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ABSTRACT

The examination of technological change and its impact on schools that is reported in these conference proceedings focuses on the human dimensions of this change, and in particular, whether the introduction of technology into education is causing turmoil for teachers. It is argued that teachers appear to be feeling the strain of the actual changes that are occurring and also the prospective changes that may occur, both in society at large and within schools in particular. After an introduction by Robert Moon the keynote address, "New Information, Technologies and Literacy" (Jonathan Anderson), is presented. The two lead papers are: "Technology and Distance Education--Queensland Developments" (Colin Sutcliffe) and "Technological Change and Education" (Kevin McCarthy). Finally, three workshop reports are presented: "Technological Alienation and the Teacher" (Alan Morwood); "Technology, Social Change and Education" (Carmen Luke); and "Technology and the Classroom Teacher" (Robert Pendreigh). The text is supplemented by various tables and figures, and a list of references is provided for each paper. (EW)

TOWNSVILLE REGIONAL GROUP OF THE AUSTRALIAN COLLEGE OF EDUCATION

FROM BLACKBOARD TO GREEN SCREEN

TEACHERS, TECHNOLOGY AND TURMOIL

Proceedings of the Eighth Conference of the Townsville Regional Group of the Australian College of Education held at St. Raphael's College, James Cook University, 15-16 May, 1987.

Edited by: R. Moon

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CONTENTS

ACKNOWLEDGMENTS

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INTRODUCTION

When the Committee was pondering on a suitable theme for the 1987 Conference, high in most people's consciousness was some topic related to technology. There is no doubt that technology, and the computer in particular, the so-called new technology, has been in the forefront of the thinking of educational planners and educational practitioners over the last twelve months or so. With increasing media discussion on such things as AUSSAT, with new developments in micro-processing, and with substantial support from both Federal and State Governments to introduce computer technology to schools, it is not surprising that there has been concern about this. However, in our discussions it became clear that the conference should not simply consider the change we described in our title "From Blackboard to Green Screen". Nor did we want to consider the topic as merely a description of progress, with all the favourable connotations that word has. Hence our subtitle "Technology, Teachers, and Turmoil". We were concerned that the introduction of new technology in education was causing, if not turmoil in the workplace, certainly turmoil in some teachers' minds and in their perceptions of what was happening. For teachers appear to be feeling the strain of the actual changes that are occurring and also the prospective changes that may occur, both in society at large and within schools in particular. So we planned a conference which would have a broad view of technological change and its impact on schools and in particular would look at the human dimension as far as teachers were concerned. The conference has not specifically addressed technological change as it might directly affect children in schools and no doubt there would be scope for another full conference on that aspect of the general theme.

In the outcome we have been very well served by our lead speakers and the discussions which they stimulated. There is no doubt that Professor Anderson's keynote address "New Information Technologies and Literacy" provided the kind of overview which we were confident would stimulate the participants. As he indicated early in his speech "technology is most simply understood as a way of doing something". But he makes the further important point that although technology may be defined as a means to do something, technology does not generally have the effect of merely providing a better way or a different way to do the things we did before. In fact as he pointed out "technology allows us to change what we have done in the past" and further "technology has changed our world and may change us."

This of course is a timely warning against one of the dangers of our age - that is, falling into the view that problems which are identified are only technical or technological. This danger is what Carmen Luke calls in her report "the technicist mentality". As Bowers (1984) states "with advances in technology the relatively fixed values that we have tend to become destabilised, this being all part of the process of modernisation". So, he argues, advances in technology have problematised other areas of our value system that previously were treated as taken for granted (1984, p. 2). In the same vein, in dealing with education and schooling specifically, he warned against regarding

all educational questions as technological and against the view that technologies can simply be accepted within the schools as neutral additions to existing school programs.

Professor Anderson also raised some very important points about literacy and technology. Fundamentally he showed that the idea of literacy has not been an unchanging concept through human history. While the taken-for-granted notion in recent times shows literacy as dealing principally with "the book", with the advent of new technologies, and in particular the new information technologies, our understanding of literacy needs to be quite substantially revised. His interesting report of ongoing research on the way information technology may affect the way we write and the way we think indicates something of the depth of the human revolution that could be occurring as a result of technological change.

In Colin Sutcliffe's presentation, "Technology and Distance Education-Queensland Developments", we have a nice case study of the way in which technological change may be used to enhance and humanize education. He provided an historical overview of the diversity of educational offerings to children in isolated areas. The rather ad hoc and unco-ordinated way in which these were provided in the past shocked many of the audience. It provided a sharp reminder of the danger of adding on to existing systems without attempting to integrate the old and the new. However his further description of how in the Distance Education Centre co-ordination among the various technologies has been achieved heartened us all. This has greatly improved the effectiveness of the delivery of education. He also made the additional point that technology is not just a matter of delivery; it allows parents, home tutors and teachers to become more involved in the decision-making process. This again demonstrates the point that technology is not simply a way of doing something which has always done but a way of providing greater options in what can be done. If these early steps in the Charters Towers Distance Education Centre continue to be successful then we can expect a far greater range of people to become involved in the decision-making process for education as it affects isolated children. There is a further point to be made here. If it is desirable, and now with the use of new technology possible, to give parents in isolated areas a greater role in decisions about their children's schooling, should it not also be possible to do the same for the parents of children in the more usual school situation. The use of information technology to promote school communication with parents has scarcely been considered, and has tended to remain at the level of the spirit duplicator and the occasional telephone call.

Our third speaker, Kevin McCarthy, also challenged us to reconsider our understanding of technology and its effects on education. He approached his theme "Technological Change and Education" by first establishing the fact that technology and technological change were with us, were not likely to disappear, and that individuals and society at large had to find ways of coming to terms with them effectively. He then identified three aspects of technological change and education. The first of these was technological literacy. He made the important point that technological literacy is not the same as being an expert in

science and technology, as that term is generally understood. Nor did he wish to trivialise the notion as is sometimes done into the view that technical and technological literacy means that a person can tinker with a lawn mower or a washing machine. Instead he directed us to the need for people to have a sufficient grounding and understanding of science and technology that they can assess the claims of experts not only on scientific and technical grounds but as these relate to social and ethical and economic dimensions of their lives as well. In the second phase of his paper McCarthy examined the impact of such change on curriculum content. In an interesting and no doubt somewhat disputed categorisation of curricula he identified three types of curriculum - general education, vocational preparation and vocational. This provided him with a framework for examining the impact of technological change on various aspects of the curriculum. An interesting comparison can be made between this approach and that suggested in WINDOWS ONTO WORLDS. This is the report of the committee appointed to review Australian studies in tertiary education. I recommend that to you as interesting reading. The committee suggests that through the cultures of work students in both vocational and vocational preparation curricula (to use McCarthy's categories) may, through their own particular vocational interests be lead to understand not only the technological changes that have occurred but also general work related changes in their chosen vocation. More broadly they may see how this relates to changes in the social, political and economic spheres in which they operate. This sort of approach can be seen as attacking the same problem that McCarthy identified earlier as the need for technological literacy. In the third phase of his paper he commented on technological change and education delivery. Here he made some important comments about the need for continuing staff development and effective ways in which this can be done.

It can be seen then that our three speakers have given us approaches to problems of education and technology which were widely different. This was to be expected given their different backgrounds - one from the University context, one from State School context, and one from the TAFE context. However they all complemented one other in identifying the sorts of technological and human social interface that need to be explored in dealing with technology. The liveliness of the debate which they stimulated can be measured in the reports of the discussion groups which followed. The impact of such conferences and the discussions that occur in them is always hard to assess. But it would be fair to say that the seriousness of purpose and the intensity of discussion suggests that this conference will have an impact on educational practice as well as educational thinking.

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NEW INFORMATION TECHNOLOGIES AND LITERACY

Professor Jonathan Anderson

Four main threads run through this paper:

1) that through technology we express our humanness;

2) that as technology develops, so our concepts of literacy change;

3) that the current state of technological development - what is called the information age - has implications for what is done in schools; and

4) that the significance of the new technologies lies in how we are changed by them.

It is a long story in that it takes us back to the seeds of time. There are implications in it both for our near and distant futures.

The Information Age

No one today can genuinely doubt that the computer is the most extraordinarily versatile tool yet invented. More than any other invention, the computer has brought forward the Information Age. There may be debate about the ultimate benefits of this new technology, for with most technologies there is usually a debit as well as a credit side - a double-edged sword is how the historian Kenneth Clark described it.

Microchips, microcomputers, micro cassettes, micro tvs, compact disks - these are all part of today's information age. The microelectronics revolution, from which the information age was born, was spurred on by the invention of the transistor and fuelled ever since by increasingly high degrees of integration whereby hundreds, thousands, and now millions of transistors are packed on to single chips. This very large scale integration has led to what we call the <u>new</u> information technologies.

