

# Computers, ICTs and Online Curriculum: A Role for the Teacher Librarian?

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*During the last thirty years the rapid development of technology has left many educators struggling to come to terms with the changes the integration of technology brings to the teaching-learning environment. Governments and education administrators around the world are currently diverting limited resources into the provision of infrastructure and computers in the belief that the use of technology as a means of education delivery has the potential to significantly enhance teaching strategies and resources currently available to schools. For schools and teachers, the push for the implementation of technology from the administrative levels has meant changes to the learning environment, the necessity to acquire new skills and issues of accountability. Thus the impact of technology in education and on learning has been the subject of much debate and an increasing body of research has endeavoured to assess the impact of various technologies on student learning, with mixed results. The purpose of this article is to briefly review the research on the impact of technology in education, determine some of the recurrent issues identified by the research and to examine the role of the teacher librarian as a possible facilitator for change and the effective integration of technology in the curriculum.*

## Introduction

The potential learning opportunities provided by the use of technology in education were recognised as early as the 1970s. However, efforts to integrate technology into traditional curriculum throughout these early years generally relied on external funding and were of relatively short duration. Major drawbacks to the implementation of computers in schools included cost, the fact that these projects were considered to be research studies and so had little impact on the wider education community, poorly designed software, a lack of support by the teaching profession who initially saw computers as a threat, the fact that complicated systems were required to manage these projects and a lack of recognition for the innovators (Charp, 1997).

This situation changed with the development of the microcomputer/personal computer. As the technology became less expensive and computers were readily adopted by business and home users, there was a perception by governments and the general public that schools needed to provide students with the necessary vocational skills to make them more employable and to utilise technology to deliver excellence in education (Charp, 1997).

In the late 1980s a few educators experimented with the Internet and using email for communication and collaboration, but it wasn't until developments in the early to mid-nineties and the proliferation of the World Wide Web and browser technology, that the

push for the integration of technology in schools from government and education administrators became widespread. Lowering costs, the development of user friendly management systems such as Windows and the accessible nature of the Internet and the World Wide Web made the promise and possibilities of technology more of a feasible reality for schools.

While research on the impact of technology in education has been ongoing over the last thirty years, there are still no definitive answers. There are also a plethora of terms used to describe how technology has been/is being used in education. The terminology reflects how education has progressed over the last thirty years and emphasises the shift from an instructionist, content-based approach, to curriculum that is more constructivist and outcomes focused. These terms tend to fall into three distinct categories that match the various phases of technology development and implementation in education, and provide an important insight into how educators view and use technology. The terminology also acts as an important reminder for researchers and educators when comparing the impact of technology in education over the last thirty years. As technology has changed, so has education. How technology is utilised and what educators now expect to gain by integrating it into curriculum programs, is quite different from the early drill and practice programs of the 1970s.

## **Terminology**

The first phase of integration of technology in classrooms began in the 1960s and 1970s when infrastructure and hardware costs were high and instructional software was in the early stages of development. Research studies tended to focus on the use of drill and practice programs to improve basic skill development and early programming languages were introduced to help students get jobs (Charp, 1997). In this phase terms such as Computer Assisted Instruction (CAI), Computer Assisted Language Learning (CALL), Computer Based Instruction (CBI), Computer Based Training (CBT) and Computer Assisted Learning (CAL) prevailed.

CAI referred to the use of drill and practice programs, CAL incorporated tutorials and sequenced learning, CALL used aspects from CAI and CAL mainly to assist students learning a second language, while CBI tended to focus on the individualisation of the learning program (Ministry of Education NZ, 2003). CBI programs were designed to take the learner through a competency based learning sequence. These terms emphasise the technology (hardware and software) as both the method of delivery and the basis for instruction. Students generally used commercial software to complete a set of tasks or a learning sequence as directed by the program. Although engaged in the physical activity of using the computer (a motivational aspect in itself), students were still passive learners. Instead of being directed by the teacher, they were being directed by the software. Computer Managed Learning (CML) where pathways through the learning were dependent on how well students performed at critical checkpoints, represents an attempt to create student-centred learning programs where the software controlled the pace of learning.

