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Ron Oliver
Edith Cowan University

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Ten more years of educational technologies in education: How far have we travelled?

Ron Oliver

Edith Cowan University

Abstract

This paper describes the advancements that have occurred in the use of educational technologies over the past ten years (1995-2005) and argues that progress has been slow and reminiscent of the slow progress observed in the previous decade (1985-1995). The paper argues that one of the principal reasons for the less than spectacular results stems from the top-down approaches that always seem to drive technology use in education and schools. It argues the need for applications and activities to be driven by bottom-up forces, by the teachers and students themselves and presents the argument that more applied and grounded research at the classroom level is one strategy that can effectively support these aims.

Biography

Professor Ron Oliver is the Associate Dean of Teaching and Learning in the Faculty of Communications and Creative Industries at Edith Cowan University. He has been a long-time user of ICT in teaching having worked with punched cards on mainframe systems in the 1970s as a maths teacher, with Apple II computers as a computing teacher in the early 1980s, with Microbees and BBC IIs as an educational computing teacher until the 1990s and has been teaching with Macs in his university classes since the 1988. He has gained broad experience in the design, development, and application of technologies in teaching across this thirty year period and has been an active member of many communities and organizations promoting the use of ICT as a teaching and learning tool across all sectors of education.

INTRODUCTION

Doing a ten year retrospective on ICT in learning is an interesting activity. Whilst technology has forged ahead in leaps and bounds, its uptake and mainstream implementation in education has been much more constrained and follows what has now become a quite a predictable pattern. Today, if we look at the various computer and communication technologies available at our disposal and try to imagine what they will be like in 10 years time, there are many possible scenarios that can arise, many of which will be almost unpredictable. The same was true 10 years ago.

Since 1995, we have seen the rapid expansion of the WWW from an academic network to a global phenomenon. We have seen a totally disconnected technology in 1995 turn to a network and wired facility in 2005. We have seen computers evolve into portable digital assistants and powerful handheld devices with wireless capabilities. We have seen telephony move from landlines to ubiquitous mobiles and we have seen digital technologies developed to the point where digital cameras have taken over conventional photography, where digital television is the norm and all computer operating systems now provide seamless multimedia functions and capabilities. The technologies have all started to converge and today it is often hard to tell a computer apart from a mobile phone.

It is interesting to observe that the accompanying changes in pedagogy appear to have been far less dramatic. Whereas in 1995, there were computers in most schools and teachers using them sparingly, in many classrooms today the same pattern holds. The technology has improved considerably, the

computers are now far more powerful, run many more applications are networked together, but still there are many teachers yet to be convinced of their value and use as learning tools. And the pattern exists across all sectors of education. With this in mind, it would seem an appropriate time to pause and reflect on what has been learned over the past ten years in relation to ICT in education and how this might help us in the future.

THE PROGRESS OF EDUCATIONAL COMPUTING OVER THE PAST TEN YEARS

A good starting point in a retrospective is to try to establish some baseline data to enable progress to be observed and measured from this starting point. With this in mind, it is interesting to observe where the educational community sat in 1995 in relation to the use of ICT in education. In 1995, among the principal issues facing ICT in education, were:

- A perceived lack of interest in mainstream teaching in the use of ICT as a an instructional support;
- Limited teacher skills and expertise in the use of ICT;
- Limited access to computers in classrooms;
- Unsustainable approaches to ICT applications in classrooms; and
- Technology leading the educational debate from an institutional and organisational viewpoint (eg. Sherwood & Buchanan, 1993; Baker, Gearhart & Herman, 1994; Becker, 1994; Means & Olson, 1994).

The technology available for use in education in 2005, as one would expect, is vastly improved and superior to that available in 1995:

- In many educational settings, teachers and students have access to a variety of multimedia products such as digital cameras and players;
- Modern operating systems provide seamless applications that facilitate the development of digital libraries and movies and support editing and manipulation of images from these sources;
- Many classrooms are today connected through a variety of means to the Internet and WWW providing opportunities of many forms for creative teachers;
- Most classrooms and schools have much higher levels of ICT, and it is not uncommon for teachers to have 3 or 4 computers at their disposal in their classrooms; and
- In many schools there have been moves away from computer laboratories to computer workstations in classrooms and libraries;

Ten years on, there are many differences among educational institutions in terms of their levels of ICT application. Use and patterns that are reported today include such observations as:

- A large number of teachers now use laptops and computers as personal tools;
- Teachers' and students' levels of ICT expertise is has developed significantly;
- There is considerable institutional and organisational expectation that teachers will use computers in their teaching;
- A large number of students use ICT in many ways at home and for personal use; and
- The ratio of computers to students in most schools has continued to rise (eg. Graves & Kelly, 2004; Smaldino et al., 2005).