Technologies

But first to technologies. Technologies are ways or methods of doing things. In other words, technologies are the tools, machines, materials and techniques designed generally to reduce labour, to increase production, or otherwise improve the value of our lives.

Not everyone agrees that technologies improve the quality of our lives. Thus Socrates was to say of writing, which is a technology, that it is a "thing", "a manufactured product", even "inhuman" (Ong, 1982, p. 79). And the workers led by Ned Lud in Leicestershire, and their counterparts in France, expressed even stronger sentiments about technologies of the Industrial Revolution. Their protests were to bring two new words into the English language: luddites and saboteurs.

There is a curious paradox here. Technologies, being man-made, are manufactured and, to that extent, artificial. But technologies are not therefore inhuman. Quite the opposite. It is because technologies occur nowhere else in nature that they set us apart from the rest of the animal kingdom and make us human. To manufacture, for instance, is "to make by (human) hand". If anyone doubts that manufactured products can enhance what nature has already endowed, one only has to consider the playing of music, the art of the great masters, or works of literature, all of which are produced by tools.

New technologies

If technologies are ways of doing things, new technologies are therefore new ways of doing things. What distinguishes humans from other animals is not just our brains and anatomical structure enabling us to walk on two legs and freeing our hands to manipulate objects, but rather the combination of these factors which allows us to fashion and use tools for our benefit. Two characteristics of new technologies are, first, that throughout time human beings have devised new ways for manipulating the environment and controlling nature - "Technology is always present in the midst of things" (Strandh, 1984); and second, that once new technologies are adopted, people rarely go back to the old ways.

Information technologies

There is a tendency often to identify new technologies with information technologies based on microelectronics. New technologies are, of course, not confined to information related concerns, but the explanation may lie in the fact that information technologies are so pervasive in society. The "third wave", Toffler (1980) called them, referring to the High Speed Revolution Society. So important has information technology become to national economies, that economists have labelled it the new fourth sector, complementing the primary (agriculture and mining), secondary (industry) and third (service industries) sectors. Third wave or fourth sector, every society today is increasingly dependent on information to govern, for purposes of trade, and to transmit culture.

Significance of new technologies

The importance of any new technology is not so much how it increases production or reduces labour, but rather that it serves as an agent for social change. As one commentator has said of our tools and machines:

> They change our world. They change us (Diebold, 1969, p. vii).

One 11 year old told me once: "Computers are our second mind", by which he meant, like Diebold, that computers change us.

The n t part of the paper traces how we have been changed by the tools we have made. What this means for education is taken up in the third section.

Technology and Literacy

We can observe how our tools and machines, new materials and techniques, have changed us by tracing the major stages of human evolution. It is argued here that these evolutionary stages correspond in large measure to four key milestones in communication; that changes in material culture and social organisation were brought about which led, in turn, to changes in communication and our notions of literacy.

Technological development and human evolution

For uncounted millennia up to the time of man's use of stone tools, change was glacially slow (Davies and Shane, 1986), but then four separate events were to take place, each of which was to change us for ever (see Table I).

TABLE I: Technological Development and Human Evolution

New Technologies	Dates (approx)	Human Evolution
Hand tools	2 million BC	Tool using animal
Language	34 000 BC	Talking animal
Writing	3000 BC	Writing animal
Printing	1440	Reading animal
Telecommunications	1837	Information animal

According to archaeologists, crude bone, pebble and stone tools have been found in the fossil record dating back for more than two million years. The kinds of tools did not change very much until about 34 000 BC (give or take a few thousand years), when a wider range and more sophisticated tools began to appear. The more standardised tool forms, suggests Leakey (1981, p. 135), may have been brought about because humans had developed another tool - the tool of language. Human were now to evolve into talking as well as stone tool using animals.

Other revolutionary milestones in communication to have had a profound effect on human evolution were, of course, the development of writing in ancient Egypt and Mesopotamia (ca. 3000 BC), the development of the printing press (1440), and the development of telecommunications (Morse sent information by electricity with his invention of the telegraph in 1837). These developments caused the human animal to change over time to become a writing animal, a reading animal, and now an animal bombarded by information.

Changes in culture and organisation

These technological developments in our capacity to communicate led, in turn, to dramatic changes in our way of life (culture) and the ways people live in groups (society). Table 2 charts these changes in our material culture and our social organisation corresponding to the evolutionary changes in the human condition from tool using animal through to talking, writing, reading and information animal.

TABLE 2: Human Evolution, Culture and Social Organisation

Human Evolution and History	Material Culture	Social Organisation
Early Man		
Tool using animal	Pebble tools Stone tools	Groups
Pre History		
Modern Man		
Talking animal	Spears Fire	Tribes
Writing animal	Alphabet Papyrus, brushes Clay tablets, stylus Paper Wheel, pottery Irrigation, farming Bows, arrows	Kingdoms City States
History		
Reading animal	Printing press Books, newspapers Steam engine Power looms Firearms	Nations
Information animal	Telegraph Typewriter Pen, ballpoint Radio, TV, video Telephone, film Computers Satellites, rockets	Global village

The development of spoken language is usually taken as the dividing line between early man (homo erectus) and modern man (homo sapiens); while the development of written language is the point when history was born.

There are many examples of our material culture other than those listed in Table 2 but those presented suggest the kinds of change that took place in people's daily lives. Corresponding to these changes were social and political developments which were to affect the way peoples of the world organised themselves into groups, from tribes to city states, from city states to nations, and from nations to major economic groupings within the global village.

Changes in communication and literacy development

The important consideration for educators is how these different technological and social developments have influenced the ways we communicate, and how these in turn have changed our notions of literacy. In Table 3 are listed the major new technologies we have been tracing, the typical forms of human communication associated with each, and what these various forms have meant for literacy development.

TABLE 3: Technological Development, Communication and Literacy

New Technologies	Medium of Communication	Form of Communication	Literacy Development
Hand tools			
Language	Stone Clay	Cave paintings	Pre-literacy
Writing	Papyrus	Signs Early alphabets	Restricted literacy
Printing	Paper	Developed alphabets	Mass literacy
Telecom-munications	Wire Air waves Tape Disk	Electric signals Bits and bytes	Multi-literacy

When spoken language was developed, the medium of communication was stone or clay. Cave paintings from this period have been discovered in different parts of the world. Man here is at a pre-literate stage of development. With the development of writing, papyrus, clay tablets and early forms of parchment begin to be used for the first time. Hieroglyphic and early alphabetic writing emerges but literacy is very much restricted to a few priests and persons of influence.

The invention of the printing press, in conjunction with the use of paper and developed alphabets, sees the beginning of the mass literacy movement. Pamphlets, broadsheets, and books come within the reach of the average citizen. The last stage we have identified, the telecommunications era, sees the emergence of radically different communication media: wire and cable, the air waves, tape and disk. There are corresponding new forms of communication that assail all our senses. We have reached what might be termed the stage of multiliteracy.

The pace of technological change

If it is assumed that some form of language had developed by 34 000 BC, then we can gain some appreciation of the pace of development in human communication by adopting a scale of a single year. In the countdown to the end of the century, we can date some significant milestones (see Table 4).

TABLE 4: Technological developments in human communication through the centuries

Day	Date	Time	Year	Development
1	Jan 1		34000 BC	Development of spoken language
:				
:				
:				
:				
:				
:				
:				
315	Nov 11		3000 BC	Invention of writing
:				
:				
:				
360	Dec 26		1440	Invention of the printing press
:				
:				
364	Dec 30	10:00	1837	Dawn of telecommunications age
364	Dec 30	16:22	1870	Compulsory education
:				
365	Dec 31	10:48	1946	First digital computer
365	Dec 31	13:00	1957	Launch of Sputnik
365	Dec 31	18:00	1975	First micro in kit form
365	Dec 31	21:36	1990	5th generation computers
365	Dec 31	24:00	2000	?

Suppose it is assumed that the development of speech takes place on January 1 (Day 1). The invention of writing does not occur until November 11 (Day 315), and the invention of printing on December 26 (Day 360). The fourth key development we have been tracing occurs four days later, but now the place is so hectic we count in hours and minutes. Day 364 at 10:00 am sees the dawn of the telecommunications age with the invention of the telegraph.

It is now about 9:00 pm on the 365th day. There are still three hours to midnight and the start of a new year. Although we can anticipate the fifth generation computer in about half an hour, it would be a brave person who would make predictions for the final hours of the year.

The pace of change has clearly accelerated from glacially slow to a roaring torrent.

Implications

The argument that has been advanced so far is that man has evolved over time from an animal whose main tools were made of stone, to a talking, writing and then a reading animal, until the latest stage of development reached is as an information animal; and, further, that these changes have been accompanied by new concepts and changing expectations of literacy. From restricted literacy to mass literacy, the information age now demands multiliteracy.