Computer Based Education (CBE) is an overarching, holistic term often used to describe programs delivered in this way.

These terms reflect the content based structure of education at the time, where students were instructed and the successful completion of traditional normative testing that largely demanded a regurgitation of facts, determined student success or failure. These terms are by no means defunct and are still being used as benchmarks for learning with technology by educational institutions (Ministry of Education NZ, 2003). Education systems are still using traditional content based tests to determine student achievement. Software companies are still producing a vast range of products that are essentially drill and practice or at best sequential, lock-step and competency-based programs of study that require little cognitive engagement or development on the part of the learner. While this approach has a place in education, it utilizes lower order thinking and although students may develop competence in basic skills, they rarely transfer these to other learning situations. The use of technology in education in this way does not develop students who are independent learners.

The second phase of integration of technology in classrooms coincides with the development of the microcomputer/personal computer (PC) and the Internet. In this phase the terms Microcomputer Based Laboratory (MBL) and Computer Mediated Communication (CMC) appear in the literature. These terms describe how students used technology to enhance their learning. In MBLs students conducted experiments and then used computers to instantly graph their results (Rochelle et al, 2000). In Computer Mediated Communication programs email, chat rooms and bulletin boards were used as communication devices to facilitate interaction between students, teachers and experts to enhance and extend the learning experience (Murray, 2000). These terms also still apply today. Students now use hand-held graphic calculators to calculate and visually display data in Science and Mathematics classrooms. They use email, discussion forums, chat programs, videoconferencing and teleconferencing to communicate and exchange information and ideas across large distances. Current developments also include group learning tools where students can use technology to participate in and manage team projects (Oliver, 2003).

During this second phase two new terms also appear – Computer Managed Instruction (CMI) and Integrated Learning Systems (ILS). These terms referred to the development of software that not only delivered curriculum content, but also contained additional record and management systems where teachers could track student progress and manage assessment and reporting (Ministry of Education NZ, 2003). WebCT is one such program that has continued to develop and is now accessible by students via the World Wide Web. It incorporates an extensive management structure that can be utilised across different campuses.

The advent of the World Wide Web, developments in browser technology and the convergence of traditional technologies with telecommunications has given rise to a new set of terms in what is a distinctly new phase in the integration of technology in education. Electronic Learning (eLearning), Online Learning, Information Communication

Technologies (ICT) and Interactive Learning Modules (ILM) refer to a combination of technologies that produce interactive learning environments.

The UNESCO *World Communication and Information Report* (2003) defines all technology as ICTs and differentiates between old and new: “New ICTs differ in several important dimensions from older technologies, including the integration of multiple media, interactivity, flexibility of use, and connectivity” (Blurton, 1999). Thus as technology has developed, the terminology used to describe how educators use it in educational settings has also altered. The terminology has evolved from a primary focus on content based, one-on-one, single-session drill and practice, to computer enhanced learning through to the development of interactive and flexible learning environments. The keywords in the current terminology are communication and learning and they indicate a fundamental pedagogical shift in the way educators have come to view the integration of technology into classroom practice. The current terminology also emphasises interaction and focuses on student engagement over multiple sessions, group activities and teamwork.

Online curriculum is the latest term to be used to describe the integration of technology into classroom practice and perhaps best describes what is happening in education today. The Department of Education and Training Western Australia distinguishes between and includes a definition of online curriculum, as distinct from online learning and the concept of elearning in its report *Online Curriculum: An Explanation and Exploration of Online Curriculum in K-12 Education*. Online curriculum is defined as:

*... specifically curriculum materials available online that are structured, sequenced and specifically tailored to the learning outcomes desired by an education system.*

*Online curriculum may involve online learning, but may also involve learning in other environments and is not restricted to online learning (Burston et al, 2000).*

Online curriculum as defined here includes a blend of teaching and learning approaches where online curriculum is part of a total resource-based learning and teaching program or as a virtual classroom where features of the technology are used to enhance and facilitate the learning experience (Burston et al, 2000 and Murray, 2000). This latest term describes the integration of technology in the classroom as a more holistic approach and encompasses the whole teaching-learning environment. Although the focus in the terminology is still on the method of delivery (online before curriculum), it does indicate a significant shift in thinking from earlier attempts to describe how technology was being/should be used in education.

