

*The Making of Technological Reality in Schooling:
A Study of the Social Construction of 'Knowledge'
about Computers and Education*



The Making of Technological Reality in Schooling:

***A Study of the Social Construction of 'knowledge' about Computers and
Education.***

***Thesis submitted in fulfilment of the requirements for the degree of Doctor of
Philosophy at the University of Adelaide (Department of Education)***

Awarded 1994

January, 1994

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DECLARATION

I certify that this research project does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any University; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

The author consents to the thesis being made available for photocopying and loan if applicable if accepted for the award of the degree.

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ABSTRACT

Computers are widely used in society and are being introduced into schooling at an increasing rate. Schools are incorporating the use of computers into many aspects of the curricula and experimenting with their ability to store and retrieve a wide variety of information. However, the introduction of the computer is accompanied by the construction of 'knowledge' about the technology and its place in education.

This study sought to establish how knowledge about computers and education is being constructed by administrators, parents, teachers and students as schools implement computing programs and teachers determine how computing is to be incorporated into curriculum. Furthermore, the study sought to determine the principal legitimators for the use of computing into schools.

Using Berger and Luckman's theory of the sociology of knowledge it is possible to analyse how knowledge about computers and education is located within different sectors of society (eg the 'world' of business, the 'world' of schooling etc). These different social groups create theories from which knowledge is constructed which is then used in a variety of ways to influence the common stock of knowledge taken as reality and shared with others in society.

It was found, for instance, that a considerable degree of theorising was promoted by educational writers. From these theories two distinct approaches were discerned. One proposed that the computer would radically change the process of education outside of schooling while the other proposed that the computer should be integrated into schooling in an effort to improve efficiency and effectiveness. The views inherent in the first were essentially pessimistic about the ability of schools to respond to the technology and to the changing needs of society. The second was more cautiously optimistic about the ability of schools to change by adopting computer technology.

A further matter of concern from the perspective of the sociology of knowledge is the reification of knowledge held by the participants. By reification is meant the capacity of society to create knowledge and then to treat the knowledge created as if it had a life of its own divorced from its human source. This study found a considerable degree of reification of the knowledge about computing had taken place and that this was influencing the ways in which decisions about computers were being introduced into education. For example, the level of reification of computing technology appears to have had a direct bearing on the process of legitimation of the knowledge about using computing technology in schooling by government, political parties, unions and the media.

Using definitions established by Berger and Luckmann it can be shown that much of the theorising undertaken by different groups in society can be described as at a rudimentary level which in effect means that conceptual thinking about the technology is essentially pragmatic and concerned with how 'things are done' and not yet integrated into theories of, for example, education.

However, the study also showed that significant changes to the theorising about education within the institution of schooling was taking place. From a survey of teachers, parents and students, it was found that they held beliefs that computers would make learning more efficient by enabling students to:-

- work at their own pace
- work from home terminals
- have access to information
- have access to assessments of their learning performance
- have access to improved assessment methods
- use computers for all subjects
- gain benefits if they were slower learners.

Furthermore, it was widely held that all students would need to use computers for future employment purposes or for further learning.

Contrary to the theories held by educational authors (Papert, 1980; Heaford, 1983; Barker and Yeates, 1985; Bork, 1985) which expressed the view that schools would be unable to change, schooling is being reshaped to incorporate, within the knowledge of the participants, an increasing use of computers to enhance learning. A new reality of schooling is being constructed where computers will be taken for granted as a tool for education. However, at this stage this reality is tentative and rudimentary. This change brings to educational administrators and teachers new challenges to presently held concepts of schooling and learning and demonstrates the dialectic and pervasive nature of knowledge in institutions such as schooling.

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ACKNOWLEDGEMENTS

A number of people have helped make this thesis a reality.

My supervisors, Dr Deirdre Jordan and Margaret Secombe, provided the guidance, persistence, patience and inspiration to bring my ideas to fruition and for that I owe my gratitude.

I am also grateful to Sharon Wilton who provided assistance with the numerous drafts and the final presentation of the manuscript.

Finally, I must thank my family who have suffered the burden of my time preoccupied and immersed in the preparation of the thesis.

Introduction



1. INTRODUCTION

Modern society is becoming increasingly dependent upon technological developments. This dependence is not a new phenomenon; technology has long been an important aspect of human experience. However, the introduction of computers has added a new dimension to this experience. Computers are in some way associated with many of the most recent advances in technology. Computer related technologies such as robotics, automated machines, communications and household appliances are creating new influences upon our way of life. In many ways this technology is hardly noticed as it replaces conventional technology. However, it has the potential to change greatly traditional approaches to work, leisure and education.

The question of taking this new technology for granted is of vital concern in the construction of knowledge. How does society come to accept this new technology as everyday reality, and how is knowledge about computers and computing located within different sectors of society (e.g. the 'world' of business, the 'world' of schooling etc)?

The introduction of computer usage into schools offers a unique opportunity to examine how technology moves out of the scientific community and is accepted and taken for granted by the general community. It is especially significant due to the process of dissemination of knowledge about computers. Most other forms of technology are mediated through the adult world. For example, cars are only used by adults. Likewise, tools are generally used in an adult world. Those

forms presented to children are usually scaled or modified versions meant for play.

Computers, on the other hand, are being introduced directly to children. Unlike most aspects of our society, computing has no historical basis from which the knowledge of its technology can be transmitted. Young and old in society must together construct knowledge about computing.

From the perspective of the sociology of knowledge, considerable social construction of knowledge regarding computers by school personnel and by parents must already have taken place for students to be confronted with this technology. Many children will be confronted with this technology in schools and many parents would expect that experience of this technology will prepare the students for their future.

The Australian experience of compulsory, universal education has produced a long tradition of schooling. The traditions of schooling have not yet institutionalised an appropriate response to the education and preparation of the young for a modern technological age. How are schools, therefore, preparing and coping with this new development?

Computers have been part of everyday life in the commercial sense for more than a decade [see Morrison, JD (1980), Marsh (1980), Martin and Norman (1974)] and are now being introduced with a sense of urgency into education. Teachers, while struggling to learn the new technology themselves, are introducing children to the processes and knowledge of this new medium. It could be expected, therefore, that teachers would respond to the use of computers within the institutionalised context

of schooling, that is, in the traditional mode of teachers imparting knowledge to students who are under their supervision and control. However, before this can occur, the use of computers must be legitimated within the curriculum of schooling.

The legitimation of computing within the school curriculum raises two issues. First, in order to locate a new phenomenon within the existing tradition of schooling, the existing curriculum must in some way be modified or replaced. For example, in the case of computers the question must be asked:- How will computers change the teaching and learning process? Second, the body of tradition of schooling, including the epistemological understanding of what is knowledge and in what discipline that knowledge resides, may create considerable tension as educators integrate the use of computers and with them a body of new knowledge into the schools. A second question must therefore be asked relating to 'traditional' divisions between disciplines:- What knowledge is being constructed regarding the importance of who will accept the use of computers within the discipline.

The study is important from the perspective of how new technology is integrated into social institutions and how the institutions change or accommodate the technology into their day to day reality. More particularly, this study seeks to determine the ways in which technology (in this case computers) is integrated into the realm of education.

Two specific questions require analysis. One, what 'knowledge' is constructed about the technology in order to present it to education and, two, what knowledge is constructed about education to enable computers to be integrated into schooling as an appropriate technology for education.

The study of these broad questions was limited in a number of ways. One, by the scope of the examination within schools and society. Two, by the timeframe within which it could be examined and, three, by the difficulties associated with the analysis of concepts such as 'knowledge'.

The investigation and analysis used the methodology of a case study which was confined to two schools, one representing the private school system and the other representing the public school system. Both schools were at the secondary level and for practical reasons the schools selected were from the metropolitan area of the City of Adelaide in South Australia.

It could be argued that these schools do not adequately represent schools in general, but the study is not so much interested in the schools themselves as with the 'knowledge' being constructed both by society and the schools in general. Further, the study does not purport to be a statistical analysis of a school population although it does use some survey methodology to collect data from within the case study. Nor does the study attempt to collect data of the theorising from all possible social groups with an interest in computers but rather examines those groups identified within the literature as being particularly influential in terms of schooling or able to promote their own version of the reality of schooling.

The study sought to determine the theories which were initially promoted about computers and schooling to establish the role of theory building and their relevance to current theorising. Surveys of the schools were conducted at approximately the same time, however, the analysis of the theorising constructed by educators, employers and computer suppliers followed at a later date. The 'knowledge' they held may have been subject to some alteration as a result of timing of the study.