In what follows, we look first at the characteristics of the information society, and next at what this means for education generally and for reading educators in particular.

Characteristics of the information society

Three characteristics of the information society can be clearly identified. An accompanying comment by different representatives from the information sector follows each.

1. Vastly increased amounts of information

   According to the Schools Council in the U.K.:

   > Never before, has so much information been available to so many, and never before have our lives depended so much on our ability to handle information successfully. We need to be able to search out what we require, to assess critically the ideas and facts offered to us, and to make use of our findings (Schools Council, 1981, p. 9).

2. Information is packaged differently

   The Managing Director of Telecom, whose business depends on accurately anticipating the information needs of Australian citizens, has stated:

   > The world has entered the information era in which ultimately all information will be stored, processed, packaged, presented, accessed, transmitted, exchanged, through the media of computers, computer memories and electronic/electromagnetic communications (Pollock, 1983, p. 29).

3. Society relies heavily on computer-based technologies

Here is what the Chairman of one of the world's major airlines noted recently:

> By bits and bytes over the last 40 years, the world has become computerised ... In only four decades the incredible computer has become the indispensable computer (Ferris, 1985, p. 3).

Implications for educators

Clearly, there are implications for educators arising from the nature of the information society. What some implications are, is highlighted by various commentators.

1. Need for technological literacy

> As changing methods of storing information have progressively led us away from a heavy reliance on memory to writing so decried by Socrates, then from writing on papyrus and hides to the mass printing presses, and now from paper to the new media of computers, computer literacy becomes a fundamental aspect of literacy (Anderson in press).

2. Knowledge requirements are changing

> The knowledge needed to earn a living has become more abstract and symbolic. The levers and gears of the industrial age have been replaced by the less observable tools of the information age. The future citizen will need to be adept at selecting information, reasoning abstractly, solving problems and learning independently (Shield, 1984, p. 309).

> Students will ... become more and more dependent on computer-related technology to help structure their researching, recording, memorizing, thinking and problem-solving (Lich, 1985, p. 77).

3. Extended notions of literacy

> We are entering a new era in communications. Before the end of the 80s it is likely that many businesses and some homes will be linked directly with computers giving access to enormous libraries of information (South Australian Council on Technological Change, 1982, p. 2).

... among the most pressing tasks of education will be to teach <u>all</u> students how to access the new storehouses of information, just as it has always been the task of education to make the accumulated knowledge of mankind in libraries accessible to all. In broad terms, this means that students need to know:

- how data are organised in databases,
- how to interrogate these databases, and
- how to utilise the information once retrieved.

These are not completely new skills: rather that are an extension of literacy (Anderson in press).

4. New modes of instructional delivery

> The consensus among forecasters is that education will be delivered through high technology, in the context of open and flexible learning arrangements, causing major upheaval to the traditional roles of school, teacher and students (Lich, 1985, p. 74).

Research questions

There are many unanswered questions about the use of computer-based technologies in education, and the need for research is therefore great. To paraphrase what was stated in the opening section, the significance of new technologies in education is to be assessed not so much in terms of increased efficiency, but rather in terms of change effected in students.

Key questions for research, then, are how this new tool - the computer - is going to change us. We conclude with a consideration of three research questions.

1. Do computers change the way we read?

Adams (in Chandler and Marcus, 1985), comments from the British viewpoint:

> The evidence is very clear that the impact of microelectronics and computing generally will make more rather fewer demands upon literacy, and that the definition of literacy will have to be extended to include screen reading and writing if it is to be adequate to the needs of those growing up in present-day society (Adams, 1985, p. x).

Reading comprehension has always been a major goal of literacy. With more and more material being presented on video screen, a key question is how does screen reading compare with reading of texts presented in the traditional way, that is with books.

This particular research question is one that is currently being investigated at Flinders University. Initial results point to some interesting findings.

2. Do computers change the way we write?

One researcher who has worked extensively in the area posed by this question is Daiute. This is part of what she says:

> Computers, like other writing instruments, change the nature of written communication. The computer is a dynamic instrument that accepts the writer's words, carries out commands, and offers suggestions about texts. Such a writing instrument can blur the distinctions between thinking, talking and writing in a way that the pencil and typewriter have not (Daiute, 1985, p. vi).

The computer could not have arrived in schools at a more propitious time in view of the current emphasis on writing as a dynamic process. The focus today in an increasing number of classrooms is more on the means and the creative process than on a single, final, neatly written, end product.

As a dynamic tool, then, the computer has the potential to free the mind for more productive learning and, in so doing, to extend students' thinking, perhaps even changing the very nature of their thought processes. There is scope for plenty of further research here.

3. Do computers change the way we think?

Elsewhere (Conabere and Anderson, 1985), it is argued that one of the major justifications for the use of computers in education is that the language in which one works shapes fundamentally the manner in which one approaches problems and the thinking processes one will employ. Papert, the founder of Logo, is one who firmly holds this view, and he developed Logo principally in response to what he saw as the educational misuse of computers. In computer-assisted instruction, states Papert (1980), the computer programs the child: his vision was for the child to program the computer.

Weizenbaum is another computer scientist who also is often critical of many uses to which computers are sometimes put. Nevertheless, his thesis in Computer Power and Human Reason (1984) is that computers, like other tools, help shape people's understanding of their world and also of themselves.

If Papert and Weizenbaum are right, computer-centred learning experiences may fundamentally redefine the nature of intelligence. This is another area worthy of research.

Concluding comment

We have travelled a long journey. Our story of communication starts in the Eolithic era - the dawn of civilisation - and advances in radically new directions about 34000 BC, again in about 3000 BC, next during the mid 1400s, and yet again in the mid 1800s. We can infer how dramatic were these changes in direction by the fact that the people of the day associated them with divine intervention. About spoken languages, for instance, we have the Biblical story of the Tower of Babel when God came down and confounded people's speech. The ancient Egyptians, too, attributed the invention of writing to the gods. Thus the God Thoth is portrayed in monument inscriptions with a palette and brush in his hands. Of the printing press, Martin Luther was to say, "God's last and greatest gift" (Severy, 1983, p. 429). and when Morse sent the world's first words by wire, he telegraphed the message "What hath God wrought!" (Anderson, 1985, p. 4).

Each of these new communication technologies - writing, printing and telecommunications - markedly influenced literacy development. Writing led to limited literacy; the printing press opened the way to mass literacy; and telecommunications widened the range and scope of communication further still by making information available in many, diverse forms.

There have been implications for education arising from each of these changes in direction. Compulsory schooling coincided with the push for universal literacy. And today we face the challenges of the information age. Barry Jones, the Federal Minister for Science and Technology, expresses the challenge to education in his challenging call to all Australians - "Sleepers, Wake!":

> As Australia moves into an information-based post-service society, the greatest hope - perhaps the only hope - for a democratic and egalitarian community will be to affect a further revolution in education. The gap between middle-class and working-class expectations and performances in education, if left to continue, will perpetuate two societies within the nation (Jones, 1983, p. 168).

Jones is referring to the dangers of an information elite and an information impoverished group. Education is the only institution in society capable of bridging the gulf. The challenge is with us.

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TECHNOLOGY AND DISTANCE EDUCATION - QUEENSLAND DEVELOPMENTS

Colin Sutcliffe

Distance education in 1987 has entered a new and exciting era with the establishment of Distance Education Centres (DEC) promoting the aim of "improvement of educational services for isolated learners". Availability of modern and sophisticated forms of technology now enables direct forms of two-way communication to occur, a luxury never experienced before by people living in isolated areas. The focus of this paper will be on why technology plays an important part in distance education and how the Charters Towers Distance Education Centre uses technology in its organisation.

Looking back

Distance education in the past has basically been associated with correspondence education. Correspondence education in Queensland has been in existence for over sixty years. While this form of home-based program has provided educational programs for children living in geographically isolated areas these programs have been limited by the communication devices available. For the last twenty-five years, correspondence education has been supplemented by school of the air lessons. Such lessons were (and still are in Mt. Isa, Cairns and Charleville) based upon correspondence papers but related in only a relatively small way to the needs of the children.

In recent years a considerable amount of development has taken place. Innovative services such as itinerant teachers, mini schools, activity days and mobile classrooms provide much enrichment to the quality and scope of children's learning. The Mt Isa Satellite trial has proved to be another exciting development in the implementation of effective educational services for children. In fact, programs have now become so varied that many are no longer directly associated with 'correspondence education'. An unfortunate outcome of this varied development has been a lack of real co-ordination among the various media of communication.