These are important considerations for the research, as they define the questions that should be asked by educators when trying to determine the impact of technology in education. Perhaps we also need to ask ourselves if this question is even relevant/important. If the term online curriculum is used to describe curriculum programs where technology is

only one aspect of an integrated learning environment, is it more important to look at the effects/impact of the technology or the overall learning environment?

### **What does the research tell us?**

As stated previously, while research into the impact of technology in education has been ongoing over the last thirty years, the results are still inconclusive. A range of studies in the early years looked at the differences in basic skills attainment by students using commercially produced software. Some of these produced positive results, while others indicated no discernable difference from performances by students working in traditional classrooms. In certain areas such as Mathematics and students with learning difficulties, results indicated that the use of computers can make a significant difference to the learning of basic skills and as a motivational tool for both students and teachers (Bialo, 1996). The Software Publishers Association's 1990 *Report on the Effectiveness of Microcomputers in Schools* assessed research conducted prior to 1990 and reported that "the use of technology as a learning tool could make a measurable positive difference in student achievement, attitudes, and interaction with teachers and other students" (Bialo, 1996).

A second report produced by the same body in 1996 examined research on the impact of technology in classrooms between 1990 and 1995. This report also concluded that educational technology could have a positive and beneficial effect on student learning. The 1996 report used meta-analysis methodology and conclusions from previous studies by Kulik and Kulik and others, to build a frame of reference to study the impact of technology presented in 176 research reviews and reports from original research projects (Bialo, 1996).

While this report reveals significant increases in student learning and achievement through the use of technology, it also highlights difficulties inherent in the research. The lack of quality research in this area, the small number of large-scale longitudinal studies and studies which replicate previous results, difficulties in defining reliable performance-based criteria and controlling variables in school environments are some of the issues raised (Sivin-Kachala, 1998). The report acknowledges these difficulties and indicates that the 176 reviews used were part of an original parent set of 1000, the others being excluded due to poor research methodology (Bialo, 1996).

Critics of this report maintain that there is still no definitive/absolute evidence that technology in schools makes a significant difference to student learning. They criticise meta-analysis as a technique to draw conclusions and determine the bigger picture, particularly when it is used to group drill and practice study programs conducted in the 1980s with collaborative projects using the Internet in 1996, or disparate programs from across a range of learning areas (Ryniker, 2001). Other difficulties include standardised testing processes being used to measure student achievement, poorly designed research parameters and variables such as the level of teacher engagement, flexibility and their capacity to integrate technology effectively into existing classroom practice. These critics lament the amount of money being withdrawn from traditional programs such as Music,

The Arts and Physical Education, as well as a lack of funding now available to address other issues in education such as programs for the gifted and talented, reducing class sizes, professional development for staff and the upgrading of out-of-date facilities (Oppenheimer, 1997; Cohen, 1998).

*Apple Classrooms of Tomorrow* has been one of the few large-scale longitudinal studies conducted, and lasted thirteen years (1985 – 1998). While this project concluded that the use of computers in classrooms had a definite effect on student motivation, engagement and attitudes towards learning, there were no significant differences in student test scores. ACOT also recognised that significant differences in student achievement depended heavily on the teacher (Dwyer, 1998). It appeared that “what the students learned had less to do with technology and more to do with the teaching” (Oppenheimer, 1998).