The most contentious issue within the study was the interpretation of the concept 'knowledge'. The author relied upon the direction proposed by Berger and Luckman (1966) to analyse the data presented within the case studies. Numerous diagrams found within the text were prepared by the author to assist the reader with the interpretation of the theoretical constructs of the sociology of knowledge as developed by Berger and Luckman (1966).

In order to understand how knowledge about computers is being constructed, it is necessary to establish some of the parameters of the 'world of meaning' within which new innovations such as computers are located. (World of meaning is defined as the "comprehensive organisation of reality within which individual experience can be meaningfully interpreted." [Berger 1971, p.96]. Berger and Luckman's theory in which this concept belongs will be discussed in detail in Chapter 3.)

I shall now attempt to indicate some of the characteristics of this world of meaning through a review of the background to computer development, a survey of the literature and a survey of research.

Literature Review

2. LITERATURE REVIEW

2.1 PREAMBLE

Literature about computers and their impact on society began to appear in the mid-1970s as the rate of diffusion of the technology increased.

In order to establish an historical perspective and the context in which computers began to impact on education, I will briefly examine the issues which writers addressed in the decade following the tentative articulation of their views from the mid-1970s.

This review consists of two parts. Part one concentrates on the broad social issues which authors addressed. Part two considers the issues from an educational perspective to determine the level of theorising by writers about the place of computers in schooling. It is my intention to establish the context in which schools were facing the introduction of computers.

I will begin by giving a brief history of the computer then examine the issues, concerns and 'theorising' discussed by authors regarding the influence this technology is imposing on social institutions. This examination will seek to understand the type of futures the writers were constructing for schools and society and the relationship between that construction and the theoretical constructs held in schools and society in the early 1990s.

2.2 HISTORY OF THE COMPUTER

The history of the computer, although short, originates from the development of early counting machines. The person generally recognised as being responsible for this development was Charles Babbage who displayed a working model of a computer in 1822. This machine was limited by the accuracy of its mechanical parts but the concept once developed was continued until in 1936 Alan Turing, a mathematician, presented his theory of a computer which was infallible and had the potential for infinite data storage (Evans, 1981).

Early developmental computers enabled engineers to realise the full potential of Turing's programmable computer. Morrison (1980) points out that the real revolution in computers occurred in 1972 with the development of the microprocessor. Since that time computers have had an increasing impact upon society.

Two aspects of the computer's impact are especially significant. First, as computers became smaller, portable and cheaper (Allen, 1980) their diffusion through society increased the awareness that computer technology had enormous potential and consequently would influence many aspects of institutional life. Second, coupled with this increased social interest, writers created a range of theories speculating on the development of the computer and on the ways in which it might restructure institutional organisations and behaviour.

Such considerations included the impact of the technology on education. In the early 1970s, authors such as Michie (1974) discussed the potential of the computer to become a tutor, secretary, research assistant or playmate. Likewise, as the computer brought pressure for change to institutional life, a thrust for change to the focus of education also arose. One aspect of this pressure can be cited in *Skills for Australia* (1987), circulated by the Federal Education Minister John Dawkins and followed by the publication of the green and white papers. These documents comment upon the need for education to be relevant to the country's economic and labour markets.

However, the complex nature of education and its place in society precludes any simple assumptions being made about how educators might respond to such demands. Nevertheless, schools will be expected to respond to the demands of computers on society and also to determine how they will use the computer in education. I will now proceed to examine the expectations within the literature.

2.3 SOCIAL ISSUES

The social issues raised within the literature provide a wide spectrum of opinions. These issues are briefly identified as follows:-

2.3.1 **The Institution of Work**

The effects of computers on work was widely debated. On the one hand, Bennett (1981), Simon (1981), Stern and Stern (1982) all argued that computers would cause job displacement and unemployment.

Coombs and Green (1980) predicted dramatic job losses due to micro-electronics in the 1990s. Marsh (1981) examined the historical development of mechanisation and concluded that fears that machines would take work away may be embedded deep in the human psyche and, unlike past technologies, computers would probably lead to long term unemployment.

Smith (1981), Benjamin (1981) and Blatt (1981) accepted that computer applications would cause unemployment but claimed that this would be the first phase of structural changes which would reduce the general need for all to work.

On the other hand, Bennett (1981) and the South Australian Council on Technological Change (1982) claimed that our standards of living and long term unemployment patterns would be adversely affected if the technology were not used.

The trade unions were also faced with a dilemma. Hill and Johnston (1983) pointed out that if they opposed the new technology they would lose jobs and if they accepted the technology they would also lose jobs.

The future would be stark said Cooley (1980); we either react to technology or we use technology to enhance human creativity and expression. Ellyard (1981) supported this view. Stern and Stern (1983), claimed that the nature of computers inhibits creativity and originality because they bring about conformity and regulate how work is done. This point was also made by Barrett (1978) who believed that the pre-suppositions of a technical world were not being examined closely by people in their daily lives and as a result they became so enclosed in those pre-suppositions that they could not imagine any other way of thought but technical thinking.

For women the computer has also become a contentious issue. Deakin (1984) claimed that women were not taking to computing as readily as they might and believed that this trend needed urgent attention.

Bevage, James and Shute (1982) in *Worth her Salt, Women at Work in Australia* argued that the sexual division of labour meant that women, in particular, were more adversely affected by the deskilling and fragmentation of jobs caused by technological change than men.

Cooley (1980), believed that the thrust for computer technology incorporated a male values bias. Those values were competition, obedience and strength, whereas female values of intuition, subjectivity, tenacity and compassion were absent in the introduction of computer technology. Women would therefore have to fight increasingly sophisticated and scientifically structured forms of discrimination which would keep them in lower status jobs.

An argument advanced by Evans (1979) and supported by Naisbitt (1984) and Martin (1981) suggested that there would be an erosion of power of professionals as a result of the availability of knowledge held in computer data banks. Doctors, engineers and teachers would become generalists rather than specialists, taking and using information from the data banks as required.

2.3.2 Political & Organisational Structures

Writers increasingly refer to Australia as an information society. Naisbitt (1984), and Lamberton (1984) both take this view. These writers pointed to the structural changes likely to occur in social organisations.

Naisbitt (1984) foresaw the following trends arising out of the widespread use of computers and information technology. Moves from centralisation to decentralisation, from institutional help to self help, from representative democracy to participative democracy and from hierarchical structures to organisational networks.

In contrast, George (1979) and Burnham (1980) expressed the belief that computer technology was providing the tools which would move society towards a computer state. George (1979), in particular, expressed a fear of a totalitarian world controlled by computers and in the hands of fewer people.

Burnham (1980) explained how individuals and organisations increased their power by the use of computers and how governments used them to stay in power. He was particularly concerned about the way in which many processes used for maintaining society such as rubbish removal, security and services were being taken over by computers.

Stern and Stern (1983) and Kirby (1984) identified the threat to privacy through violation of computer systems and the vulnerability of computers to criminal use.

Evans (1979), and Martin (1981) suggested that considerable changes would take place in people's homes as leisure time increased and computers were used more for pleasure, entertainment and education.

George (1979) claimed that the changes would be so dramatic as human kind developed 'thinking' machines that there would be a growing disbelief in religions. Evans (1979), on the other hand, believed that such developments were creating such a complex society that new religions could arise in which the computer may play a predominate role.

Of greater concern to some writers was the state of international relations. This concern stemmed from the increasing technological control of weapons. Evans (1979) argued that war would cease because computers would show each side that they could not win. Michie and Johnston (1984) cited the near launching of nuclear weapons in 1979-80 but they claimed that better technology would make decisions for us.

Norman (1981) and Naisbitt (1984) pointed to growing interdependence between rich and poor countries brought about by micro-electronics, communication technology and international business integration which was beginning to alter some of the traditional relationships between countries due to emerging trading arrangements.

2.3.3 Human & Computer Interactions

Shallis (1984) put forward the view that human beings were treating computers as if they were alien invaders. He believed that people were seeking to know what the computer had to tell them. Reineke (1982) supported this contention with his book entitled *Micro Invaders*. Shallis pointed out that above

... all other technologies it is computer technology that has rapidly become highly anthropomorphised. (Shallis, 1984 : 2)

He claimed that the computer stands between people and interferes with their relationship with each other ultimately breaking down responsibility.

Schools, he claimed, were responsible for perpetuating notions about computers and their ability to assist in information transfer. In fact, he claimed, school policies were being directed towards capturing children as young as possible to enhance their adaptation to computers.

