"The computer can free students (and teachers) to attend to other aspects of learning."

TIME TO BREAK THE MOULD?

TECHNOLOGY is now commonplace in most schools. There are few schools which do not have a television, film projector, video cassette recorder or, most recently, a computer. Incorporating this technology into the classroom has meant that learning can progress from the passive mode to an interactive environment that can address individual interests and needs.

When linked to satellites and other telecommunication devices, utility courseware, two-way television, interactive video disks and electronic databases can dramatically reduce communication distances and open opportunities for students to truly become members of a "global community" (Shuman, 1987). However, the implementation of these technological innovations in the curriculum has been sporadic and fragmented. Technological developments are transforming the society our schools serve, and the schools cannot afford to ignore these changes.

Therefore to make meaningful use of powerful new technologies, such as computers, should schools adapt them to the existing curriculum or should new curricula be developed which include the integration of such interactive innovations? If the latter is the path we must take, how will it be implemented, what problems will arise and will the learning outcomes be worthwhile?

The education policymakers are allowing the classroom use of technology to be implemented in an ad hoc fashion. No one education system appears to be willing to formulate "curricular changes of real significance" (Stenhouse, 1975:167). It is imperative that this trend be reversed, that innovations are not moulded to fit into the existing curriculum. Rather, education systems should be developing curricula which will prepare our students for a world increasingly influenced by advancing technology.

Life Wasn't Meant to be Easy! The changing role of work

The accelerating pace of technological and social change has resulted in a large number of skills and professions becoming obsolete, or dramatically reduced in numbers and importance. The pace of job obsolescence is likely to accelerate rapidly in the 1990's (Willis, 1987:2). The resulting change already means an unprecedented need for flexibility and retraining, but even then large sections of the potential working population are likely to remain unemployed (Willis, 1987).

Such changes in the industrial base of the economy make new demands on the labour market that will require different kinds of products from the education industry, causing changes to the structures, processes and content of the education system. "Education has to prepare people for a rapid and complex world of change and is itself a powerful vehicle that facilitates and guides this change." (Education in Modern Society, OECD Report, 1985:106).

The changing role of education

"Education is the driveway of an informed society. Information, processed into knowledge and wisdom, has become our dominant resource in the United States. ...Educational systems need to be demanding, relevant and continuous and broad and wise. The people and nations that don't learn to participate in an information-based society will be its peasants. Yet, our formal systems of education haven't assimilated the new fact that more than half of all work is information work and that, as a consequence, the nature of work for which we educate students is changing faster than ever" (Cleveland, 1986:62).

Walker (1985:95) agrees with Cleveland's statements. He says that "the high rate of growth and development of knowledge means that we cannot expect any individual to acquire enough knowledge in the first third of life to coast through the rest. Continuing education, recurrent education, education throughout the lifespan will be essential". Schools should be preparing children for life in a society in which microelectronic devices and systems are commonplace and pervasive.

If we are to include a microelectronic device, such as a computer, in the classroom, the emphasis should change from the student simply being taught to the student having to learn. In a rapidly changing society, the ability to be adaptable and to learn is an important skill - but one which must be taught at an early age! Learning should move away from the memorisation of content; away from the mechanicalrote learning of spelling, number facts, and historical data and into "learning to learn" where the emphasis is on the learning of "general principles and strategies that can be applied to a wide variety of situations". Such "innovative learning" should enable people to "anticipate developments, prepare for them, and adapt quickly and well to changing circumstances" (Walker, 1985:96).

A Vision of Excellence?
The educational potential of computers Paper (cited in Sullivan, 1985) asserts that there will be a significant change in patterns of intellectual development occurring as a result of "cultural change" brought about by the computer. Over the last ten years we have seen a gradual movement from a computer-oriented approach (in which the computer controls the interaction) towards a learner-oriented approach, characterised by a more personalised, adaptive and exploratory attitude to learning. As technology develops we can expect this trend to continue: to see the computer being used to assist in teaching reasoning and intuition rather than the "right or wrong"; "drills and frills" approach.