The challenge presented by the new technology

The 1980's has seen an increase in the range and scope of educational technology which now includes broadcasting by satellite, use of computers with telephone hook ups, video recorders, facsimile machines, teleconferencing facilities, etc. This means that children, parents, home tutors and teachers involved in distance education programs are able to talk together, exchange ideas and information, solve problems and provide immediate educational support for one another. It also means that teachers, administrators and other professionals have access to a network of educational support systems. This technological development has enabled a rethinking and restructuring of distance education services to take place.

This rethinking featured parents and educators planning and working together. Discussions with parents and isolated children have been used by the Ministerial Advisory Committee on Distance Education (MACDE) for the development of a report. The areas of the present operation which warranted consideration were basically:

- the decentralisation of correspondence education to Centres of Distance Education
- a more effective co-ordination of services and personnel
- the provision of more personalised education programs which reflect children's individualised rates of learning and development
- the creation of learning programs in which the content bears direct relevance to the children's real life experiences.

These considered views of parents have provided a central focus in the plans for the restructuring of distance education services in Queensland. As a result of the discussion and in consideration of the potential that modern and sophisticated forms of technology offers the term DISTANCE EDUCATION is now used to refer to all educational programs associated with people living in geographically isolated areas. Distance Education, therefore, need not only apply to the geographically isolated child, but also to the delivery of professional development programs for teachers in their schools, to secondary students studying a particular subject not offered at a local school, to adults wishing to enrol in a basic education program or to update previously acquired skills, and to support programs for teachers in small country schools (eg. remedial teaching, music, art and drama).

Implementation of the Report of the Ministerial Advisory Committee on Distance Education

The initial step in implementing some of the recommendations detailed in the Report of the Ministerial Advisory Committee on Distance Education, has been the establishment of Distance Education Centres in regional areas. The general thinking behind the plan is to provide an educational centre for the broader community in various locations in the state; that is to say, a centre which caters for the educational needs of not only geographically isolated children, but also of parents, home tutors, teachers and other specialist resource persons who together form a supportive network. However, priority in the first instance has been given to students needing general education from Preschool to Year 10.

The centres, initially established at Longreach and Charters Towers, are seen not only to provide the various facilities and support services with which 'correspondence' families are already familiar, but to provide them in a more co-ordinated and effective way.

The Charters Towers Distance Education Centre

At the outset it is important to highlight that the two centres established in 1987 and those to be established at a later date may approach the provision of their education programs in different ways. The features described within this paper relate to the Charters Towers Distance Education Centre.

In order to understand more fully the Charters Towers Distance Education Centre and the role that technology presently plays, as well as its future potential, it is appropriate to view the Centre as three separate but related components. These are:

- People
- Curriculum
- Organisation

People

It is our belief that the people component of the centre is made up of many different groups. Although these groups might exist within many educational institutions, it is necessary to understand how some of these groups play different roles in distance education. Distance education is very much concerned with family based education. In beginning to have some understanding of this concept it is necessary to acknowledge the differences which exist between school based education, home based correspondence education and distance education from the Charters Towers Distance Education Centre. Not only are the settings different (home v school) but the roles and role relationships are also different. In a school based program it is the teacher who interacts directly with the child with intermittent parent involvement. In a home-based correspondence program it is the home tutor, who is very often the parent, who interacts directly with the child with intermittent support from the teacher.

In the program offered by the Charters Towers Distance Education Centre close relationships have been able to be developed in a variety of ways. Not only are children, parents, home tutors and teachers able to talk with one another directly regarding learners and their educational programs, but, as well, teachers are able to meet children in their own homes and get to know all members of the family unit. Likewise, children, parents, home tutors and governesses are able to visit the centre whenever they wish. Special opportunities are made for groups of children to have some real classroom experience, as well as time for recreation, sporting activities and school camps. Furthermore, teachers will now be able to bring small groups of parents and children together in working sessions to help parents build their own skills in working with their children at home. In all, the possibilities for group interaction and social activity at the centre will be extensive.

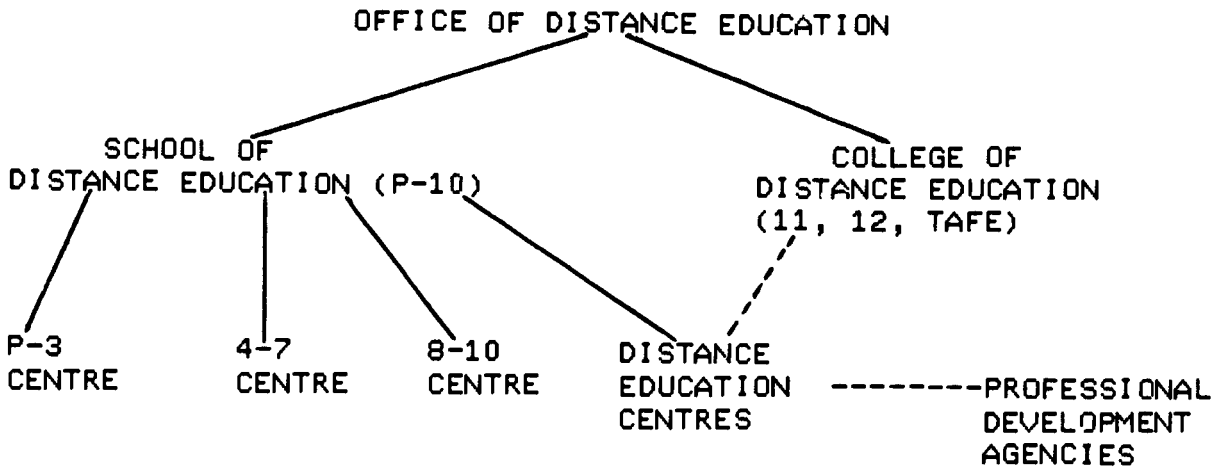
An important part of the people component of the centre is the ancillary staff. Obviously, these staff members at any school are essential to the success of the school's operation. However, for the Distance Education Centre the role played by one of

these, the Technical Officer, is vital if the relationships elaborated above are to be effective and efficient. Imagine the consequences of poor reception or transmission on a regular basis during the broadcasting of lessons?

At the Charters Towers Distance Education Centre all of these groups have a common commitment - to better education. It is not being suggested that the education previously provided for the isolated child has not been good. This goal, to be achieved with greater use of new technology, set by parents, staff, students and the advisory committee, will be just as applicable in ten years time as it is today. In the light of the objective of "better education" and in consideration of the MACDE Report the Centre's mission statement has been established as "providing a comprehensive education through personalised integration of distance education services". The goal of improving education is always before us. However at the Charters Towers Distance Education Centre it is intended not simply to add components to existing programs but to restructure and reorganise as necessary to improve education.

Curriculum

In order to understand the 'curriculum' component of the Charters Towers Distance Education Centre it is necessary to be aware of the structures and relationships proposed within the MACDE Report. A restructuring of the present correspondence schools in line with the State Education Department's philosophy of P-10 would see a structure as set out below:



At the present time the centre uses the correspondence materials as the core of their written programs and modifies them according to the needs of the child and aspects that can be effectively dealt with by other means eg. on air lessons, video, inreach activity days, outreach activity days, telephone. This process of modification is the means by which personalisation of the education program is able to be achieved.

Organisation

The centre's organisation is based upon a two-way process. The two components of this are the Centre Inreach Program and Centre Outreach Program which aim to bring the 'people' component into the centre and vice-versa. It is within this 'organisation' component that technology plays such an important role. In fact within the MACDE Report, one of the underlying assumptions for the establishment of a centre is that "Centres of Distance Education would reflect the following characteristic (among others):

- extensive and increasing use would be made of high technology to improve communications, involving audio, video and data".

Technology - Different approaches to learning and teaching

The availability of modern communications at the Distance Education Centre not only provides children, parents, home tutors and teachers with immediate access to information and feedback on progress, but even more, it gives teachers the opportunity to develop different approaches and techniques to distance learning and teaching. One important feature of these developments is that children are now even more actively involved in their own learning because they are able to receive almost immediate response and reinforcement from their teacher. Likewise, through the use of video, teachers are able to share much with the children as well as extend and challenge their thinking.

Furthermore, teachers can act as 'models' in providing parents and home tutors with effective techniques in working with their children at home.

The range of options available are still very much in a developmental stage. Some of the centre's use of technology is listed below:

TYPES OF TECHNOLOGY	EXAMPLES OF TEACHING/LEARNING STRATEGIES
Telephone (Centretel) Single	. Answering particular questions from students and home tutors. . Data exchange using computers and modems. . Arranging visits. . Seeking advice on interests, progress, etc. . Conducting tutorials with students and home tutors.
Teleconferencing	. Holding small group discussions on units of study. . Identifying problems common to numbers of students. . Student - student interaction.