Turkle (1984) shared this concern for human relationships but her concern was directed at the relationships formed between people and computers when the former spend considerable time interacting with computers. Because the computers have the ability to be interactive they offer companionship without the demands of human interactions. Further, she claimed that people became trapped by

building their own private worlds with computers. Frude (1983) also claimed that people became attached to machines as they became more humanlike which, in some cases, led to intense relationships between people and computers. He tendered considerable evidence to support his claim.

A further perspective on the machine/human interface was offered by Michie and Johnson (1984). They explained that computers must be built in the image of the human mind.

However, to do this computers would have to present information within the human window, that is, present information in such a way that it falls within human perceptions. Only then could humans hope to control them. As humans tend to distort, simplify and use myths to help understand complex systems, computers would have to do likewise. They did not expand the social consequence of such directions.

Weigenbaum (1976) argued that people could never be compared to machines and warned about the dangers of becoming slaves to computers. Turkle (1984) was also concerned with the tendency to conceive of the self as a machine. This outcome, she observed, tended to occur because a 'machine that thinks' was perceived as a 'machine who thinks'.

Boden (1977) warned of the danger to society which might be effected by undermining aspects of our current view of ourselves and our self-images through the insidious use of technological analogies used by workers in artificial intelligence which enter into our culture.

It is against these issues and within their context that education is presently grappling with the questions of how best to use the technology of computing.

Although the writers confronted many contentious social issues, there was no emerging consensus regarding the way in which they believed computers would change social institutions or individual needs. However, it was clear that considerable theorising was being constructed around each of the issues cited above.

2.4 EDUCATIONAL PERSPECTIVES

Papert (1980) in his book *Mind-Storms* claimed that:-

... computers can be carriers of powerful ideas and of the seeds of cultural change (1980 : 4).

He also claimed that computers could be used in such a way that:-

... they cut across traditional lines separating humanities from sciences and knowledge of the both of these (Papert, 1980 : 4).

His work on the development of 'logo', a special computer language designed for educational use, draws on the ideas of Piaget and artificial intelligence. Papert reinterpreted Piaget to demonstrate that environments could be constructed which were sympathetic to children's natural growth. The construction of such environments was through the medium of the computer.

The computer, he believed, was able to give concrete form to ideas about thinking which were previously abstract.

The computer was thus able to shift the boundaries between Piaget's 'concrete' and 'formal' thinking and, he argued, only through the aid of the computer has this been possible (Papert, 1980 : 156). Furthermore, he argued that teaching children procedural thinking analogous to computer programming was a powerful method which enabled them to better understand themselves. Concerning people's fears about such approaches leading to mechanical or linear thinking he said:-

They worry about people losing respect for their institutions, sense of values, powers of judgement. They worry about instrumental reason becoming a model for good thinking. I take these fears seriously but do not see them as fears about computers themselves but rather as fears about how culture will assimilate the computer presence (Papert, 1980 : 155).

Papert (1980) was particularly critical of current educational practice. Children's learning was not along natural developmental phases but curriculum driven. He claimed that tentative theories held by children were seen as evidence of deficiencies of thinking which schools must correct rather than evidence of children's early steps at learning how to think.

Papert believed that the appropriate approach was to create an intellectual environment where children could develop their own laws not dominated by the school's criterion of 'true and false'. Such environments were created, he claimed, by the use of language and computers.

Citing mathematics learning as an example he explained that:-

... our educational culture gives scarce resources for making sense of what they (students) are learning (Papert, 1980 : 47).

His main concern was that schools would not exploit the potential for change offered by the computer. The natural conservatism of educational institutions would stifle innovation. Moreover, he claimed that very few people with imagination and creativity enter education and hence the conservatism is self perpetuating.

A weak link exists, he claimed, in the increasing use of home computers which will

... gradually return to the individual the power to determine patterns of education. Education will become more of a private act, and people with good ideas will no longer be faced with a dilemma where they either have to "sell" their ideas to a conservative bureaucracy or shelve them. They will be able to offer them in an open market-place directly to consumers (Papert, 1980 : 37).

Papert's lack of confidence in schools and his expectation for computers was quite explicit.

I believe that the computer presence will enable us to so modify the learning environment outside the classroom that much if not all the knowledge schools presently try to teach with such pain and expense and such limited success will be learned as the child learns to talk painlessly, successfully and without organised instruction.

This obviously implies that schools as we know them today will have no place in the future. But it is an open question whether they adapt by transforming themselves into something new, or wither away and be replaced (Papert, 1980 : 9).

Bork (1985), Heaford (1983) and Barker & Yeates (1985) all argued for a greater role for computers in education. Heaford took up this point when he claimed:-

... we must find new direction for education if we are to equip today's students for a technology-based society (Heaford, 1983 : 86).

The new direction, he believed, would be achieved through the use of the home computer.

Education through computers at home will see a dramatic growth in the next decade (Heaford, 1983 : 85).

Schools, he believed, would essentially concern themselves with accreditation of courses and learning arrangements which students undertook outside of the institution. Likewise, Barker and Yeates (1985) argued that

... education, teaching and training cannot escape the onward strides of technology. It is therefore time that the role of computers in education was critically assessed.

We believe that computers can:-

- (1) enrich a learning environment,
- (2) enhance the learning process,
- (3) make education more widely available,
- (4) produce cost effective solutions to the dissemination of knowledge (Barker and Yeates, 1985 : 38).

Furthermore, they felt that:

... never before has an educational medium as powerful as the computer presented itself (Barker and Yeates, 1985 : 38).

Bork (1985) on the other hand, although supportive, was far more cautious.

For instance he claimed that:-

... computers, although little used in education at present, will eventually become the dominant delivery system in education at all levels (Bork, 1985 : 161).

He provided the following reasons for this direction:-

- (1) educational systems at all levels were in serious trouble,
- (2) evidence existed which suggested that the quality of education was in decline,

- (3) student and community attitudes towards education were negative,
- (4) schools were in financial difficulty,
- (5) teachers in science related areas were leaving to seek more remunerative and gratifying jobs, and
- (6) education tended to resist attempts to change.

The answer for many people, he claimed, was computers.

Some people consider computers to be a panacea, a solution to all types of problems (Bork, 1985 : 162).

He suggested that unquestionably computers would be the "least expensive way to establish a new educational system" (Bork, 1985 : 162). That is, he said, if schools continue to exist. The future, he claimed, would be a period of great change and tremendous turmoil in education. Heaford (1983) felt so strongly about the importance of computers in education that he prefaced his comments with the following words:-

Computer/Literacy - at any level, at any age, at any price - is the fundamental basis upon which the future of industry, and maybe society, will depend (Heaford, 1983 : V).

Like Papert, Heaford claimed that computers in education would herald

... a renaissance in education; because I believe that the myth of the learning machine that begins, "computers can never", will be exposed in the next decade.

However, the issue according to Heaford was not "whether intelligent machines are possible, but if indeed they are desirable" (Heaford, 1983 : VI). It was also apparent that the issue for many of the writers was how to deal with the future and how people were to be prepared for it.

O'Shea and Self (1983) gave three reasons for the introduction of computers into education:-

- (1) Children needed to be aware of the nature and uses of computers in order to be able to cope with the present and the technological future.
- (2) Computers could help with certain administrative chores such as the maintenance of records and scheduling of classes, and
- (3) Computers could help to improve the learning process.

This last point was the most controversial. Principally, they believed that the computer removed the drudgery from learning, freed time and offered scope to students imaginations and creativity. Heaford (1983) raised a number of specific concerns.

- (1) The advancement of new technology was so rapid that it was beginning to alarm concerned educators.
- (2) Many schools confined computer studies to mathematics and physics departments and only encouraged students with high mathematical aptitude to undertake such studies.
- (3) Males monopolised many aspects of computer activities.
- (4) There was a lack of knowledge about computing amongst the teaching profession.
- (5) There was lack of studies focussing on the impact of computers on society.

Rushby (1981) reviewed micro computer use in Europe and concluded that whether computers were designed and built specifically for education or not was a political decision often influenced by pressures to support indigenous micro electronic industries.

Further, he identified two extremes between teaching about computers and teaching with the aid of computers. France adopted the integrated approach (ie, throughout the curriculum) while various other countries such as West Germany, Denmark and the Netherlands adopted a middle ground between the UK and USSR who adopted the separated approach (ie, separate computer lessons). Also, he claimed, that Western Europe followed the North American school of behaviourism, the UK concentrated on simulation and modelling while the Netherlands concentrated on tutorial modes.