Despite these technology advancements, the use of ICT in teaching and learning today still appears sporadic with levels of use and application influenced by a number of impeding factors:

- Many teachers are faced with delivering a full curriculum whose assessment is by standard measures such as assignments and tests. Such settings are often not conducive to ICT use.
- Many teachers prefer to use directed teaching modes based on the delivery of content and information. ICT offers little opportunity or advantage to such methods of teaching.

- Teachers can still find themselves in settings where access to ICT is limited. Planning delivery processes that rely on the availability of ICT can often lead to disappointment and frustration.

It is interesting to consider how far the ICT baseline has actually moved in the past ten years and if it is still moving today? If the promises of ICT in teaching and learning that were claimed ten years ago were well-founded in truth and fact, one would have expected that the role of ICT in education today would be far greater than is evident. In 1995, the use of ICT in teaching and learning tended to be championed by a small number of early adopters in various institutions. Whilst there was institutional support for the use of ICT in such settings, mainstream use was still a long way off (eg. Nelson & Pagram, 1993). This pattern is still evident in many schools today.

Many writers back in 1995 were arguing the need for student-centred learning settings and rationalising ICT as a means by which such settings might be realised and supported. Whilst it was being strongly supported in the literature (eg. Savery & Duffy, 1995), its practice was not common. The didactic nature of many educational settings were being queried and technology proffered as a solution to a pressing problem.

The value of student-centred learning settings supporting knowledge construction among learners is a common feature of many educational programs in 2005. Today, there is usually little argument about the value of this approach among practitioners. The rationalisation in recent years in many settings to curricula with outcomes-based forms has seen teaching seeking outcomes linked more to knowing *how* than knowing *about*, and this feature has helped to sell this message to mainstream teaching (eg. Biggs, 1999). In the meantime, there have been constant reminders that what is more important in education is what the learners are doing rather than what the teacher is doing (eg. Shuell, 1992).

For teachers seeking to deliver and support student-centred learning, contemporary ICT provides many supports. In universities, for example, most teachers are very much aware now that Web-based learning can provide many supports for student centred learning settings. Web tools such as discussion boards, online chatting, Weblogs and communication portals all have direct relevance to this form of learning and their applications are not obstructed by high overheads such as the need for high level skills or equipment specifications.

But still, ICTs are not mainstream in the teaching practices of many teachers in our institutions. In all sectors, large numbers of teachers prefer to deliver their courses in ways which make little or no deliberate use of ICT. And this is despite large amounts of technology infrastructure, large amounts of software and enabling factors. We still seem to have today a problem that was prevalent 10 years ago, the approach to ICT in education is still primarily being driven by top-down rather than bottom-up approaches. Teachers are being told and encouraged to use ICT but many see no reason, have little need and as a result are resistant to such moves. The question we need to ponder is whether we can find any strategies to create a bottom-up push for ICT as teaching and learning tools that deliver ICT as a mainstream teaching and learning tool.

Current Projects

When one looks at ICT and education in a big picture mode in recent years, there are a number of initiatives we can observe that highlight these top-down approaches which appear to take projects and ideas in the same direction as those from previous years.

a. Virtual Universities.

One such example has been the recent move within some universities to harness ICT and elearning as potential forces for new markets and directions in program delivery. Universities discovered ICT for teaching and learning some years after they were popular in schools. Since this time they have been adopted in quite systematic ways in universities with large amounts of financial and administrative support. During the last ten years a large number of universities throughout the world have looked to technology as a means for creating new markets and providing support for an array of off-campus educational programs. Large sums have been invested, consortiums formed, online courses developed and offered to the market. But in almost all instances the market has not been that interested and few of the programs and projects have realised their aims.

Consider, for example, the UK e-University (UKeU) established in 2000 to market online learning worldwide. Despite a massive investment in high quality courseware and hardware, UKeU was unable to attract anywhere near the number of students needed to pay its bills and it was disbanded in 2004 having lost over 50 million pounds. In discussing its demise, the funding council (HEFCE) noted that the preferred delivery modes for students were "blended" learning involving a mixture of technology, traditional, work-based and face to face learning which appear more able to meet the diverse needs of students (MacLeod, 2004).