	. Planning programs to suit the needs of students. Eg. between Isolated Children's Special Education Unit (ICSEU) and the Distance Education Centre (DEC). . Liaison and planning with Longreach DEC.
HF/Radio Single contact Group network	. Class lessons. . Towers Talk (Home tutors session with teachers). . Towers Radio Roundup (A sharing time session). . Clubs, eg. fitness, brownies, cubs, music, bible club. . Debates. . Meetings of committees of Parents and Citizens, and Isolated Children's Parents Association.
Photocopier	. Suggesting student activities. . Providing information and reference material. . Providing guidance to tutors. . Assessing student performance. . Newsletters, information pages. . Ngarrawah (a regular news bulletin).
Audio-cassette	. Guiding music and movement experiences. . Giving examples of good speech models. . Telling stories. . Receiving oral responses from students. . Communicating with families with low levels of literacy.
Video-cassette	. Providing cultural experiences. . Extending students' experiences of other geographic environments. . Demonstrating particular skills and procedures.
Facsimile	. Providing feedback from other agencies on written work. . ICSEU program support development. . Providing written work and information to set up teleconferences. Eg. DEC and ICSEU.
Computer	. Extending interactive learning experiences outside normal teacher-contact periods. . Transmitting modified print materials.

Q-Net (Two way audio and one way visual)	. Open line teleconferencing to support teacher development. . Open line teleconferencing to provide for whole group interactions. . Teacher/Community development.

The satellite services and equipment requirements that may well eventuate at the Distance Education Centre are still developmental and depend very much on the trial using the Australian Communication Satellite System and Mt. Isa School of the Air.

For effective Distance Education these various options must be coupled with the other opportunities including:

OPPORTUNITY	TEACHING/LEARNING STRATEGIES
Correspondence	. Communicating personally with tutors and students about specific issues.
Teacher visits home	. Establishing personal relationships. . Consulting with tutor. . Helping children with particular problems. . Evaluating progress and program effectiveness.
Teacher visits group	. Helping build social networks and relationships. . Discussing matters of common concern with tutors. . Assisting with play-group or self-help group organisation.
Group visits teacher(s)	. Using specialised materials and equipment. . Providing additional cultural experience.
Student/Tutor visits teacher(s)	. Consulting on a personal basis. . Diagnosing particular difficulties.
Sports Days/Campus Mini Schools	. Providing additional social, cultural and physical experiences and periods of schooling under close supervision of teaching staff.

Conclusion

In this decade of the twentieth century distance education has come a long way towards increased personalisation of the services. This permits higher levels of flexibility in service delivery and in personal interaction between teachers and the families they serve. As the range and uses of technology continue to expand in the future teachers must continue to be

involved in deciding which teaching strategies best suit the needs of particular students and which communications options available best meet these needs. The goal of better education must remain as the most important consideration in the development of technology and new teaching/learning strategies using this technology.

TECHNOLOGICAL CHANGE AND EDUCATION

Kevin McCarthy

> Science, technology and education are the ally of every Australian, and the preservation of these disciplines ensures a secure future for our coming generations (Leslie, J.B., in Pope et al).

The quotation from Mr Leslie, Chairman of Advance Australia, very correctly highlights the importance of our role as educationists. By using the singular noun "ally" for the group 'science, technology and education', rather than the plural 'allies', he also hints at what I hope we would accept as a reality: that education is inextricably interwoven with science and technology, and that technological change will presage educational change. If we accept that statement as a truism, then we have to accept that, in this era of rapid technological change, we as educationists must also experience rapid change. In introducing the topic, I would also assert two other starting positions:

> It is fundamental to man that he is unable to contain his curiosity, and unable to resist improving his position - that is, to tend towards being economical of his labours and the materials he uses (Hildebrand, 1983, p. 35).

> Technology cannot be ignored. If you do not control it, it will control you (Badham, 1986, p. 288).

My starting position, therefore, is that technological change is a reality, which will not go away. Educational change is closely linked with it, and as educationists we are required to detect this change and control the way we react to it. It has the capacity to enhance our role in the most exciting fashion, or it has the capacity to confuse us and create inefficiency.

I would like to address the topic in three phases:

a) phase 1 - Technological Literacy.
b) phase 2 - Technological Change and Curriculum Content.
c) phase 3 - Technological Change and Educational Delivery.

But before we start, let us consider some areas of technological change.

Table 1 lists a range of innovations which exist, and are available for application, in Australia now. In considering technological change, and its effects on education, we are considering a wider challenge than, say, the use of computers in classrooms. We have to recognise these innovations, and decide whether, and how, they can be included as knowledge elements in curricula. We have also to assess them and decide whether they can be used to improve the communication skills and the knowledge base of our teachers.

TABLE I: TECHNOLOGICAL INNOVATIONS

- Computers and Information Processing
  - Microprocessors
  - Microcomputers
  - Very Large Scale Integration
  - Personal Computers
  - Office Automation
  - Expert Systems and Intelligent Machines
  - Computer Software
- Information Transfer
  - Optoelectronics
  - Digital Transmission
  - Integrated Data Systems
  - Encryption
  - Large Scale Database Networks
  - Satellites and Space Technology
  - Video in Information Transfer
  - Electronic Funds Transfer
- Biotechnology
  - Genetic Engineering or Recombinant DNA Techniques
  - Monoclonal Antibodies
  - Immunotoxins
  - Vaccines
  - Diagnostic Probes
- Biomedical Technology
  - Clinical Diagnosis
  - New Prosthetic/Orthotic Devices
  - Pharmaceutical Biotechnology
- Agriculture
  - Conservation Techniques in Land Management
  - Farm Machinery
  - Sheep Shearing
  - Plant Agriculture
  - Animal Husbandry
    - Vaccines
    - Reproductive Technology
    - Electronic Identification of Animals
- Manufacturing, Energy, Materials
  - Computer-aided Design and Manufacture
  - Flexible Automated Manufacturing Systems
  - Advanced Materials
  - Energy

(Adapted from Bishop and Douglas, 1986)

Phase 1 - Technological Literacy

One aspect of our society that I feel is quite worrying is what I would like to identify as a lack of 'technological literacy'. Some would probably argue that this phrase is a contradiction in terms: that to be literate, or a person of letters, is opposed to being knowledgeable about matters of science and engineering.

Historically, such as not the perception. The great philosophers and thinkers of ancient times philosophised about physical sciences as well as social sciences. On knocking the dust off some writings of Aristotle which just happen to have been gathering it for two millenia in our den at home, I note that he wrote in depth on Logic, Physics, Astronomy, Ethics, Meteorology, Metaphysics, Biology, Politics, Rhetoric and Poetics. He would have been a difficult man to win an argument with; however, imagine having him on your side in a game of trivial pursuit! The 17th century French philosopher Descartes dedicated his wisdom to the fields of Mathematics and Physics, as well as to Logic, Ethics and Metaphysics. The separation of the sciences from the arts became more defined towards the end of the 19th century. This was probably inspired by the emphasis on technology which came out of the industrial revolution. That independent status of technology was not, however universally accepted. To this day the Oxford dictionary describes technology as the 'study of the scientific and mechanical arts' - a definition that would not please many scientists and engineers.

Returning to my concept of 'technological literacy', I suggest that, through allowing a formal separation of the arts and sciences in our education systems, we have bred generations of graduates who have insufficient knowledge of basic scientific principles to allow them to participate in, or even understand, the profusion of change that confronts them. While this may cause us concern for those citizens who are, in their way, educationally disadvantaged, it is a tragic situation when it embraces people who are leaders in society. How can a politician, a judge, or a senior manager make appropriate decisions on technological matters when he or she does not have sufficient knowledge to understand the problem, let alone differentiate between the conflicting technical advice which is usually received?

How can a journalist, whose duty is to inform and educate, carry out those functions, when the standard journalist blanches with discomfort if confronted with any topic outside a politico/economic background? How can a teacher, regardless of specialisation, assist students to understand arguments, both moral and technical, about issues such as privacy, health, conservation, communications, and energy generation, if that teacher is not personally equipped to understand the conflicting points of view?

The effects of these dysfunctions range from hilarious, through frustrating, to alarming.

A few years ago a prominent senator told the Townsville Bulletin that he had seen an open truck with yellowcake being driven to the Port of Townsville with the yellowcake blowing away in the wind. The offending substance was flowers of sulphur. Anyone with even a basic knowledge would question whether, regardless of environmental considerations, yellowcake, which is extracted in relatively small quantities at some cost, would be allowed to blow about in the wind. The Townsville Bulletin, however, published the story.

On a more serious note, let me ask you to consider how a person whose sole sources of information are the popular media could ever have a valid opinion about issues such as:

a) Nuclear power generation, with its dramatically publicised dangers, versus fossil fuel power generation, with its less publicised, but perhaps more drastic, pollution of the upper atmosphere with carbon dioxide;

b) Moral and ethical versus genetic considerations associated with in-vitro fertilisation and surrogate motherhood;

c) Whether the logging currently taking place in rainforest in the Bluewater ranges is carefully controlled, and unlikely to cause any long term damage, as the logging company would say, or whether the forest and its ecosystem will be destroyed, as asserted by conservationists?

