration of technologies in
support of teaching and learning cannot be guaranteed” (para. 9); paragraph 38
stresses the importance of “cultural changes within HEIs and departments”.

Dearing has much to say about the management of change in HE, and his points apply
equally to other parts of the education service, for example:

“The development and implementation of an integrated C&IT (communications and information
technology) will be one of the main challenges facing managers of higher education institutions.”
(Dearing, 1997, 13.10)

“The challenge to leaders of higher education will be to harness both the communications
infrastructure, and the growing and developing collections of high-quality learning materials,
within a management strategy capable of being responsive to the needs of staff, students and
other stakeholders in higher education.” (Dearing, 1997, 13.12)

“The successful exploitation of C&IT will require a rethink of institutional priorities and a change
of institutional culture. The leadership given by senior management will be critical.” (Dearing,
1997, 13.15)

The use of information and communications technology changes the nature of a
learning environment just as much as it transforms the ways in which a business
operates. Our schools, colleges and universities have introduced computers but the
context in which they are used often remains the same. The learning materials, teacher
and student roles, use of buildings and space are unaltered. Technology needs to be
properly integrated into what Macfarlane calls an “intensely supported learning
environment”.

Conclusion
It is important to be clear about the various uses of the term “technology” when applied
to education. Three main definitions suggest themselves:

• technology as a curriculum area in itself (IT skills for students, word processing,
using email etc.)
• technology as the presentation of learning material for students (as in most TLTP
projects), with occasional additional functions such as assessment
• technology as the administrative and managerial infrastructure (finance, personnel
etc.).

On the third point Dearing claims “progress ... has been mixed”: institutions “should
aim to improve their economy and efficiency by making more effective and extensive
use” of technology (Dearing, 1997, 13.9). “A major task for management in institutions”
is to get maximum benefit from the high levels of expenditure (13.14).
The above three definitions are those usually offered. But there is a fourth and very important use of technology not encapsulated in these three: a learning system through which teaching and learning are managed, transacted and recorded regardless of the location of the student. This is what Dearing is glimpsing, for example in section 13.3: “over the next ten years the delivery of some course materials and much of the organisation and communication of course arrangements will be conducted by computer”. This is the area of technology use in which the education sector has to make the greatest strides, and it is also where the payoff will be greatest.

The thinking behind the introduction of technology has to date been limited. Its purposes have been narrowly defined as either cost-efficiency or learning effectiveness, or some balance in between. Linked to this has been the implicit equation “new technology equals a new way of conveying the same old course content”. This paper argues that technology needs to be thought of much more radically as the means by which our schools, colleges and universities will respond to the challenges they currently face. This requires visionary thinking and the construction of scenarios which generate the energy and will to act. A well-thought out use of technology will help secure both cost efficiency and quality, with the additional marketing benefits of an attractive and flexible learning environment, and one to which a wider student constituency can gain access. But the whole learning environment needs to be the focus of attention, not just the technology used within it.

To achieve these objectives will require partnerships: between educational institutions, between educational institutions and entertainment providers (from whom the sector has a lot to learn) and between countries. Dearing advocates cross-sector, global sharing in the development and delivery of software (Dearing, 1997, 13.7) and links with the communications, media and publishing industries (Dearing, 1997, 13.8). Institutions need to identify both their competitors and their partners, in accordance with their strategic imperatives. The University for Industry in the UK is one fascinating development that will lead to new groupings of partners to meet the economic and educational challenges outlined at the start of this paper.

**Recommendations**

What steps, then, should educators and educational managers take towards achieving the vision outlined in this paper? The following is a start:

- engage with the pedagogy arising from “constructive learning”, stressing outcomes, learner choice and multiple routes
- ensure assessment encourages (and tests) active learning and that curricula are not over-loaded with information
- develop technology relevantly to support active learning (rather than just information input) and in a variety of locations (including home and workplace)
- ensure vulnerable groups are supported in using technology to learn
- develop a shared vision for learning, together with a strategy and plan to implement it
• where necessary, invest selectively to support the development of the new learning environment rather than simply patching up the old
• within the strategy, consider not only technology but also the other necessary components of an active learning environment, including staff roles and responsibilities and student expectations
• develop greater expertise in managing change in the learning environment.

References