In the final report from the *Weatherstation Project* titled *Thwarted Innovation: What happened to e-learning and why*, the authors look closely at why the early promises of elearning have failed to eventuate. The final conclusion of this report states that elearning failed because “there were too many new ventures pushing too many untested products - products that, in their initial form, turned out not to deliver as much value as promised. The hard fact is that elearning took off before people really knew how to use it” (Zemksy & Massey, 2004, p. 5). In this particular report the design features of elearning are discussed as well as market readiness and the three major assumptions made by educational systems and institutions when instigating the development of elearning programs.

- If we create elearning educational institutions will use it.
- Students from the Net generation will have no problems using elearning programs.
- Teaching will change as a result of elearning programs.

The authors found that despite massive investments in hardware and software, only course management systems such as Blackboard and WebCT have been widely deployed, principally by tertiary institutions. The report found that while students wanted to be connected to each other, they saw elearning initiatives as an enhancement to traditional classroom teaching rather than a viable alternative. The authors’ conclusion for the third assumption, that elearning and technology would force teachers to change the way they teach, was “not by a long shot” (Zemksy & Massey, 2004, p. 5).

### **Issues raised in the research**

While the verdict on whether technology actually has a significant effect on student learning is still debatable, there is enough evidence to conclude that technology can be an extremely powerful educational tool. The ACOT program found that the integration of technology in the classroom appeared to work best when teachers used technology as one tool among many, tailored usage to students needs/abilities and used a range of teaching-learning resources (Apple Computer Inc, 2003). This project also found that an enormous amount of support is required for teachers to embrace change and integrate technology effectively into classroom practice (Dwyer, 1998). The ACOT researchers also concluded

that the widespread presence of technology in schools could become a catalyst for change and force teachers back into learning mode (Apple Computer Inc, 2003).

This finding is also identified by the UNESCO report as a major issue that needs to be addressed by educational systems and schools. There is a growing recognition that for technology to be truly effective in the classroom, it needs to be based in good teaching-learning pedagogy. This will only occur when both pre-service and existing teachers have access to professional development and ongoing support at both the systemic and local level (Blurton, 1999 and Rockman, 1998). The deployment of hardware and infrastructure without the accompanying professional development for sound educational practice, means that the actual learning environment at the school level changes very little. There has generally been a lack of a systematic approach by educational systems (Lemcke, 1998). This is evident in Australia where technology initiatives are taking place at the systemic level in the provision of the infrastructure, hardware and software, but there is no system approach for the provision of staff professional development, either in basic technology skills or the pedagogy required to effectively integrate technology into classroom practice.

The importance of technology leaders in schools is also an important factor in the successful integration of technology (Blurton, 1999). Technology savvy leaders in schools can assist staff at the local level and provide professional development that is relevant to teachers at the point of need. When this occurs, meaningful programs that integrate technology into classroom practice will be designed, rather than using technology as an 'add-on' to learning (Means, 1998).

Creating a learning culture, of which technology is one component, will lead to real changes in classroom practice and student learning (Rockman, 1998). To achieve this outcome educational institutions at the systemic level need to look closely at the architecture of the learning environment provided in a traditional school. School buildings, the nature of education (particularly in secondary and tertiary settings) and subject specialisation also impact on student access to technology and the creation of a collaborative working environment for teachers, all necessary ingredients to induce change in learning environments (Rockman, 1998). Traditional learning environments/structures encourage isolationism and do not encourage flexibility of delivery or teaching methodology (Fatemi, 1999).

The provision of adequate technical support, commitment from administration and the development of user policies, staff incentives and the recognition of best practice are also areas identified as prerequisites for the successful integration of technology (Charp, 1997). The top down approach to integrating technology in schools is also criticised by some researchers, who maintain that schools/ communities need to step back and make decisions about how technology will benefit them and then collaboratively plan for change. Systemic initiatives that concentrate on infrastructure, placing computers in schools and teacher professional development that focuses on acquiring basic technology skills, will not translate into change or effective use in the classroom (Cohen, 1998).