The questions could go on. The point I make is that, without technological literacy to assist them to understand the issues, people will make poor judgements. They will make judgements based on emotional rather than rational grounds.

This, I put to you, should be of concern to all educationists.

Phase 2 - Technological Change and Curriculum Content

In the second phase of this address I would like to consider how technological change should influence curriculum content. I use 'should influence' rather than 'does influence', because I am not convinced that our curricula react to take account of 'technological change' in any but the most arbitrary manner. Discussing curriculum content with such a diverse group of educators is a difficult (and hazardous!) business. I consider that, regardless of the type of institution we each represent, our curricula can be classified according to three elements. These are:

a) General Education Content which is directed toward developing general educational skills, knowledge and attitudes.

b) Vocational Preparation Content which can be justified as giving students non-specific vocational skills, knowledge and attitudes.

c) Vocational Content which is derived from specific vocational skills, knowledge and attitudes.

Figure 1 attempts to classify the various education sectors against these curriculum elements. The number of marks in each box is an attempt to represent the emphasis on respective content elements for each sector.

FIGURE I: CURRICULUM CONTENT CLASSIFICATION

Curriculum Content / Sector	General Education	Vocational Preparation	Vocational
Pre-school	x		
Primary	x		
Secondary	x x x	x x	
Special	x x x	x	
TAFE	x	x x	x x x
University/CAE	x x	x x	x

While this classification is simple and arguable, it attempts to demonstrate that the curriculum in each education sector has different purposes, and correspondingly different rationales for its content. The impact of technological change on curriculum content will vary accordingly with each sector, or with courses within each sector. This does provide some framework for discussing that impact.

Vocational curricula

Vocational curriculum content is very sensitive to technological change. Institutions or systems offering vocational courses have to react in various ways of such change. They have to:

a) detect new/changing educational needs in industry and commerce;
b) adapt educational patterns in response to a) ;
c) adapt curriculum content accordingly;
d) adapt/procure plant and equipment.

One well-based criticism that educational institutions receive is that they are too slow to adapt to new technology - that instead of being pro-active in developing programs, they plod along some years behind industry. This slow reaction to the needs of industry is not an easy situation to resolve.

'Industry' is not as homogeneous as most commentators would have us believe, and much of Australia's industry is justly criticised itself for being slow to apply new technology. It seems to me that there is an important role missing in our vocational

education system. Systems and institutions should have units whose role is to identify emerging technology and its applications, to assist industry and commerce to adopt these changes, and to assist institutions to incorporate it in their curricula. I would like to refer to this as a 'sentinel function'.

The role I am suggesting for sentinel function is on the borderline of education and industrial development. One of our major organisational problems in Australia is that industrialists do not speak to educationists, and vice versa. The velocity of technological change has simply highlighted what has been a long-standing problem. For us, the most radical element of this suggestion is probably the concept that we should advise industry on how to apply new technology. However, I would argue that providing such advice to senior planners is as much an educational function as is training personnel to use and maintain the new systems.

Vocational preparation curricula

Many of the comments made about vocational curricula are pertinent to vocational preparation curricula. The content of these curricula, not being tied to specific industrial or commercial practice, does not have to react so directly to technological change. However, institutions or systems offering such programs need to:

a) adapt curriculum content to new technology applications in the work place;
b) adapt/procure suitable plant and equipment.

General education curricula

In discussing these matters with teachers, I have developed the impression that attitudes towards the implementation of technological change in general education curricula vary greatly. The extreme views appear to be:

a) Involve students with as many new ideas and concepts as possible; against
b) There is too much change creeping into the classroom, and the cost is the demise of basic skills.

I do not intend to take a personal position in this debate, but what I do consider educational systems and institutions must do is give leadership in deciding how technological change should impinge on curricula. I refer back to my earlier discussion on technological literacy. I suggest that <u>all</u> students, at all levels, should be exposed to technological change so that they understand it, and they understand how it may be applied, and how it is likely to affect their lives.

Phase 3 - Technological Change and Educational Delivery

The third phase of the impact of technological change on education is its impact on educational delivery.

Changes in communications technology and media allow us to modify existing learning styles, and develop new ones. Techniques such as computer learning, computer managed learning, and interactive video disc have the potential to allow students to apply their own pace to their learning. Communications technology, giving access to data banks, expands information available to teachers and students, and removes some of the tyranny of distance.

The new technology is also available to enhance management systems, and develop new building designs.

Staff development

The most serious challenge arising our of all this is to keep our teachers and managers abreast of change. How do we get teachers to maintain their expertise, and develop new skills and knowledge as they go? How do we assist them to have positive attitudes towards change, and to use the new technology wisely? How do we develop management skills and attitudes to support the changes outlined in curriculum content and delivery? I believe our present commitment to these tasks leaves much to be desired.

Some developments that will have to be considered (and implemented!) urgently if we are to survive are:

a) Recurrent Patterns of Teacher Education. To maintain their licence to teach, all teachers should be required to attend periodically (perhaps every five years) refresher programs. The programs should be carefully and specifically designed to re-educate teachers in curriculum content and delivery innovations.

b) Staff Training for Educational Managers. Managers should also be required to attend periodic refresher training in specific innovations available in educational management, so that they are able to use the new technology, and lead from the front. The days of 'counting the rulers and rubbers' are long since gone.

c) Attitudes Towards In-service. Our present attitudes towards in-service need to be seriously questioned. The activities sponsored by some groups under the umbrella of in-service remind one of the Walt Disney Academy run wild. Let me start by casting the net close to home: in TAFE I have recently noticed in-service sessions for such serious needs as 'a visit to the new Roma Street railway station' and 'Deep Relaxation'. In other divisions we have the phenomenon of three pupil-free days per year being dedicated to in-service. This was originally a brilliant concept, but having decreed that this should happen, the Department lost interest in how they were to be used. The in-service days have degenerated into a squabble among the union, which has been allowed to regard them as alternative days off, principals, many of whom would like to use the days for school administration, and teachers, who feel that the commitment should not interfere with their personal holiday plans. While all this is going on, the school is metaphorically burning down.

Conclusion

The rationale of this paper is that educational change is very closely tied to technological change. For a host of reasons, we cannot afford to ignore those pressures.

The change impinges on our educational systems and institutions in two ways:

a) curriculum content;
b) educational delivery.

I have outlined a number of issues which I see have to be addressed in these areas. I would like to conclude by leaving you with the following questions:

a) How do we detect new/changing needs in industry and commerce?
b) How do we adapt curricula to keep abreast of technological change?
c) How do we maintain/develop essential skills and knowledge in our teachers?
d) How do we develop high-quality managerial skills?
e) Should we perform a 'sentinel function' by having a group capable of evaluating technological change and identifying those elements of it which are relevant to education?
f) Should we assist industry and commerce to keep abreast of change?

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Workshop Report

TECHNOLOGICAL ALIENTATION

Mr Alan Morwood

Definition and frame of reference

In examining technological alienation the workshop narrowed its frame of reference, although not exclusively, to computer alienation, and the following causal factors and proposed remedies. These may not be applicable to all aspects of technology.

Alienation is defined formally as "turning away" or "estrangement". Almost the sole cause of technological alienation is FEAR OF THE UNKNOWN, the reason for which is rooted in lack of confidence, insecurity, lack of knowledge and the potential for embarrassment.

The group noted that these factors were present to a much greater degree in adult educators than in children when exposed to the computer. Hence one might expect that computer alienation is a short term problem as children introduced to the system will not possess alienation tendencies as adults. Naturally there would also be a small proportion of adult society with alienation symptoms, owing to their fundamental psychological make up, which no amount of training will overcome.

This short term prognosis is a very healthy sign, but it must be remembered that technology will not remain static, and there will be new machines always emerging with a potential for alienation.

Perceived causal factors of alienation

1. Resistance to change of lifetime habits: This is a natural characteristic of all individuals, and not just the "over 40s". The resistance is often greater when the individual has evaluated his/her previous methods as being successful.

2. Fear of the machine taking over the mind and will: The teacher may feel the threat of redundancy, where the teaching process is controlled by the machine. The computer is often given a personality owing to its perceived status. In the past (no so much now) girls perceived the computer as being "male".

3. Depersonalisation of society: The Big Brother syndrome.

4. Fear of failure: Often the first step to computer mastering is not taken because of this.

5. Perception of "experts" and "non experts": We tend to attribute an undeserved aura to the alleged expert, thus fostering our own insecurity.