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However, there are educators who do not believe that the integration of the computer into the classroom will provide “innovative learning”. Baker (1984) believes that the computer will only reinforce passive learning. He feels that it does not create development and progress; instead it strengthens and reinforces existing approaches. Rather than inspiring teachers to re-examine their aims and goals in the curriculum, the microcomputer “may act as a reactionary or confining influence on the curriculum”.

Taylor and Johnsen (1986) are also concerned that by giving the computer a prominent place in the curriculum we will teach our young people to accept and learn to cope with their “assigned role in a technological society”. Rather we should “engage students in an experience of looking critically at the assumptions of that society.” Education should be about empowering educators and young people “to exercise the freedom and assume responsibility for exploring the full range of alternatives that give meaning to human choice”.

No other educational innovation has received the attention that has been focussed on the computer. The appeal of the computer can be traced to its “inherent pedagogical strengths”, whereby it provides for more active, individualised learning (Walker, 1986). Whereas television is a visual, interesting medium, it is not interactive. The computer allows for input from students; decisions to be made by the user which will then affect the outcome of the program.

Ways to use computers for education

In present-day classrooms, the teacher is still the dominant force, allowing little interaction between students. Emphasis is on the individual with little encouragement for collaborative group work (Galton, 1987). The ways to which the computer is put to use in the classroom will have quite different implications for the curriculum and the teaching strategies employed by most teachers. The computer can create an environment in which mistakes or failures are expected as an initial part of learning and that such mistakes can provide a basis for further understanding. By reducing the mechanical burdens of computation, writing and the manipulation of information, the computer can free students (and teachers) to attend to other aspects of learning, such as higher order thinking skills, and to aspire to new levels of cognition (Moore, 1987). It also promotes peer discussion, peer tutoring and collaboration at a level not usually seen in most classrooms. “There is more peer interaction in this kind of setting than there is in most current class-rooms - and it is focussed on the learning process. Students help each other to understand the material, a powerful learning aid” (Bork, 1986:36). The role of the teacher changes from that of “giver-of-all-knowledge”, to that of a facilitator or co-learner.

What is also becoming apparent is that the individual achievement ethos of the classroom needs to be replaced with the ethos of co-operation with others (Education in Modern Society, OECD Report, 1985). How then should technology be used in the primary curriculum to achieve individualised instruction, in accordance with each student’s needs, interests and abilities and yet further collaborative group work?

Many primary school teachers organise their work around an interesting topic or theme, and the theme forms the basis for investigating, creative writing, mathematics, art and craft; in short, work in any curriculum area which the ingenuity of the teacher and the enthusiasm of the pupils can identify. Within this classroom environment, teachers can use word-processors, spreadsheets, graphics generators, desktop publishing software, adventure games, simulations, Logo and databases to develop challenging curriculum. In this way the computer becomes an integral component of the learning process and not an “extra”. For example, if the thematic unit is on Dinosaurs, the children may use a word processor to type their stories/reports about dinosaurs. A database could be used to enter categorised data on dinosaurs, an adventure game called Dinosaur Discovery may be played, crosswords may be generated using utility software and dinosaur pictures drawn using a graphics package.

Good teachers will use computers (as well as other media) to offer learning experiences which provide direct concrete activities and which take into account the student’s prior knowledge and experiences, the nature and direction of the task, and the student’s level of motivation. Thus the students become active learners; they read, write, think, discuss and interact with each other and with the teacher. However, even within these activity-based classrooms, there will still need to be major changes in terms of objectives, content and certainly teaching methods. Teachers will need to consider new ways of ordering and classifying knowledge and develop new forms of classroom (and school) organisation. There will also need to be a reassessment of values and attitudes towards learning and the role of the learner (Teaching, Learning and Computers in Primary Schools, 1985).

The challenges of implementation

Such changes in the classroom will require far-reaching adjustments in the purpose, content, and structure of schools” (Walker, 1986:28). The implementation of these changes will pose a considerable challenge to those involved in curriculum development; whether it be at the school, regional office or head office level. Organisationally, schools in Queensland are set within a fairly rigid centralised hierarchy with the major decisions being taken by a small number of senior bureaucrats. Inevitably there are lengthy delays, middle managers are reluctant to take risks or show any initiative. It is safer to wait for the policy to be set by the Department of Education. Yet computer technology is developing very rapidly and we need to be able to respond to some of its effects quickly, decisively and effectively. It should also be taken as “fundamental that we should be concerned with qualitative change in the educational process rather than with the simple addition of new means to old ends or old wine in new bottles” (Gooby, 1982).

