The educational benefits of computer use in schools have been widely acknowledged by experts. However, research indicates that in order to use information and communication technologies effectively, critical changes and new paradigms in teaching are necessary. Within that context this paper articulates an investigation on the research literature in relation to the integration of computers in classrooms and establishes the support structures necessary to enable teachers to change and adopt pedagogies for effective use of computer-based tools to support learning.

The term 'computer-based tools', an eclectic one, represents the diversity of information and communication technologies (ICT) such as problem solving software, desktop publishing software, spreadsheets, multi-media, the internet, electronic mail and chat facilities. ICT use refers to the integration of computer based tools to support learning within a predominantly constructivist approach, that is an approach that provides students with opportunities to actively engage in constructing their own knowledge.

INTRODUCTION

Educational research indicates that the use of computers as part of regular classroom practice may have many positive effects on student learning and attitudes (Cotton, 1997; King, 1997; Newhouse, 1998). However, for successful integration to occur, critical changes and new paradigms in teaching are necessary (Graham & Martin, 1998). From this perspective, successful computer integration (Wesley & Franks, 1996) is often seen to involve not just the acquisition of technical skills and resources by teachers but also the challenging of deeply held beliefs, attitudes, perceptions and experiences with regard to teaching methods and pedagogy. It is also proposed that successful engagement in computer-related classroom activities occurs when teachers promote their own methodological and attitudinal changes through participation at their own volition, with assistance through effective professional development, technical assistance, instructional sharing and collaboration (Wesley & Franks, 1996).

HISTORICAL CONTEXT

The effects of the computer on student learning and attitudes have engaged the attention of researchers since its introduction into schools. It is possible to locate a multitude of studies that have supported the use of computer-based tools. The earliest studies focused on student achievement outcomes. To make meaning from the diversity of research
undertaken, Edwards, Norton, Taylor, Wies and Van Dusseldrop (1975) and Vinsonhaler and Bass (Khalili & Sashani, 1994) reviewed the findings of several studies to generate their conclusion that the use of computer-based tools resulted in more positive effects on student achievement outcomes than did traditional instruction alone, when measured by improved scores on standardised tests.

In an effort to refine the synthesis approach to computer use in classrooms, researchers began to embrace meta-analysis techniques in the early 1980s. Meta analysis is a research synthesis methodology which enables researchers to summarise the breadth of the literature and generalise about relationships. A meta-analysis of forty studies by Burns and Bozeman (1981) on the effects of computers in elementary schools favoured the use of computers in classrooms. Likewise, a meta-analysis conducted by Kulik, Bangert and Williams (1983) focusing on studies in schools between 1970 and 1983, indicated that students who used computers as part of their instruction generally learned more, remembered longer and required less instructional time.

More recently, there has been a shift in the way computer-based tools are perceived in the classroom, with an emphasis on the quality of learning experiences for students rather than just quantifiable outcomes. The literature (Cotton, 1997; King, 1997; Newhouse, 1998) now describes computers as powerful teaching and learning tools that, when used effectively, have the potential to reshape the educational process. That is, when computer-based tools are part of a well designed program they help to support learner engagement, sustain motivation and enthusiasm, improve social skills, and provide a range of interactive opportunities not previously available in learning environments. It has also been noted that with careful planning, the integration of computer-based tools can promote students’ sense of ownership of the learning process (Squires, Morton & Brown, 1997).

Researchers are in agreement that when computer-based tools are used appropriately in well-designed programs and supported by teacher input and feedback they have the potential to support and extend pedagogical goals. Furthermore, effective use of the tools can actively engage students in constructing their own knowledge and sustain their motivation to learn. Researchers (Mann, 2000; Newhouse, 1998) caution however that the success of such an approach is dependent upon teacher input within a supportive school context.

THE SCHOOL CONTEXT

The first decade of computer use in schools focused on integrating the computer into the existing school system (Collins, 1991). Collins described this system, particularly in the American context, as a self-sustaining, interlocking structure of age-graded schools dominated by multiple-choice testing, curriculum content, and lecture and recitation methods that naturally resisted computer-based tools. Collins concluded that only those uses of computers that fitted the prevailing structure would penetrate it in the short term. That is, if computer use supported lecture and recitation methods of teaching that would be easily assimilated whereas computer use that promoted the student as a self-directed learner would not be so easily taken up.

Collins’ view has been challenged by Fullan (1997) and Spender (1998) who advocate a re-engineering of outmoded school structures. Those researchers argue the need for curriculum remodeling, stating that students will require a different set of skills to negotiate learning in the future as new parameters will dictate what is required to function in tomorrow’s world. Schools need to be adaptive and bear relevance to a world of the future, not one of the past.

If computer-based tools are to support the skill sets required in a future world then among the school structures to be re-engineered is the curriculum itself. In this respect, what is needed is a greater focus on how learning is organised. Implicit to such a change is the need for greater flexibility within the learning environment, with a shift in the teacher’s role to that of a manager and facilitator of learning, as it is not the computer but the manner in which it is used in the classroom that will determine whether or not students will acquire the new skills.