This difference had become less marked in recent times. The success of computers in education lies in teacher training, he claimed, and each country faced a massive training problem if the aspirations of the various departments of education were to be realised.

But if we are realistic, we must admit that whatever we do, it will come too late because micro computers have already arrived in the classrooms in continental Europe (Rushby, 1981 : 12).

Unlike the previous writers who questioned whether schools would survive

Coburn, et al (1982) claimed that:-

As long as there are societies, there will need to be schools. While some affluent families now and in the future may supplement their children's learning with home computers, it seems unlikely that even they would wish to deprive their children of the important formative influences experienced in schools. (The Computer Goes to School, 1982 : 4).

However, the authors raised a number of issues related to using computers in schools.

- (1) How would teachers get adequate training?
- (2) Were present computers reliable or easy to use?
- (3) What social problems accompanied the introduction of computers into schools?
- (4) What were the appropriate educational goals for computer literacy?
- (5) How would educators make use of the computers' learning potential?

The authors provided no simple solution but rather a range of scenarios which the future might hold. The authors concluded by pointing out that the greatest challenge was in educating themselves for, they claimed, if they did not begin working towards this end who else would?

It was on the question regarding the rationale of computer use that Conabere and Anderson (1985) focused. Like Bork (1981), Conabere and Anderson claimed that the school was in serious trouble

... unable to jettison in-essentials, the school is rapidly becoming something of a struggling pack-horse for society, wandering between poles of superficiality and gross inefficiency. In many schools there is widespread disaffection among students, and even teachers. (Conabere and Anderson, 1982 : 2)

They continued,

... if educators continue to apply a technology of a bygone age to current needs and wants, then the deficiencies in their services will become increasingly obvious; the astute will seek satisfaction elsewhere (Conabere and Anderson, 1985 : 2).

They argued that despite increased teacher student ratios, additional resources and service personnel, the 'teacher - talk - text' technology persisted.

Four reasons were advanced

- (1) schools have never had any real competitors
- (2) the teaching profession was essentially conservative
- (3) there had been no real commitment from Government to on-the-job training and development
- (4) there was no tradition of educational research and development to show how to improve.

Conabere and Anderson, however, were largely optimistic about the future of schools.

Fortuitously, though, developments in computing offer schools the opportunity to re-assert their importance in society and to continue to do well that which they have traditionally done well (socialisation, character development, promoting the values of society, and so on) (Conabere and Anderson, 1985 : 5).

For these authors, the immediate justification for introducing computers into education was as follows:-

- (1) Evidence existed that the computer could enhance and aid learning through its immediacy and access to data.
- (2) Students showed increases in motivation, stimulation and pride in presentation.
- (3) Using computers may also develop better information processing skills and children may also learn 'to think about thinking'.

However, the authors warned that if these new opportunities were not taken up then the situation in schools would worsen.

Most research dealing with computers in education addressed the methodological aspects of using computers to teach students or assist their learning. Such studies using the computers as a teaching machine date from 1958; these early developments included the *Individually Prescribed Instruction project*, Pittsburg Elementary School, *P. Suppes' arithmetic program* at Stanford University, the *Huntington I and II projects* at the State University of New York, and *Solo Project* at the University of Pittsburgh, *A. Borks' tutorials* at the University of California, the *PLATO project* at the University of Illinois, the BBC projects on micro computers and S. Papert's *Logo project* at the Massachusetts Institute of Technology. These projects became popular topics for meetings in 1968 and were extensively explored in the proceedings of the World Conferences on Computer Education in 1975. The meetings were essentially concerned with determining how well children learned using a variety of computers and software to do what they normally would learn with the help of teachers.

They were not directly concerned with the creation of knowledge about computers, that is, with the meanings given to computers and computing by the participants (children, teachers and parents).

Turkle (1984) undertook a study which sought to "provide evidence for the 'subjective' impact of the computer and to provide concepts to organise thinking about it" (Turkle, 1984 : 321). In her work, which dealt essentially with research projects, one of the questions she sought to answer was:-

How do ideas born within the technical communities around computation find their way out to the culture beyond? This is the province of the sociology of knowledge (Turkle, 1984 : 21).

In her work, she recognised the influence of social groups to which individuals belong and, most importantly, participation in subcultures which greatly influence the ideas that are mediated.

The meanings of computation for the individual are shaped by the group which emphasises and mythologises certain modes of relating to the computer (Turkle, 1984 : 319).

This perspective was taken up in research by Sproull, Kiesler and Zubrow (1984). From their research they pointed out that,

When novices encountered computing, they learnt more than skills: they learnt cultural lessons. Novices acquired perceptions of the social organisation of computing; they learnt 'we - they' distinctions and language; they learnt values. This cultural learning, we think, will magnify differential outcomes of organisational socialisation to computing (Sproull, Kiesler and Zubrow, 1984 : 31)

Sheingold, Hawkins and Char (1984) undertook research in introducing computers into classrooms, pointing out that teachers' interpretations of the meaning of the computer and whether it had a legitimate place in traditional curricular areas and modes of learning, had a powerful influence in shaping the role of the computer.

Furthermore, they explained that the views held by teachers and students about the interaction between themselves and the computer would have a considerable bearing upon the role of the computer in schooling.

Not everybody believed that research into the effects of new technologies was worthwhile. For example, Menzies (1982), Suman (1977) in Caparael and Thorngate (1984) pointed out that reactions by individuals and groups was a matter of generational idiosyncrasies or cohort effects. As older people retired and new generations came to use technologies as 'matter of fact', any research would be of questionable validity in understanding future trends.

Nevertheless, the process of moving from unacceptable to acceptable in social groups and society, is itself, of considerable research interest. Moreover, institutions change and that change is influenced by various social forces and technologies. Such changes are the province of the sociology of knowledge and may be interpreted by the application of that discipline.

2.5 SUMMARY OF ISSUES IN THE LITERATURE

2.5.1 Social Issues

From the spectrum of ideas discussed by the previous writers it was not just the computer which caused consternation but technology in its broader sense. Humanity was ill at ease with its own creations. Essentially, human beings had two concerns:-

- (1) The technology itself, that is the machines produced, and
- (2) How humans might use the technology.

Perhaps the level of concern for a particular technology can be measured by the scope of its application. Like the technology of weapons, computers have the propensity to affect everybody.

Likewise, the issues tend to radiate from the point of impact most likely to affect people's everyday lives. For example, the influence of computers on work is discussed in great detail.

In essence the authors explore the question:

- What will become of work?
- How will people earn a living?
- How will society adjust to a world with less work?
- What would happen if the technology were not used?

Women who have been struggling for decades for recognition as workers of equal status to men, find themselves confronted by a technology of recent origin which appears to have the potential to cheat them of that goal.

Even professionals, long protected from the fluctuations and uncertainties found in lower status jobs may be reduced to generalists and be subjected to the same dictates of job uncertainty and lower status as other workers when their power of knowledge is removed by computer technology.

As the nature of work changes, so does the organisational structure which supports it. The authors speculate that as information will be widely available, organisations will be smaller and decentralised.

As the emphasis moves from institutional help to self help less significance will be given to institutions based on service and organisational knowledge as the basis for jobs. Institutions generally have a long history and such changes will be resisted at all levels.

Governments and government agencies are viewed as objects of suspicion at any time but the prospect of providing them with the power of computing systems which increase their reach and influence caused the writers to view such prospects with alarm. Historical precedents provide ample evidence of the abuse of power by political

movements. Computing facilities now available and likely to be available in the near future appear to have reawakened these concerns.

Within a similar context is the concern for international relations. As the authors viewed governments with a degree of caution they viewed the potential of government to government relationships on a national scale as even more problematic when coupled with the aid and assistance of the computers.

This concern is linked with increased militarism and the dependence on technology with its potentially awesome and destructive power.

By and large, these issues are all related to the social context, for example, how people live and relate to others and how the computer interacts in these relationships.

The remaining issues can best be described as pertaining to the psychology of human beings. Authors questioned the human response to 'thinking' machines and their ability to come to grips with this new phenomena. If human beings view themselves differently as a result of technological developments how will they view others and how might this affect their relationships with others? In general the authors viewed these developments with disquiet.

Education prepares people for the future, be it with skills for jobs or with essential social and cultural knowledge to organise life. However, when the future is uncertain and subject to doubt and disquiet then education itself becomes uncertain for the premise of its existence is in question. That is, can it prepare for the future?