There are a number of virtual universities throughout the world that operate successfully, for example Phoenix University Online and the UK Open University, but these institutions offer a service to students where a need for distance education is known to exist. The speculative virtual universities, of which UKeU was one, have usually been conceived by those far removed from the actual process of program delivery and learning, and this separation has often been one of the factors that has led them to understandings and ideas quite removed from practical and grounded viewpoints. They are examples of top-down thinking resulting in systems being provided for customers and clients who are not yet ready and receptive to them.

b. Learning Objects

There is currently a degree of frantic activity being undertaken in many circles to provide support for the development and application of reusable and interoperable digital resources for learning, which are typically referred to as learning objects. This activity has consequences and impacts on the actions of the vast majority of those associated with teaching and learning process and includes such stakeholders as:

- administrative and financial bodies that look to benefit from the potential costs savings associated with reusing and sharing learning resources;
- policy-makers who are interested in the legal and ethical implications of copyright and intellectual property among the shared objects;
- instructional designers who need to consider design strategies that facilitate and support sharing and reuse; and
- developers who need to consider appropriate development strategies to ensure interoperability and a capability for use of resources beyond the context for which they are designed (eg. Downes, 2000; Shepherd, 2000).

Learning objects have been the subject of research and development for several years now leading to the development of standards and guidelines (eg. ADL SCORM, 2004) but the last people to be involved in the activity have been teachers. While the technical and infrastructure problems have been addressed, issues associated with practical implementation have yet to be resolved. Despite the huge efforts by those involved in these projects, and the vast array of products and services that have been developed, there are very few examples of learning objects becoming a feature of mainstream

teaching, or any teaching for that matter. Very little of the effort has been directed towards implementation and practical activities supporting their use by teachers in classrooms. The thrust of learning objects projects, like so many others, has come from a direction other than that for whom they are intended. Like so many ICT applications for learning, learning objects have yet to realise much of their potential and could very well become another example of a good idea, not appreciated by those for whom they are intended, and as a result yet again unable to realise the perceived potential.

c. ICT and corporate training

There has always been considerable interest expressed in the use of ICT as a means for delivering corporate training. Morrison and Spencer (2001) provided some compelling figures to support their claims that ICT through elearning was the way of the corporate training future:

the online educational component (corporate and educational) is (expected to grow) from \$9.4 billion in 2001 to \$53.3 billion by 2003—a 54% growth rate. More than 90% of college students access the Internet and spend 85% of their online time in academic pursuits. In addition, more than 2.2 million college students are expected to enroll in distributed courses in 2002, up from 710,000 in 1998—a three-fold increase. (Morrison & Spencer, 2001)

In reality, elearning has never provided the learning benefits promised and its uptake has diminished rather than increased in recent years as many intended outcomes have failed to be realised.

Technology provides many opportunities for cost-saving in terms of delivery any time any place but the lack of face to face teaching brings with it reduced motivation and interest, key elements of learning (eg. Collis & Winnips, 2002). Whilst the delivery format works well for administrators seeking economies in delivery and presentation, it appears not to serve the learners as well. Recent figures have shown unexpected downturns in levels of uptake and use, suggesting the need for some rethinking and re-evaluation of how best to take advantage of the opportunities. (eg. Ellis, 2004).

d. Learning management systems

Whilst the previous examples have showcased applications that may not always have realised their potential, there are some success stories from the past 10 years. For example, there is growing use of Web-based technology systems which complement many existing teaching activities. In universities we now see the large scale implementation of Learning Management Systems (LMS) like Blackboard and WebCT which provide varying levels of learning support depending on the needs of teachers. In concert with LMS, we are also seeing the development of Learning Content Management Systems (LCMS), complex databases enabling institutions and organisations to manage and organise their electronic learning resources in ways which ensure copyright compliance, reusability and appropriate resource management. These systems do not require any substantial change to the way teachers teach, but rather they add options that can be accessed at will by learners and teachers. Whilst these might be seen as top-down approaches, in their implementation, they do actually operate through bottom-up strategies. Often learners will encourage teachers to use these tools based on their needs and expectations.

These projects and activities and their relative successes and returns on investment are quite typical of previous projects associated with educational technologies. Very few ever make the quantum leap from good ideas to mainstream applications. A question to ponder is whether things will ever change in the future? In considering this question, it is useful to examine some emerging technologies today and their potential applications and uses.