If significant qualitative changes are to be made to the curriculum to include microtechnology it is highly likely that there will be resistance at various stages, within the implementation process, from some teachers, parents, and administrators. Parents who oppose the introduction of computers will look at it in terms of cost. The monetary resources required are large by comparison with other curriculum materials such as reading books. Equity of computer access may also be a cause for opposition. If the administration has decided that only the upper school will use the computers, these parents may feel that none should be used until all students have equal access.

Many primary school teachers regard microtechnology as yet another demand upon their time, another area in which they are supposed to become “expert”. There are also those teachers, whom Chamberlin (1983) calls Technophobics who cannot adjust to the use of modern technology in the learning process. Most teachers cannot set up a film
projector unaided, and the television set may be easier to operate but is often not used effectively because of scheduling problems or relevance of program concepts and curriculum support materials. At the other end of the continuum we have the Technomaniacs who are overly enthusiastic about the use of technology—especially computers—in their classrooms.

School administrators are generally in favour of microtechnology in their schools. However, it is not always favoured because of educational benefits, but rather because it will confer status and prestige on the principal.

Unless a major in-service program is undertaken it is highly likely that the use of computers will remain at the periphery of the school, not affecting its core activities. “Computers (must be kept) out of the closet where the learning kits, teaching machines, video equipment and other flotsam are stored” (Oakes & Schneider, 1984:78). For the implementation process to be successful a massive input of funds at the regional level will be required, and a qualitative change in the thinking of regional inspectors and school principals. Classroom techniques need to be devised to enable teachers to use computers effectively in ways that help all children. Teachers do not intuitively understand how to teach with computers, and what teaching strategies are most appropriate for certain situations; they must be taught. This is not to say however that these teachers are not good teachers. To fully integrate computers into a primary classroom will require changes to certain types of learning experiences, and to the strategies used to provide those experiences.

New courses need to be developed at the pre-service level. There needs to be large scale development of curriculum materials that make the computer an integral part of learning from pre-school through to college or university. The colleges are responding in part to this challenge. Brisbane College of Advanced Education offers a number of units in computer education for pre-service teachers. Mt Gravatt Campus, for example, has two compulsory units: one covers technology and resources in teaching and the other, curriculum applications of the computer. The universities offer very little to students in these areas. If these institutions do not see the computer as an important component within the learning process, then the teachers who are trained at these institutions will also not see it as important.

Software and supporting curriculum materials must be developed, in accordance with the learning styles of children.

Much of the early software was designed by non-educators and was of the drill and practice or tutorial type where the answer was either right or wrong. Individual learning and competition was reinforced. The design of open-ended software such as adventure games or simulations which allow the teacher to integrate its use across the curriculum must be the highest priority.

The decision on what computers to purchase must be made at a state level. The choice of computers in Queensland primary schools is left up to the individual schools. There is a recommended list provided by the Department of Education, but this nominates three mainstream computers and approximately four specialised computers which schools may purchase; a total of seven recommended computers. Narrowing the computer brand down to one or two as other states have done will mean that software selection and resource spending may be minimised as schools may pool packages.

The problems of implementing any innovation on a widespread basis are immense. If the implementation process is to proceed through the usual curriculum decision-making process in Queensland then “a premium is placed on those uses that interfere least with the existing pattern” (Walker, 1986). Walker goes on to say that if the problems are overwhelming then the following will happen:

1. slow, haphazard, and scattered acquisition of equipment, because there is no budget for this purpose. This is the current situation in primary schools in Queensland. Computers are purchased by schools’ Parents and Citizens Committees. The Department of Education provides no funds for this purpose.