PEDAGOGICAL ISSUES

Although teachers are aware of the educational benefits offered by computers, historically there has been little reported success in the fostering and effective integration of computers in classrooms. Gross (1993) and Moersch (1995) observed that computer use in schools generally lacked intellectual content because it was restricted by teachers’ lack of operational skills. Later findings in an American study by the Office of Technology Assessment (OTA) underscored the need for teacher skills in computer use at all levels (Maddux, Johnson & Willis, 1997). The OTA findings also stated that the place of computers in the curriculum continued to be ill defined and only vaguely perceived by teachers. Issues similar to those of the OTA findings have been identified more recently in Australia by Bowes (1998), Fifoot (2000), and Mann (2000).

As a group, teachers have been slow to employ computer-based tools in classrooms, with several contemporary studies (Cummings, 1998; Mann, 2000; Newhouse, 1998) still emphasising teachers’ negativity and resistance towards the use of computers. Those studies concluded that resistance arose because teachers perceived computer use to be too time consuming and they were also reluctant to hand over control of the learning environment to their students. It could be argued that such resistance is manifest because not only must teachers learn how to use new computer software and constantly update those skills, they must also consider alternative teaching strategies if they are to use the new software to support learning within a constructivist approach.

NEW ROLES FOR TEACHERS

The teacher’s role as described by Graham and Martin (1998) is one that is evolving from the authoritative transmitter of knowledge to that of co-learner and facilitator. Graham and Martin recommend changes in pedagogical practices that would generate a transformation from the outmoded, broadcast learning model of the past to an interactive learning model. An interactive model (Scheffler & Logan,
Teaching with computers is effectively a new pedagogy to many teachers. This could be attributed to a discontinuity between the learning environments in which they were students and the demands imposed upon the integrated learning environments in which they are teachers. Implementing a new pedagogy requires skill, creativity, and time. Teachers must be aware of differences in learning styles, have alternative approaches to cater for those differences in learning styles, and help learners achieve instructional goals through effective computer use. To increase teachers’ confidence and prepare them to make these pedagogical changes they must have access to adequate professional development and support.

PROFESSIONAL DEVELOPMENT FOR TEACHERS

The introduction of computers into schools has occurred largely on an ad hoc basis, relying to a considerable extent on the goodwill and voluntary efforts of teachers (Graham & Martin, 1998). Many teachers have been expected to pick up computer skills in their own time, either at their own expense or informally from their colleagues. In the process of acquiring computer hardware and software perhaps the most valuable part of the education equation has been overlooked, that of professional development (PD). Williams and Price (2000) state that less than 15 percent of schools’ technology budgets have been spent on training teachers to use ICT effectively in classrooms.

SKILLING TEACHERS IN ICT AND TASK DESIGN

To become confident, critical and creative users of ICT teachers must have access to PD programs that enable them to have multiple skills, both, in the use of technology and in task design. Professional development must not only provide teachers with a perspective on the operational use of ICT, that is the use of computer hardware and software, but also focus on skills involving the use of computer-based tools to support learning. Teachers would need to understand the rationales for integrating computer-based tools into learning environments, and interpret curriculum documents to make decisions about designing, delivering, managing and evaluating instruction (Graham & Martin, 1998). The transfer of these new skills to pedagogy is dependent upon the attitudes and experiences of individual teachers who must also have adequate access to computer hardware and software and time to experiment with computer-based tools (Williams & Price, 2000).

ONSITE TRAINING

The Teacher Learning Technology Competencies document (Williams & Price, 2000) also underscores the importance of making onsite PD opportunities available for teachers. To be effective, training must be specific to the school’s goals with situated models and positive reinforcement and support. Teachers must be able to choose from a range of learning experiences to meet a particular need or support a desired change in their teaching practice. Furthermore, since rapid advances in computer technology make specification of skills a moving target, for teachers this would mean frequent research and review of pertinent skills.

ACCOMMODATING ADULT LEARNING

Professional development programs must accommodate the principles of adult learning (Castner, 1998). Paramount among those are that adults are best motivated to learn when they can take responsibility for their own learning and promote (Wesley & Franks, 1996) their own methodological and attitudinal changes, progressing through a developmental change process. That change process addresses the issues of emotional support, technical assistance, instructional sharing and collaboration. In this perspective, computer integration involves not just the acquisition of technical skills and resources but the challenging of deeply held beliefs, attitudes, perceptions, and experiences with regard to teaching methods and pedagogy as it is not just the use of computer-based tools but the learning experiences within the classroom context that will determine successful integration.
CONCLUSION

The issues that have come to stand out most clearly as a result of this paper are those concerned with pedagogy and support structures for teachers in relation to effective use of computers in classrooms. Questions that need to be investigated further are (1) "What new skills and attitudes do teachers need in order to empower them to integrate computer-based tools effectively into the learning environment?" (2) "What support structures offer teachers the opportunities to make the necessary pedagogical changes?" and (3) "What school cultures are most supportive of teacher change?"

REFERENCES


At: http://www.iste.org/L&L/index.html