6. Loss of status: The teacher fears the loss of his/her traditional classroom status, as s/he realises children could well be far more adaptable in mastering basic computing skills.

7. Lack of application to the teaching process: Not only is ignorance of where to make use of technology a problem; so too is the lack of appropriate software and the knowledge of how to use it.

8. Perception of computers as a toy: Many adults are opposed to children at primary school using computers, as they incorrectly see the computer as merely a toy at this level.

9. Transition phase: Impatience is always present when changing methodology - we expect too much too soon of the machine.

10. Frustration owing to teething and maintenance problems: For some reason we expect the computer to have zero maintenance qualities.

11. Waiting for the latest brand: Utopia is always just around the corner, but regrettably never arrives.

12. Physical problems: Eyestrain, backstrain.

Remedies to overcome alienation

All the above may be overcome totally or partially by appropriate remedies: some are functional and other are attitudinal. "Do not be like that" is not one of them - they are all positive in nature.

1. Inservice: The obvious approach here is through seminars and conferences, but of greater importance is on-site inservice ie. in your normal workplace, by one or more of your colleagues.

2. Support personnel: As above; it helps if these are on-site.

3. Practice: Once again, a regular on-site function.

4. User friendly machines and software: These are now available. They require practically no technical expertise.

5. Entry point and staging of training process: It was suggested that the best entry was having a computer game in the lunch hour with a computer minded colleague, on a user friendly machine.

6. No jargon initially: Jargon should be avoided initially in both the formal and informal instructional process.

7. De-emphasis of black box: There is no need to understand the nature of a computing component, or to be a microchip expert: use the machine as you use a vacuum cleaner, or for many of us, our motor car. It is an appliance - it has no personality.

8. Defer programming skills: There is no need for everybody to acquire programming skills from the word go.

9. Keyboard skills: Keyboard skills are desirable preparatory skills for children, but adults could well develop these as they proceed.

10. Role perception: Realise that the computer cannot and will not replace the teacher, but it can enrich the teaching.

11. Institutional location: It is best if computers are not placed in one department eg. maths or science. They must be seen as a whole of school resource.

12. Involvement of management: Management should be keen to support computer development. It should show a lead in the administration field. The group felt that in general management alienation was not attitudinal but based on cost objections. Management should not wait for the latest, most expensive machines. In waiting for the latest brand, we run the risk of losing the most needed component, the "liveware".

Alienation owing to a social conscience

The group looked briefly at the spectre of growing unemployment and the alleged responsibility for this by technological advancements.

Historically, social change has always lagged behind technological change and the gap has always created employment difficulties. The dramatic rate of technological change currently means that the creation of new jobs to allow for it is slower than usual. However, as in previous times, these new jobs will emerge. Humans will not be replaced by machines.

Workshop Report

TECHNOLOGY, EDUCATION AND SOCIAL CHANGE

Ms Carmen Luke

Introduction

Professor Anderson concludes his paper in these proceedings by noting the real challenge to educators of the advent of high technology: the prospect that computer access and competence will become the domain of the middle and upper classes, and that those excluded will constitute a marginal underclass. There is already persuasive evidence that this is becoming the case (Barker and Downing, 1981; Marvin and Winter, 1983), that women, minorities, and working people are not gaining increased access to knowledge about and competence with computer technology. Speaking of the 'dark side' of technological innovation, Marvin and Winter (1983), Apple (1986), Noble (1984) argue that the industrial division of labour and inequality of access to control of labour are being reproduced with the new technology: that workers using computer technology are, contrary to popular beliefs in the 'empowering' nature of computers, progressively losing control over creative, decision-making aspects of their work. In other words, as word processors, microchip based cash-registers, on-line computer services and other technologies that require only non-critical, passive "end user" skills are introduced to the workplace, many workers are losing creative control over work processes, which in turn are being reduced to simplified tasks that require little thinking.

Accordingly, the workshop on "Technology, Education and Social Change" was structured to discuss both the positive and negative aspects of technological innovation. The discussion centred on six basic issues: the effects of technology on women and girls; effects on employment structures; effects on social interaction and development; effects on the role of the classroom teacher; the relationship of computers with "older" technologies like television, and; the possibility of the exclusion of economically less advantaged groups. In what follows are reported opinions that members voiced on these issues, concluding with a summary which I hope will serve the polemical function of provoking further debate.

Issue 1: Will computers lead to the further 'deskilling' of women in the workplace?

The group believed that since the majority of service and clerical jobs in Australia are already held by women, the substitution of conventional cash registers and typewriters by computer technology would not significantly change women's economic status. The opinion was stated that this change may mean that less skills are required but also that new skills will be needed. It was noted that many women already are retraining at TAFE and other institutions. Members of the group did not seem to feel that RSI was a social/health 'cost', since much research was being done to minimize the hazards of the new

technologies. Further, most in the group did not agree with the seminar leader and others that new technologies would create permanent underclass of unemployed because of "job sharing" and because "society is already used to large percentage of unemployment".

Issue 2: Have technologies been rejected in favour of existing technologies to retain jobs?

The group argued that other than an unspecific number of biomedical technologies, the use of which seem to have ethical consequences, technologies do not seem to be rejected in favour of saving jobs.

Issue 3: Do the new technologies create isolates - lone individuals at the screen?

The group agreed that the computer in the family setting does lead to social isolation, but it was argued that clerical staff are no less isolated behind the screen than they were behind the typewriter. Most teachers in the group observed that computers bring children together for cooperative problem solving. These teachers saw computers as valuable in fostering cooperative social and learning behaviours.

Issue 4: Will the technology change the role of the teacher in terms of autonomy over curriculum, evaluation and teaching?

The group felt that technology will not replace the teacher, but rather change the teacher's role to one of facilitator with more time to devote to individual students. None expressed concern that the new software would usurp curricular or evaluative prerogatives and autonomy. Instead, it was argued, this software would enable the teachers to learn new skills. This would require attitudinal change on the part of many.

Issue 5: How can we reconcile positive attitudes towards the computer with negative attitudes towards that other, prevalent and powerful information technology of television?

Members of the group argued that computer literacy was essential for coming decades and that TV literacy was not as essential. Most noted that the introduction on VCRs has freed families from slavery to the local TV schedule. Some argued that the need for media literacy is as important as computer literacy, since TV is perhaps the single most important source of social and political information.

Issue 6: How will access to computer technology and competence affect the economically less well off?

The group argued that the new technology will not "deskill" or disempower more people than those already marginalised. The general consensus of the group was that educators and citizens must reconsider existing values and attitudes and "accept" the new technology rather than resist it. Many argued that the educational and economic benefits far outweighed the social costs. There was general agreement that all children should have access to computers in the classroom. The group expressed a

shared belief that the social change engendered by the new technology would be a "progressive" aid to the quality of life, and not regressive.

A polemical conclusion

In his recent book Teachers and Texts (1986), sociologist Michael Apple discusses the range of social, economic and educational effects of the new technologies, which, he notes, have been well underway in the United State and Canada for well over a decade. Apple argues not for a new Luddism, but rather for a critical perspective on the new technologies, their effect on the workplace and on teachers' work. He surveys the major body of sociological research in the UK and US which indicates that there is a hidden agenda to technological development, that the rhetoric of "positive effects" has a bandwagon effect which causes educators to omit due consideration of social consequences. This literature indicates that already computer technology - its major scientific and research applications notwithstanding - has led to the replication of industrial divisions of labour: specifically, the same groups excluded from access to wealth and power in industrial society are similarly excluded in post-industrial, "high tech" society. In other words, the scenario foreshadowed by Professor Anderson's comments is already unfolding.

Ironically, Apple comments that the tone of most in-service and pre-service training, conferences and workshops for teachers focus on the "positive effects" paradigm, skirting what he believes to be the central questions facing educators. He concludes,

> ...the new technology does not stand alone. It is linked to transformations in real groups of people's lives, jobs, hopes and dreams. For some of these groups, their lives will be enhanced. For others, their dreams will be shattered. Wise choices about the appropriate place of the new technology in education, then, are not only educational decisions. They are fundamentally choices about the kind of society we shall have, about the social and ethical responsiveness of our institutions of the majority of our future citizens (Apple, 1986, p. 174).

Apple is not against technology per se. But he is calling into question what German philosopher Jurgen Habermas calls the rationale of "technicism" - the dominant belief that technological progress in and of itself leads to resolution of ethical matters concerning social equality, justice and truth.

The most recent Carnegie Foundation report on teacher education claims that the acquisition of 'high tech' skills is not enough and that teachers and students alike will need to acquire critical thinking competences precisely to be able to identify and assess weighty social, political and economic issues in the light of technological change. I would hope, having listened to and reported the views of educators in this summary, that we would turn our primary concern away from an uncritical panegyric of the virtues of high technology. Computers are valuable educational and cognitive aids which teachers and children must learn to master. But I also would argue, with Apple, that

educators as a group need to consider wider questions of social effects. With the advent of every new information technology has come an array of both anticipated and unanticipated, planned and unplanned economic and cultural concomitants. And, Ellul (1980) reminds us, technologies and systems themselves can never be held to blame, it is their human creators and users who ultimately must bear responsibility for the consequences.