2. use by a few enthusiastic teachers who become specialists, because there are no plans for staffing, in-service education, or staff development. The current situation is to have the most qualified or most interested teacher in charge of computers and in-service for the rest of the staff. This in-service usually looks at the hardware components and the mechanics of turning the computer on and off. Rarely considered are curriculum applications of courseware packages or programs that develop problem solving skills. Therefore, it is no surprise to learn that most teachers use drill and practice software in their classrooms (Wright, 1987; Syson, 1986).

3. use in isolated individual courses, because adoption throughout a department or curriculum component would require an institutional commitment.

4. improvisation, year-to-year adjustment, because strategic planning requires an institutional commitment. Usually even year-to-year adjustment does not take place as the improvisation is at the level of individual teachers, not at the school level.

5. highly variable quality, because individual users will not assert a right to pass judgment on the quality of what another may do, and the institution, having washed its hands of the matter, will be powerless. To acquire the expertise required to implement the innovation, teachers tend to employ a process of trial-and-error which is rarely shaped by ideas of how children learn, but usually assimilated or adapted to existing classroom practice (Walker, 1986).

Significant widespread changes require more money, more effort and expertise from teachers, administrators and policymakers. Becoming obvious are the major differences between the visionaries and the realities of how computers are being implemented into the classroom.

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Models of implementation

Thus, the implementation process should be a combination of all four models. The basic research or discovery of the innovation comes from the Research, Development and Diffusion Model. From this we move on to interest in the innovation and an evaluation of its appropriateness to the curriculum (Social Interaction model). The innovation is adopted, trialled and evaluated (Problem Solving model). The outside consultant should be involved at all stages. Provision of a resource support network (the Linkage model) within regions would enable schools to collaborate on curriculum applications. The central body takes on the role of facilitator and coordinator of the implementation process. This opposes the usual "top-down" rule taken by the head office of the Department of Education.

The processes of change are lengthy, expensive, and the outcomes are not always predictable; characteristics which are often anathema to a central bureaucracy which maintains a tight control. Demands for time, energy, money, and especially for knowledge and expertise are already far in excess of the ability of schools to respond. At present they are receiving little assistance from the central decision-making bodies within the Department of Education. The rhetoric continues in support of education linked to technological awareness, at both the state and federal levels, but the government's policy of limiting public spending means that schools are seldom able to afford additional equipment or software. (Syson, 1986:290)

Conclusion

I see the classroom as an artificial and inefficient learning environment that society has been forced to invent because its informal environments fail in certain essential learning domains, such as writing or grammar or school mathematics. I believe that the computer presence will enable us to modify the learning environment outside the classroom that much if not all the knowledge schools presently try to teach with such pain and expense and such limited success will be learned, as the child learns to talk, painlessly, successfully, and without organized instruction. This obviously implies that schools as we know them today will have no place in the future. (Papert, 1980:8-9)

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Rewards beginning to flow

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...tailored to its unique situation. When using the system it is possible for a teacher in the ACT to access a range of information including details about resources needed in the classroom and their availability in the library, as well as look up a description or review of a particular software package and its use as part of a curriculum project in another state. The synergy of the components of the ASCIS database also has enabled access to reviews of various educational resources, education policy documents and projects in progress throughout the country.

The ACT Schools Authority has been part of ASCIS since it was first mooted as a shared cataloguing and information system for schools some fourteen years ago. The choice of software and the need to have a low cost, efficient information service for Australian education has meant that small systems like the ACT can maximise the benefits of belonging to a large scale organisation and further develop the principle of 'one-stop-shopping' for education information for its schools.

Further information about ASCIS and the ACT Schools Authority's use of its products and services can be obtained from: Executive Officer, Library and Information Services, ACT Schools Authority, PO Box 20 Civic Square, ACT 2608 or Executive Director, ASCIS, 325 Camberwell Road, Camberwell, Vic 3124

Conclusion

The 1980s bear witness to waves of initiatives in the Asian regional countries to introduce computers into education, both in the teaching/learning process as well as in the management of education. These initiatives are poised to spread, expand and diversify in the coming years, through to the end of the century.

Developments of computer use in education offer great opportunities for regional and inter-country co-operation. UNESCO will be happy to play a catalytic role in promoting and facilitating such co-operation.


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