Another major issue that reappears constantly throughout the research is the difficulty in measuring student learning using traditional testing. Educational systems are currently moving away from content-based curriculum and towards the provision of an outcomes-focused teaching and learning environment. In this environment, major educational goals include the acquisition of numeracy and literacy skills, and the development of information skills that lead to an understanding of the process of knowledge acquisition, evaluation and creation (Combes & Sekulla, 2002). Teachers are now endeavouring to produce students who have the skills to be lifelong learners. Traditional testing methods do not successfully measure higher order thinking, problem-solving or information literacy skills, just as they do not measure changing attitudes to learning, motivation and levels of engagement. Becker concludes: “[We] don’t have effective ways to measure integrative performance” (Becker, 1998).

Thus a recurring theme throughout the research is that politicians, school administrators and educators need to critically assess what it is they want to achieve in terms of student learning and whether the integration of technology into the program will be beneficial, rather than trying to measure the impact of technology on education. Comprehensive technology planning at the structural, administrative and curriculum level; the presence of pro-active teachers working in a supportive environment with access to ongoing professional development to assist in the design of meaningful learning programs (Means, 1998); and the development of a learning technology culture at the school level; will lead to changes in the way technology is integrated into classroom practice and to positive learning outcomes for students.

### **A role for the Teacher Librarian?**

The role of the teacher librarian (TL) is often misunderstood and most administrators and staff in schools overlook the potential of this untapped human resource. Research reports significant increases in student achievement of learning outcomes when there is a pro-active library service in place.

*Principals often leave library potential untapped despite fifty years of research evidence that effective library media programs — when led by active, involved [teacher] librarians — can have a discernible positive impact on student achievement regardless of student, school and community demographics (Hartzell, 2002).*

The TL, as the title implies, is a teacher first and a manager of resources second. In this role TLs are in a unique position in the school. In their managerial role of the resource centre they have a comprehensive knowledge of curriculum across all Learning Areas and select a range of resource types from realia and print to digital/electronic and web sites to support teaching programs in schools. As a teacher they collaborate extensively with teaching colleagues to provide curriculum support in the areas of program planning and delivery. TLs may also be extensively involved in curriculum, organisational and

operational leadership activities in the school (Hartzell, 2002). In recent years they have become the teachers who teach students how to use the Internet appropriately and effectively and are often the policy makers for Acceptable Use Policies in schools. TLs have also utilised the features of technology to cater for different learning styles and to teach and embed information literacy skills development into online programs across the school (Combes & Sekulla, 2002).

A major issue that reappears throughout the research dealing with the integration of technology in education is the need for strong and ongoing support for teachers if they are to integrate technology into effective classroom practice. This support is more than teacher competence with the technology, although this is one aspect. For teachers, ongoing local support at the point of need is the key to the design of programs that integrate technology into classroom practice. Local support includes local knowledge of the school community, students and their needs; a knowledge of curriculum across all Learning Areas; curriculum initiatives for that particular education system and the types of resources available in that school/community to ensure an holistic learning experience that caters for all learning styles. The TL is in an ideal position to provide this support, both in terms of resource provision and in the design of seamless curriculum that embeds information literacy and literacy skills development.

Teachers also need support to embed good teaching-learning pedagogy into programs that incorporate the use of technology. When this does not occur, then the focus remains on the technology as the delivery mode, rather than student learning and the development of higher order thinking skills. There is no doubt that the technology can be used to enhance and scaffold learning, but this needs to be incorporated into the curriculum design.

*Good curriculum is resource-based; student-centred; encourages higher-order thinking; develops information literacy skills; actively engages the learner; uses prior knowledge to further develop increased understandings of concepts; places learning in a relevant context for the learner; encourages independence; and provides opportunities for the further development of essential skills (literacy, numeracy, teamwork, communication) (Combes & Sekulla, 2002).*

Good curriculum utilises a range of teaching-learning tools, strategies and resources that are designed to cater for different learning styles and to maximise the learning experience for all students. Online Curriculum as defined by Burston et al (2000) utilises a blend of teaching-learning methodologies that tailors delivery to students' needs/abilities and uses a range of teaching-learning resources.