2.5.2 Educational Issues

Alternative realities discussed by educational writers also provide alternative possibilities for changes to education.

The most extreme position taken is that education becomes a private matter based on the resources of computer systems. In this scenario personal choice becomes the key ingredient. Learners or their parents purchase access to educational systems which they think will best provide for their educational needs.

Even removing the issues of equity, enormous responsibility would fall on learners to determine the programs best suited to their needs. Furthermore, this raises problems of determining learning styles and appropriate performance criteria remote from a social interface. Schools in this scenario would be reduced to providing accreditation and awards for learning.

Such a prospect also raises the issue of the commercialisation of education, since control would be in the hands of corporations which would sell educational packages much the same as they would motor vehicles. In such a system the open market philosophy would prevail.

On the other hand, there are those writers who raise questions about the long term dangers which might be inflicted upon the social structures of society if computers are allowed to intervene in what for them is a social process. These writers view the human interaction as the most important element in the learning process.

Between these two positions rests a wide variety of ideas with respect to improving the learning outcomes by using a range of technologies in which computers play the major role.

These prospects raise a number of issues rarely addressed in the literature. One of the most interesting is the assurance by the promoters of computer learning that students will learn more effectively using computer methods. There is not a lot of convincing evidence to date that students' learning performance improves significantly when using computer programs. Much of the current work being done is based on the assumption that this situation will change in the future as computing systems and programming techniques improve.

Another facet of concern for teachers will be the prospect of their ultimate replacement by computers. Although there are no strong reasons to indicate that this is a likely direction, it has been suggested by some writers.

One of the fundamental assumptions held by promoters of computer learning is predicated on the notion that the current teaching methods are both inefficient and ineffective. Furthermore, it assumes that the human capacity to learn may be expanded by the use of technology.

Considerable theorising is clearly in evidence as educators mould traditional learning theories to new concepts arising out of the technology of computers. This in itself is an interesting development from which a new body of theories and a new body of experts will arise.

Criticisms of the use of computers in education were as follows:-

- (1) Educational institutions are too conservative to exploit the potential of computers and too resistant to change.

- (2) Educational institutions are unable to change the curriculum to make room for new subjects.
- (3) Educational institutions are unable to cope with rapid changes in technology.
- (4) Educational institutions are unable to reduce the male monopoly in technology and science.
- (5) Educational institutions are unable to provide sufficient computer knowledge to teaching professionals.
- (6) Educational institutions are unable to provide details on the social effects of computers due to the lack of studies in this field.

In the following section I will attempt to define the problem to be researched in the light of the central issues with respect to education found in the survey of the literature.

2.6 THE PROBLEM DEFINED

Computers have become the representational metaphor for technological change and computers are being held responsible for the concomitant social upheavals which tend to accompany their introduction. This metaphor also epitomises many of the uncertainties which face parents, students and children in the immediate future.

The technology seems to represent on the one hand immense promise for the future but on the other hand a considerable threat in terms of all that has been taken for granted in the past to represent success, security and identity.

As jobs rapidly change or are lost, computers are presented as the element which may provide the key to success and the hedge against unemployment or failure in a world where work is still seen as the single most important social indicator of success.

Parents naturally seek to provide their children with the greatest advantage to be successful in a world of diminishing opportunities in terms of job prospects. Many of these prospects, we are told, will involve computers in some way.

Parents who interact with the 'theorising' have two avenues of influence. One, they can purchase the technology and thus provide immediate opportunities for their children; first hand experience. Two, they can bring pressure to bear on the institution which prepares children for their role in society to provide computers and computer instruction.

Coinciding with this trend, there is the general community acceptance, as evident in the literature, that schools are the place in which people are prepared for the future and where the dilemmas of the recent, social issues must be resolved so that young people can take their place in the technological world of the future, able to handle the technological and social problems with confidence. There is a lack of agreement that this is what schools are doing. However, the perception still exists that somehow it will happen.

This project will research how knowledge about computers and education is being constructed by administrators, parents, teachers and students, as schools implement computing programs and teachers explore ways in which computing may be incorporated into curriculum.

However, this project is not concerned about the actual use of computers in schools or their educational merit but rather about the ideas, concepts, knowledge created by the people involved in their use.

Theoretical Framework

3. THEORETICAL FRAMEWORK

3.1 SOCIOLOGY OF KNOWLEDGE

As previously cited, Turkle (see page 26 above) asked the question, how do ideas born within the technical communities around computation find their way out to the culture beyond? Her answer was, "this is the province of the sociology of knowledge". It is within the context of the sociology of knowledge that this investigation will be pursued.

In seeking to establish a theoretical basis for an examination of how knowledge is socially constructed with reference to computers in education, I shall draw on the writings of Berger and Luckmann.

The sociology of knowledge must concern itself with whatever passes for 'knowledge' in a society regardless of the ultimate validity or invalidity of such 'knowledge'. And in so far as all human 'knowledge' is developed, transmitted and maintained in social situations, the sociology of knowledge must seek to understand the processes by which this is done in such a way that a taken-for-granted 'reality' congeals for the man in the street. (Berger & Luckmann, 1966 : 15)

Berger and Luckmann believe that the proper role for the sociology of knowledge is an analysis of the phenomena of how social reality in general is constructed. A key factor in the theory is that 'knowledge' becomes socially established as 'reality'. In other words what I 'know' is my reality but I gained this knowledge from what my social group regards as reality. The sociology of knowledge will therefore have to deal with the widest interpretation of knowledge and the process by which this becomes reality.

I shall now briefly outline essential elements of Berger and Luckmann's writings which will be used in the present thesis to establish a theoretical framework within which the problem to be researched will be situated.

3.2 THE SOCIAL CONSTRUCTION OF REALITY - KEY CONCEPTS

3.2.1 Consciousness

Fundamental to the construction of reality is the role of consciousness. Consciousness in this context relates to one's personal awareness of self and immediate environment. The 'here and now', of an individual's attention is described as the pre-eminent act of consciousness (Berger & Luckmann, 1966 : 36).

Although the human mind is able to recognise a variety of realities such as the world of dreams, the most intense and persevering is the reality of every day life. However, people are not limited by the immediate consciousness of the every day life. Beyond the zone of immediate attention exists those elements which are less intense and urgent but which nevertheless make up the consciousness of an intersubjective world which is shared with others.

There is an ongoing correspondence of meanings between those held by the individual and those held by all others in the world. That is, they share a common view about the reality of the world. It is this common sense characteristic of all consciousness that is central to this study.

The sharing of meanings does not mean that different perspectives of reality do not exist or that conflict about those perspectives will not arise. Regardless of how one might deal with such differences of perspective, for instance, from a theoretical perspective, it is necessary to return to the world of common sense reality to relate your knowledge to that of others. The term common knowledge is used since it is the knowledge common to most people.

It will be on this common stock of knowledge that this examination will focus.

3.2.2 Reality Construction as a Dialectic Process

Society is perceived as being constructed by a dialectic between objective givenness (facticity) and subjective meanings. Furthermore, Berger and Luckmann propose that this dialectic exists between three fundamental moments from which social reality can be analysed. They are as follows:

Society as a human product, (externalisation)

Society as an objective reality (objectivation) and

Man as a social product (internalisation)

However, objective facticity and subjective meaning are given particular attention. They are crucial to the theory's ability to analyse and explain society.

Objective facticity, that which is experienced as outside reality (that is outside of one's body) and subjective meaning, that which is experienced as being within consciousness, are described as being in a reciprocal interaction. Thus, social reality has within it a reflection of individual consciousness.

Second, consciousness as defined in the theory is the consciousness of everyday life and therefore, pre-theoretical most of the time. This pre-theoretical consciousness consists of the 'taken-for-granted' meanings which make up the everyday actions and relationships which are shared with others in a particular social world.

Third, a particular social world is constructed from the meanings held by those who inhabit it. In other words, the reality of a particular group in society is socially constructed. The definitions they construct may be of different types including cognitive, referring to what 'is' or normative, referring to what 'ought to be'. Furthermore, they may have varying levels of theoretical elaboration depending on the consciousness of the individual. For example, the consciousness of the labourer may differ from the consciousness of the academic, the consciousness of the employer or the consciousness of the public servant and teacher.

The construction of reality takes place as human consciousness interacts with the many spheres of reality in everyday life.

We come to know reality as we apprehend it. Its order and patterns are already objectivated and its presentation and sequence are independent of our apprehension of them. We are conscious of experiences in a variety of ways. For instance, we become conscious of those experiences which are closest to us, those which we can handle and modify.