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Workshop Report

TECHNOLOGY AND THE CLASSROOM TEACHER

Mr Robert Pendreigh

Introduction

> Imagine a classroom partitioned into semi-isolated booths. In each booth are a pair of headphones, a typewriter keyboard, a screen similar to a television set, and a photo-sensitive 'light gun'. All of these stations (and others in other classrooms) are in communication with a computer. A student communicates with the computer by typing on the keyboard or touching his/her light gun to designated spots on the screen; the computer communicates with the student playing recorded speech through the students earphones; or by writing or drawing pictures on the cathoderay tube. Each student can be working on a different lesson, or two on the same lesson can progress at different rates. A teacher walks from booth to booth, answers questions, sees that the stations are operating properly, and supervises requests for new materials. There is no need for testing; students records are maintained automatically. (George A. Miller in Cotterell and Collins, 1974, p. 99)

A science-fiction fantasy? Not at all. Such systems were already operating in 1974. The one just described was established in a public school in Palo Alto, California.

If the above scenario of sterile domestication was an experimental type classroom in the U.S. in 1974, what has reality produced in Australian classrooms in 1987?

Typical Classroom Scenarios, October, 1987

In primary schools in this part of the world at least, the most common scenario is that of a group of two to five children clustered around a single microcomputer and engaged in animated discussion. Such children might in fact be discussing the possible solutions to a particular problem, or perhaps making suggestions about which way their cybernetic turtle should move next, or perhaps discussing how the text of their story should appear.

In secondary schools of today's Australia, the students are typically pictured in a computer room with one (maybe two) students seated at each of the fifteen stand-alone computers. There is a high probability that such secondary students would be engaged in the word processing of text or writing a computer program to instruct the computer in the solution to a mathematical problem using (unfortunately) an unstructured third generation language such as BASIC.

In neither case are students the domesticated recipients of piped information that is so typical of the content-delivery mode of large computer-based instructional programs as described by George A. Miller in the opening scenario.

Computers and Classrooms

Commonwealth, State and parent funding or have supported a tremendous influx of microcomputers into our schools in the period 1980-87. How are they being utilized and what are the effects do they have the habits of the users? The one things that we can be certain of is that the presence of the computer and its related technologies is not a neutral force. In all sorts of ways the lives of the users and the non-users alike are being influenced by the introduction of modern technology to the classroom.

The propositions of Jacques Ellul - that every piece of technology exacts a price - are being realized at this very moment throughout the whole educational system. The beneficial effects are inseparable from the adverse effects and furthermore, it is a continuing paradox that the adverse effects don't really begin to manifest themselves until we attempt to reap the harvest of the perceived benefits.

For this reason, it is crucial that teachers make sound educational choices about technology that is introduced to their classrooms. When teachers make technology-related choices for themselves, they also, be default, make the same choices for their students. Learning about computers in education therefore does not so much mean learning about computers, as learning about education. This is the real challenge for teachers in classrooms today - to make the use of computers an empowering and liberating force and not an influence for domestication and quiet submission. When astute decisions are made by teachers on sound educational premises (rather than technological premises) then such decisions are more likely to maximize the beneficial effects of having a computer in the classroom and at the same time counter-balance or reduce the adverse effects, or at least make the classroom participants aware of them.

The Workshop

The presenter of the workshop entitled 'Technology and the Classroom Teacher' very much emphasized the beneficial effects that microcomputers can have upon the learning environment and the learning habits of our students. The theme of the workshop was 'Using Power to Empower Learners'.

The following modes of operating a microcomputer are seen as empowering learners by making them active agents in the interaction between learner and computer:

(1) <u>Using a modern word processor to support writing skills</u>.

A word processor such as Bank Street Writer III (in primary schools) or Perfect Writer (in secondary schools) allows students to perform the following:

(a) enter and edit text (with out retyping it again);

(b) invoke an electronic spelling checker to check for spelling that is consistent with the electronic in-built dictionary;

(c) reformat text so that it is consistent with the form of a socially recognizable genre; and

(d) print out the text using any of the facilities (boldface, underline, italics, double width, etc., etc.) offered by a modern dot-matrix printer.

(2) Using an electronic database facility.

Appleworks or Bank Street Filer (in primary schools) or Perfect Filer (in secondary schools) allows students to exert almost supreme control over quite massive amounts of electronic data. Not only are students able to control massive amounts of data quite easily, but they also learn the crucial skills of interrogating large mountains of electronically stored information to select the pieces that are useful, relevant and valid to the research topic at hand.

(3) Developing problem-solving skills, strategies and attitudes.

Students may do this by employing such pieces of software as LOGO or The Factory. The times in which we live demand astute and creative problem solvers who have the ability to invoke the aid of a computer to assist in problem-solving. There are strategies which students can practise and which explicitly or implicitly develop their abilities to:

- look for a pattern
- construct a table
- account for all possibilities
- "act" out a problem
- make a model
- guess and check
- work backwards
- make a drawing, figure or graph
- select appropriate notation
- restate the problem
- identify wanted or needed information
- write an open sentence
- identify a sub-goal
- change a point of view
- check for hidden assumptions.

(4) Developing thematic curriculum plans.

These may be based upon electronic adventure programs such as "Where in the World is Carmen San Diego?". Quality pieces of electronic adventures and simulations can be the springboard for speaking, writing, art, drama, projects and research.

(5) Telecommunications.

This is surely the most exciting facet of utilization by both primary and secondary students. For example a small rural school in Northern Australia, some 140 km from the nearest metropolitan city, is in almost daily written communication

with other schools in such countries as New Zealand and Alaska. By using a modem to interface their computer to the phone lines, their writing audience expands to embrace students and teachers in other cultures and other places. These children and their teacher have, in part, shrunk the world into their classroom.

But what of the adverse effects? Is there a danger that in pursuing the beneficial effects on education we may ignore or even exacerbate the inevitable adverse effects? Personal observations from field experience suggest the following problems.

Access

Adverse effects at this stage seem mostly related to problems of management, organization and costs. Costs are the major factor which determines who shall and shall not have access to facilities. The simple reason is that nearly all equipment in primary schools and much of the secondary school equipment is purchased by Parents and Citizens Associations. Certainly some groups are being disadvantaged by the limited access provided in our schools to technological hardware. One suspects that the most disadvantaged are those students who attend out largest urban schools where access to computers and associated technological equipment is extremely limited. This is especially so when such large urban schools are located in lower socio-economic suburbs. Management and timetabling tend to favour those secondary students who are engaged in Maths and Science subjects. By default this also tends to limit the access of girls and those students who pursue with community based learning or social science type subjects.

Strangely enough, children in small rural schools, who are led by young, enthusiastic teachers and who have one or even two microcomputers available at any time of the day, have visibly become the most powerful utilizers of technological equipment. The small rural school mentioned above is typical of many other such schools scattered over our part of Australia.

Alienation

There is certainly no evidence of technological alientation among the young. In fact, quite the opposite. Students are so willing to embrace computer-related technologies, that perhaps they embrace the useless, the trivial, the dangerous and even the illegal modes of operating a computer as well as the useful, the beneficial, and the empowering.

Dependency

Classrooms are now becoming more and more dependent upon the operation of third party 'entitles' such as steady electric supply, direct telephone lines, floppy-disk manufactures, computer suppliers etc.

(4) Blurred Moral Issues

A new sort of 'numb morality' seems to be evolving. Persons who would never consider stealing another's property think little of copying another's work simply because it is written upon as innocuous magnetic disk. Copyright laws are still vague especially as regards the application of copies of software for the purposes of education.

Conclusion

It is rather sobering to realize that the child who is enrolled in preschool next year will still be at school in the year 2000. No one can predict with accuracy what the future of such a child will be. The exponential rate of change in the present mitigates against such predictions being realized simply because the 'ground rules' are constantly changing. However we can be fairly sure that the best decisions that are made now about the future of our educational systems will be made in the full light of our knowledge of the 'new technologies'. Further, the best decisions will be made if the premise is accepted that we should be using the new technologies to give future users control over them. It is imperative that the classrooms of today seek to give students both control and understanding of such facilities as microcomputers, even from a very early age. As teachers, we must seek to instill the responsibility that is encumbent upon having control over the machine and develop the wisdom that comes from understanding its technological modus operandi. Even our survival as humans might very well depend upon our ability to exert control over the pieces of technology that already exist, let alone those which are yet to arise.

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