EMERGING TECHNOLOGIES

The new millennium has seen a number of new and exciting technologies emerge, many of which appear to have, yet again, great prospect for learning applications and supports. A stroll through technology shops and the current literature reveals the following developments:

- The emergence of portable hand held computing devices that provide the power and functionality of desktop computers in very small forms. Wireless technologies coupled with miniaturisation have led to the development of small hand-held computers with the full functionality of laptops and desktops. Whilst they are limited in some respects by the absence of a keyboard and mouse, the stylus and the text recognition capabilities overcome these problems;
- an expansion of mobile technologies including mobile phones that are providing many extensions to existing telephony functions. Mobile phones typically include multimedia capabilities and instant messaging options which are starting to change the way many people communicate and interact;
- Internet functionality now supporting synchronous communication and instant messaging in an array of forms that support voice, text and media communications;
- Wireless networks enabling users to access all forms of their technology from any location removing the need for cabling and specialist facilities;
- Client-server technologies have seen the introduction of network services enabling users to have a variety of external access and storage privileges.

Everyone of these technologies has great prospect for learning. Already we are seeing the expression m-learning being applied to applications of a mobile nature being used in schools and education (e. Leonardo Da Vinci project). We are seeing ubiquitous laptop programs being implemented in ways across whole institutions and organizations (eg. Arcadia University Laptop Project). And we are seeing very creative applications involving Web-based messaging and conferencing being demonstrated (eg. Notschool.net). Past experience will lead many to wonder, the extent to which these applications will develop and how many of these interesting technologies will find their way into schooling and education in any big way.

ICTs in education in the next decade

Teaching is very much an individual pursuit where practitioners deliver their programs in ways that suit their own styles, preferences, capabilities and needs. For many teachers, ICTs present impediments more than opportunities for learning. The mainstream use of ICT will only ever occur when the vast majority of teachers are able to perceive that the technology will assist them and their learners. We are seeing today the development of an array of technologies and technology-based tools that will likely achieve this outcome but the question still remains however, what can be done to advance this uptake and to see technologies used ubiquitously by all, or most, teachers.

One of the key strategies needed to achieve this is to further the research activity that explores implementation and application issues. Too often in the past the moves to embrace educational technologies have been led by the technologies themselves. Whilst such activities will often prove the technology(ies) fit for purpose, they often fail to address the best conditions under which they might be used. The need for research and inquiry to address issues of implementation and application at the coalface seem a logical approach.

There have been a number of studies in the past 10 years that have provided support and direction for ICT activities. For example:

- A study of teacher professional development projects provided sound insights into strategies most likely to lead to ICT uptake among teachers (eg. Downes et al. 2001);

- A number of studies have demonstrated beyond doubt that in schools where ICT use is an integral component of the curriculum, achievement levels in literacy and numeracy tests are significantly higher than their counterparts (eg. BECTA, 2003);
- A number of studies have demonstrated that technology can also distract learners, a finding that very few people would find surprising. It is not a matter of having access to ICT but how the ICT is used that counts (eg. Booth, 2005)
- There has also been considerable research undertaken into explorations of technology-facilitated learning designs, the deliberate development of learning settings able to engage and stimulate learners to bring about the intended learning outcomes (eg. Hedberg et al., 2002).
- There has been research undertaken to explore how technology can be used to create effective learning settings for remote and distant learners. The use of bulletin boards, discussion forums and synchronous communication have all been researched to provide informed feedback on how best they might be used.

SUMMARY AND CONCLUSIONS

ICT has always been considered the catalyst that was going to change the way teachers teach and students learn. History has shown that in fact a groundswell move to more student-centred modes of teaching has come from a number of sources unrelated to ICT and that ICT has played only a small part in the curriculum change. Our experiences from the past twenty years have revealed that top-down approaches where organizations and institutions direct and guide teachers have not usually worked well in promoting ICT use in classrooms. Teachers tend to adopt ICTs when they see a need, when the ICTs are available and can solve a problem, and when they can be inserted effortlessly into existing practices. There are still many places to day where these conditions have not been met despite the efforts of many.

For ICTs to fully realise their potential in education, the field needs to be supported by well-informed research and inquiry that can adequately address the issues needed to remove the impediments. New tools and approaches need to recognise the needs of teachers and to provide the supports that teachers need to use technologies seamlessly as tools of their trade. We should not be too worried about the speed of uptake of technology in our classrooms. The nature of the technology is that it generates its own use when people have access to it, are able to use it and find it able to solve problems they encounter.

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