Less important are those over which we have minimal or no control and which occur in zones which we cannot access.

Life is subdivided into a temporal structure within which a series of routines gives sense to, and makes possible, the many events of everyday living. When problems arise we seek to integrate them into the unproblematic and the routine.

3.2.3 The Role of Language in Theory Building

Language establishes and provides the objectivations of life giving meaning to places, objects and relationships. As Berger and Luckmann (1966 : 36) put it, language 'marks the co-ordinates' of life in society. Furthermore, through language we share the common sense knowledge with others. Individuals are able to establish the

correspondence of meanings between themselves and other interpretations providing the ongoing basis for the common-sense understanding of society. (This is not to suggest, as will be discussed below, page 49, that there are not competing systems of meaning.)

Similarly, the meanings held about the use of computers must be based upon a correspondence of meanings shared between others if they are to provide an ongoing common sense understanding in society.

Concerning language, the following points are made:-

First, human expression is capable of objectivation. These objectivations provide evidence to others of their subjective intentions.

Second, the production of signs is a special case of objectivation. Signs are especially important in so far as they can become detached from the immediate situation.

Third, language is the most important sign system available to humanity and society.

Although language originates in face-to-face situations it is capable of detachment and has the additional ability of being a repository of accumulated meaning which can be preserved and transmitted. Its characteristics include the crystallising of personal subjectivity, generalising typical experience, and providing the mechanisms to define provinces of meaning.

Fourth, such accumulations of meanings establish the basis for knowledge. The common stock of social knowledge is shared with others and this determines the location of individuals in society and assigns the appropriate behaviour to such individuals. Furthermore, language provides the basis for the development of theories. Through theorising people make sense of the world. By sharing those theories via language, people explain and share their understanding with others. Such theories become institutionalised through the crystallisation of generalised meanings.

3.3 OBJECTIVE REALITY - KEY CONCEPTS

3.3.1 Social Order

An explanation of objective reality begins with the understanding that social order is a continuous human production. Creation of a social order is essential to form a stable environment from within which human beings can conduct their lives. Transmission of this environment occurs through institutionalisation.

3.3.2 Institutionalisation

A brief analysis of institutionalisation illustrates this process. The origins of institutions begins with habitualisation. Habitualisation occurs when meanings become embedded as routines in the general stock of knowledge. Habitualisation brings with it the advantage of reducing the number of decisions necessary in any situation.

Furthermore, it makes it unnecessary to redefine each situation each time it is confronted. Against this stable background human beings are able to focus their attention in a deliberative way making possible innovation.

3.3.3 Typifications

Habitualisation initiates institutionalisation through the typification of habitualised actions by individuals called 'actors'. This typification of habitualised actions creates institutions. Since these typifications are shared they are available to all the members of a particular society.

Only by the process of typification can social traditions be transmitted to a new generation. Almost all members of society know about life by means of typificatory schemes.

3.3.4 Institutional Persistence

In the course of history these shared actions control behaviour by establishing preferred patterns of conduct which are repeated rather than inventing new patterns of conduct on each occasion. Institutional behaviours contain within them a primary form of social control in that the acceptance of a particular conduct channels human behaviour in one direction rather than the many directions possible.

Berger and Luckmann express the power of institutions succinctly in the following statement:

... they resist human attempts to evade or change them, they have coercive power over them by their force of facticity and through the control mechanisms that are usually attached to the most important of them (Berger and Luckmann, 1966 : 78).

The pervasive effects of institutions lead the human mind to conclude that 'this-is-the-way-things-are' and moreover that there is no other form of behaviour for members of society. A major gain stemming from institutionalisation is the predictability of behaviour.

From the same historicity of institutional actions is acquired the quality of objectivity. At this point institutions reflect a reality of their own.

An institutional world, then, is experienced as an objective reality. It has a history that antedates the individual's birth and is not accessible to his biographical recollection (Berger and Luckmann, 1966 : 77).

Further,

the institutions, as historical and objective facticities, confront the individual as undeniable facts (Berger and Luckmann, 1966 : 78).

Two mechanisms maintain institutionalisation: legitimation and social control. Both legitimation and social control largely depend upon language to define 'correct' behaviour and language draws upon the social stock of knowledge to explain and apply the appropriate institutional meanings. Every institution has a body of recipe knowledge which supplies the appropriate rules of conduct. Since this knowledge defines the institutional areas of conduct, any deviance from that predefined conduct will be seen as a departure from what is held to be the norms of a society. Knowledge then becomes a controlling element in institutional behaviour.

In other words, people behave according to the knowledge available to them and this is historically derived.

Knowledge about patterns of behaviour or the way things are done provides both information about what is acceptable behaviour within the institution and also what is not acceptable. All situations which may arise within an institution and those roles which are to be performed in handling any situation will be limited by the knowledge available about that situation. Hence, knowledge has a controlling influence on all situations arising within institutional boundaries.

3.3.5 **Bureaucracy**

A study of institutions must concern itself with how bureaucracies work as much of modern society is subsumed under bureaucratic control.

The possibilities of social change are limited by access to the knowledge necessary to make decisions from the various alternatives available. As Berger and Luckmann express it,

... knowledge is a social product and knowledge is a factor in social change (Berger and Luckmann, 1966 : 104).

Hence, if knowledge is inaccessible then social change is also limited. Furthermore, bureaucracies tend to have an elaborate apparatus to maintain their version of reality. By-and-large the bureaucracies have established their views of reality in sympathy with broad social institutions. However, they have by their

organisation established rules, procedures and policies with which to maintain that institution. This places bureaucracies in the position where social change to existing institutions is resisted by bureaucratic control even if society no longer fully supports the original position.

They do this in several ways - firstly, by the creation of specialised knowledge.

Thus a specified body of knowledge emerges (and with it a specific language) which appertains to bureaucracy and to bureaucracy only (Berger, Berger & Kellner, 1973 : 49).

This tends to restrict the understanding of the general public. Secondly, organisations are able to devote considerable time and resources to presenting their view of reality. As Berger, Berger and Kellner say:-

... there is in bureaucracy a considerable dichotomisation between bureaucratic and client as to the meaning of the institution. Therefore there is a considerable problem of legitimation ... bureaucratic agencies are much more dependent on ongoing propaganda designed to legitimate their operations and indeed their very existence (Berger, Berger and Kellner, 1973 : 61).

This may well mean that members of the bureaucracy have different meanings than those of their clients.

Within bureaucracy there exists the potential for institutional segmentation which leads to sub-universes of meaning which may in turn cause conflict or competition between groups.

This raises the problem of keeping members of a sub-universe within it and keeping those outside under control. It also demonstrates the dialectical relationship between knowledge and social change.

3.4 **ROLES**

The transfer of meanings requires a social apparatus for its management. Within the social apparatus are individuals designated as transmitters. Berger and Luckmann tell us there is a need to examine the knowledge held by individuals and groups if one is to determine the institutionalisation of human interaction at any time in human history.

'Knowledge' and 'Not Knowledge' depend on what has been socially defined as reality and for this reason it is necessary to identify the roles of transmitters as well as other roles in the institutions. Roles, therefore, are an essential element in understanding both the theory and the process of transmission.

The importance of roles to institutions is explained in the following way:

Institutions are embodied in individual experience by means of roles. The roles, objectified linguistically, are an essential ingredient of the objectively available world of any society. By playing roles, the individual participates in a social world. By internalising these roles, the same world becomes subjectively real to him (Berger and Luckmann, 1966 : 91).

3.5 REIFICATION

The ways in which people reflect upon knowledge about technology is of equal importance to this study. Knowledge being objectivated about technology has thus far been based upon the assumption that people are able to relate to that knowledge in a dialectical way, that is, use it as if they had the ability to modify it to their need. However, this may not be the case. Berger and Luckmann explain the process by which human beings no longer recognise their role in the creation of their world.

... the dialectic between man, the producer, and his products is lost to consciousness (Berger and Luckmann, 1966 : 106).

Reification occurs when objectivation is extended to the point where the objectivated world once created is no longer seen as a human product.

Reification appears as an extreme step in the process.

The reified world is, by definition, a dehumanised world. It is experienced by man as a strange facticity an opus alienum over which he has no control rather than as the opus proprium of his own productive activity (Berger and Luckmann, 1966 : 106).

Possibilities for reification increase as societies become more complex and technological, bureaucratic, pluralistic and possessing a wide distribution of knowledge.