The TL is one person in the school who can provide expert knowledge and access to a wide range of quality curriculum resources. This person already has a history of working collaboratively with peers; literacy and information literacy skills development have always been part of the TL's teaching role and he/she has a broad knowledge of how a wide variety of curriculum resources can be used effectively in learning programs. Many TLs are also

accomplished webmasters and have created and managed 'virtual libraries' that support the traditional print-based collection.

The research also criticises system initiatives that take a top-down approach to the integration of technology into the curriculum. These initiatives fail to address the local needs of teachers, who have been identified as key elements in the successful implementation of technology in education (Lemke, 1998, Blurton, 1999). Current Commonwealth initiatives in Australia to create copyright-free, quality, digital 'learning objects' that will be available to schools, will only translate into effective use in classrooms if they are integrated appropriately into teaching-learning programs (Le@rning Federation, 2003).

The TL has the curriculum knowledge and access to a wide range of other teaching-learning resources to support blended online programs that incorporate learning across learning environments. They are the ideal collaborators to help teachers as they integrate technology and these 'learning objects' into student-centred programs that meet the needs of their local school community in an outcomes-focused educational environment. They are in a position to provide the ongoing local support for teachers that has been identified in the research as a major issue for the effective integration of technology in education. When support is localised and ongoing, teachers will be better equipped to design holistic curriculum programs rather than unrelated, one-off projects that don't foster skills development or content knowledge which will enable students to transfer skills and learning from one context to another.

The presence of a curriculum leader who can coordinate curriculum design and incorporate a range of learning resources to create student-centred learning environments that encourage learner independence, higher order thinking skills and information literacy skills, is also acknowledged in the literature as an essential ingredient for the successful integration of technology in education. Schools need look no further than their TL to fulfil this role.

Is there any evidence to suggest that TLs can or have taken up this challenge? Research conducted at Sevenoaks Senior College in Western Australia where the TL took on this extended role of curriculum development has already revealed some preliminary results. The research found that the high implementation rate of online courses during the first year of operation was due to the fact that all teachers actively participated in the creation and design of online courses thus ensuring 'ownership' of the concept. This fostered the development of a collaborative teaching environment where the provision of ongoing local support and curriculum advice by the TL were recognised as a key factor in the successful implementation of online curriculum delivery at the College (Aldridge et al, 2002). Research currently in progress by Ross Todd at Rutgers University is also revealing the differences a pro-active TL can make to the integration of technology into classroom practice, the development of higher order thinking skills by students and integrated learning programs that address student learning outcomes across the school. (Todd, 2003)

## Conclusion

The use of technology in educational settings has evolved over the last thirty years as education has changed to accommodate new ICTs and the information explosion. The terminology educators have used to describe how technology has been used in education reflects these changes and provides an insight into how it is being used in current learning environments. The latest term, online curriculum, best describes the core business of the school and the blended teaching-learning environments currently being developed in schools. In these schools technology is just one part of a dynamic learning environment where the educational focus is outcomes based and on the development of students who are adaptable, flexible learners equipped with the skills necessary for lifelong learning.

While research into the impact of technology in education is still inconclusive, it does indicate that technology has the potential to be a powerful tool for learning. This research has also consistently highlighted a number of systemic and local issues that affect the successful integration of technology in classroom settings. While schools have little control over initiatives at the system level, they generally have the resources to deal with local issues. These issues centre on the need for ongoing support and professional development for teachers who are trying to come to terms with the implementation of rapidly changing technologies and educational pedagogy. Schools already have the personnel available to provide this necessary curriculum support and guidance in the TL, a role that is often underestimated and misunderstood. The research has identified the need for someone at the local level to take on the vital role of ensuring that teachers have ongoing, 'grass roots support' for the development of collaborative teaching-learning environments where all resources, human and physical, are used in the design and creation of curriculum programs that integrate technology into the learning culture of the school. The TL has the overarching curriculum knowledge, the collaborative background, manages curriculum resources across the school and is ideally placed to be such a key person.

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