Such developments may leave people in a dilemma regarding their role and ability to interact in the process of change. They may find it particularly difficult to integrate new technologies such as computing into their 'world of meaning'. If the technologies are reified and hence their relationship to the technology is reversed in consciousness then they may relate to their place in the technology rather than technology's place in their 'world'.

This matter is critical to people's knowledge about the role of technology in education and it will be considered where evidence of its action can be identified.

3.6 CONCEPTUAL MACHINERIES

3.6.1 Legitimation Processes

The main function of legitimation is for the purpose of integrating the many and disparate meanings attached to institutions.

Two essential functions are identified: one, to provide a plausible sense to the totality of the institutional order, (this is described as the horizontal level of integration). Two, the acceptance of the various phases within an individual's biography, that is, the logic of the institutional orders within which the life span of the individual must be meaningful. This is identified as the vertical level of integration.

Both functions contain a cognitive and normative element which suggests that a level of knowledge must exist before the values held within an institution can be realised.

All forms of legitimation are not, however, assumed to be of the same level. The *first level* is pre-theoretical. That is it is the foundation of 'self evident knowledge' on which all subsequent theories must be built. Furthermore, the individual is unlikely to become incorporated into the traditions of the institutions unless this knowledge is established. This level contains all the simplest affirmations of how things are done.

The *second level* contains rudimentary forms of theoretical propositions, for example, proverbs, legends, folk tales and moral maxims. This level is described as highly pragmatic and related to direct concrete action.

The *third level* contains explicit theories by which an institution is legitimated in terms of a specific body of knowledge. These are likely to be highly complex and thus are often placed into the hands of specialised transmission personnel. It is also likely to develop the theories beyond pragmatic needs to 'pure theory' where full-time legitimators manage its transmission.

The *fourth level* is that of a symbolic universe. This level has the special role of integrating the different provinces of meaning and providing the institutions order with a symbolic totality. The symbolic totality is referred to in the following way:

... the symbolic universe is conceived of as the matrix of all socially objectivated and subjectively real meanings; the entire historic society and the entire biography of the individual are seen as events taking place within this universe (Berger & Luckmann, 1966 : 114).

Furthermore,

... the legitimation of the institutional order is also faced with the ongoing necessity of keeping chaos at bay. All social reality is precarious (Berger and Luckmann, 1966 : 121).

As for legitimation of institutional order so too is there a necessity to legitimate symbolic universes.

Specific procedures of universe - maintenance become necessary when the symbolic universe has become a problem (Berger and Luckmann, 1966 : 123).

Every symbolic universe is incipiently problematic (Berger and Luckmann, 1966 : 124).

This problem is particularly evident during the transmission of the symbolic universe from one generation to another such as in schooling. It is most likely to be under greater threat during periods of rapid change and development. Not only must the institution of schooling be contained by a symbolic universe which epitomises the values and benefits of education but it must be meaningful to the new generation and to those outside of institutional definitions.

It is recognised that there will always be competing definitions of reality between rival groups. Figure 1 represents this reality and illustrates the various ways in which competing definitions of reality may be positioned.

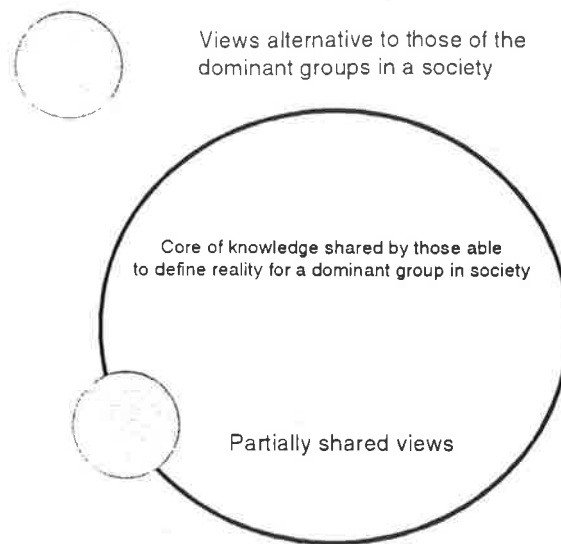


FIGURE 1: ALTERNATIVE DEFINITIONS OF REALITY

The transmission process incorporates some specific means by which these rival groups maintain their own definitions and deny any alternatives. The latter concept is developed to explain the phenomenon Berger and Luckmann called nihilation.

Two methods of application are recognised. First, alternative interpretations are given "inferior ontological status" (Berger & Luckmann, 1966 : 132). Second, alternative interpretations are reduced in importance by incorporating them into the terms of the dominant group, out of their original context and terms of reference.

In the same way that competing definitions are reduced, a conceptual machinery is employed to maintain that any likely proponents for alternative definitions stay within their own universe. To do this a body of knowledge which includes a theory of deviance is applied to individuals. They therefore receive the appropriate therapy, counselling or re-education so that they see the error of their ways.

3.7 **ROLE OF THEORIES**

Within the model of the sociology of knowledge lies the enormous potential for the role of 'theorising' and its dialectical capacity on society. Within whatever passes for knowledge or reality, are embedded theories pertaining to just about every aspect of life. These theories have the potential to create reality or change it, to legitimate and maintain it, or to set the parameters for the application of nihilation or therapy as appropriate to the situation. The propensity for individuals to theorise about computers in society and education has been well documented within the review of the literature.

This study will concentrate particularly on the theorising being undertaken by various sectors of society regarding technology and education. As Berger and Luckmann point out, when theories are widely held about situations which appear to be problematic,

... the reality of every day life seeks to integrate the problematic sector into what is already unproblematic (Berger and Luckmann, 1966 : 38).

During this process changes may take place. Figure 2 sets out to illustrate this process in a diagrammatic form.

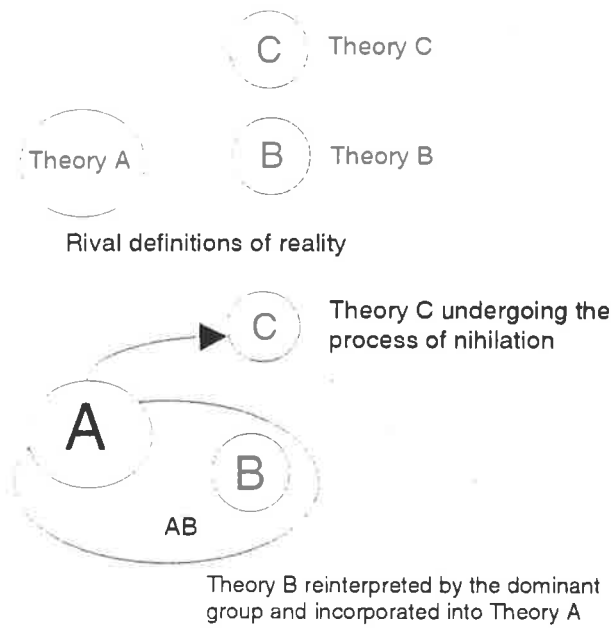


FIGURE 2: THE INTEGRATION OR NIHILATION OF THEORIES

Theory construction attempts to make complex matters coherent, that is, to integrate aspects of life such that they can be explained and legitimated.

A coherent theory may be represented as in Figure 3. If complex enough the theory may contain all levels of theorising from incipient through to symbolic which locates a particular aspect of life within all other meaningful aspects of life.

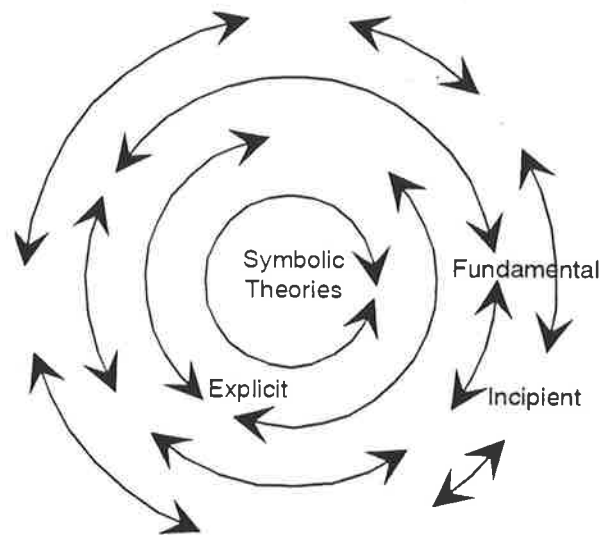


FIGURE 3: A CONHERENT THEORY STRUCTURE

However, during times of great change or when social institutions are under threat the process of theory building may become fragmented as society and specific social groups seek to make relevant some theory which can meaningfully integrate the discrepant aspect into every day life.

This process is represented by Figure 4 which shows considerable incipient knowledge which would come about as a result of pragmatic decisions about where, when and how computers may be used, for instance, in schools.

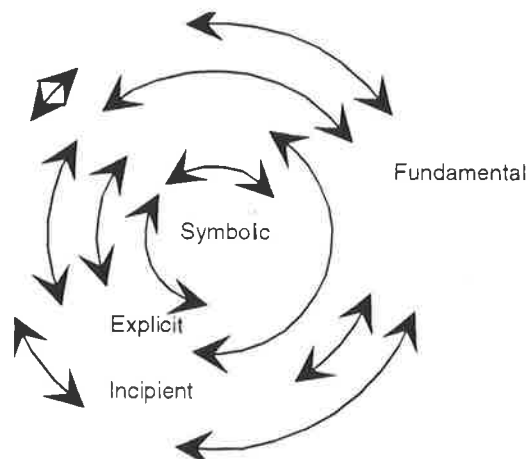


FIGURE 4: MODEL OF A PARTIALLY CONSTRUCTED THEORY

This process would culminate in the development of coherent theories explaining all aspects of computers in schools rationalising educational theory, development theory, economic theory and so on.

The provinces of meaning that would otherwise remain unintelligible enclaves within the reality of every day life are thus ordered in terms of a hierarchy of realities, ipso facto becoming intelligible and less terrifying (Berger and Luckmann, 1966 : 115).

Berger and Luckmann identify a number of consequences for the development of theories.

The first is the establishment of universal experts who create pure theory. These theories may be of little pragmatic consequence but nevertheless, the experts claim ultimate knowledge of the definitions of reality as such.

Second, theories are said to strengthen the traditionalism within institutionalised actions or as Berger and Luckmann say, if there are sound reasons for continuing to take existing actions then they are unlikely to change.

Third, the development of full-time experts has the potential for conflict between the experts and the practitioners.

When both theoretical and practical competition arise between rival experts, the process of theory development becomes reversed. That is, the theory is demonstrated to be pragmatically superior by its applicability to the interests of a particular group.

Most importantly, in regard to this point, there is always a social base to rival definitions of reality and the final resolution will be achieved by the development of this base.

Thus, in summary, theories are created to legitimate social institutions and are maintained by the processes of conceptual machineries. However, the theories also have the potential for redefining social institutions in order to make them 'more legitimate', hence, producing the dialectic between 'theory' and 'social institution'.

Figure 5 represents a model of theorising at an institutional level with conceptual machineries to maintain institutional order and meaning.

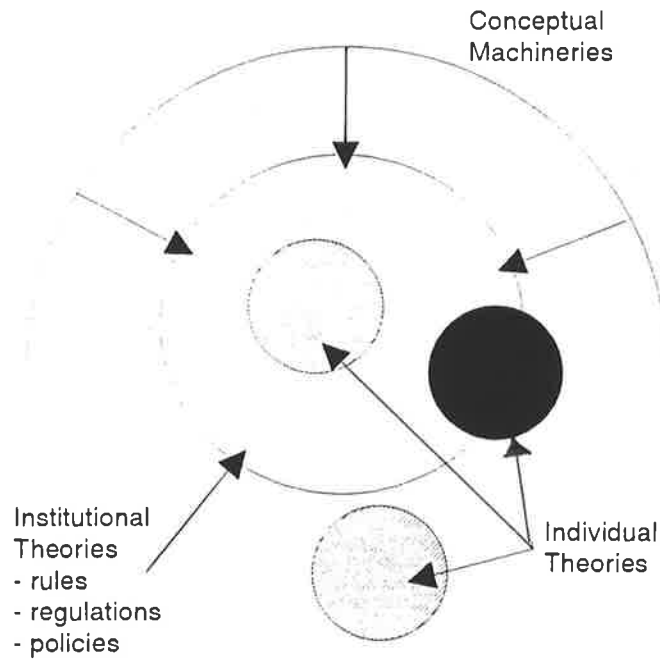


FIGURE 5: MODEL OF INSTITUTIONAL THEORISING

A dialectic exists in all perspectives of the taken-for-granted social reality, between objective reality, subjective reality and all the sub-sets of the processes devised to create and maintain them. To fully understand a social situation all aspects of the dialectic must be appreciated.

When theories are created or being created from different perspectives and out of different social orders based upon different 'knowledge' then there exists the potential for conflict within the various conceptual machineries created to legitimate the perspective of particular groups.

Figure 6 suggests that the purpose for teaching technology in schools may be in conflict with the perspective of other institutional theories. For example, conflict may arise between the institution of work and the institution of education bringing into play the conceptual machineries of each institution to maintain and justify their own positions.

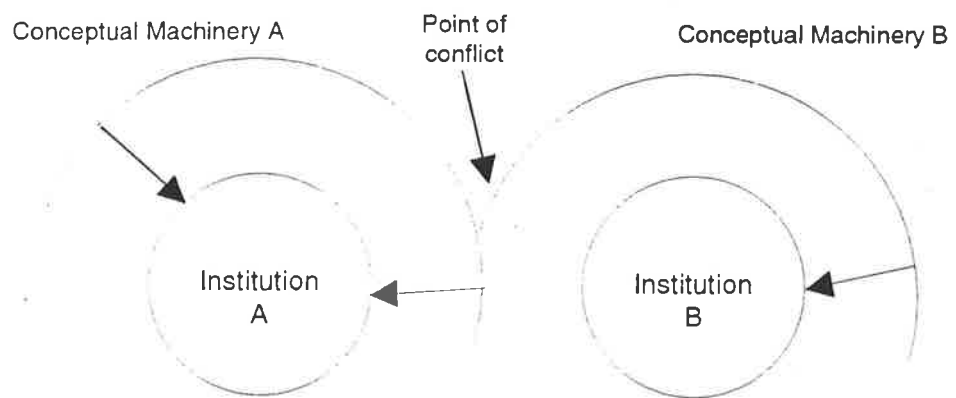


FIGURE 6: CONFLICT OF CONCEPTUAL THEORISING

However, a further possibility exists due to the pluralisation of modern society. An exploration of pluralism will now be undertaken.

3.8 PLURALISM

Of particular relevance to contemporary society is the subject of social change. First, society as we know it today is complex and a considerable degree of pluralism exists. This creates a problem of integration as individuals accommodate the discrepant 'worlds of meaning'.

Modern life is typically segmented to a high degree, and it is important to understand that this segmentation (or, as we prefer to call it, pluralisation) is not only manifest on the level of observable social conduct but also has important manifestations on the level of consciousness (Berger, Berger & Kellner, 1973 : 63).

The level of pluralisation has been assisted by the education process and mass media.

In this sense the school teacher has been a carrier of 'urbanity' for at least a couple of centuries. This process has been vastly accelerated, however, by technological communications media. Through mass publication, motion pictures, radio and television the cognitive and normative definitions of reality invented in the city are rapidly diffused throughout the entire society (Berger, Berger & Kellner, 1973 : 65).

Figure 7 illustrates the nature of pluralism.

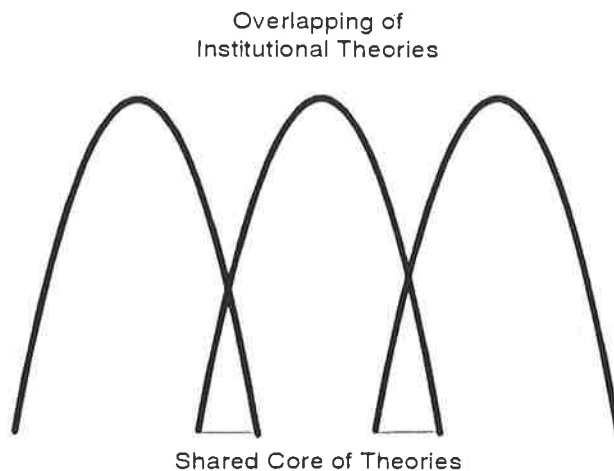


FIGURE 7: THEORETICAL PLURALISM

Institutionally this has been characterised by a shared core universe and "different partial universes co-existing in a state of mutual accommodation" (Berger and Luckmann, 1966 : 142). Conflict has largely been replaced by tolerance or in some cases co-operation.

Figure 8 describes the hierarchy of theories from incipient to symbolic with the over arching conceptual machineries to maintain the order and importance of institutional knowledge. Theoretical pluralism comes into being when various theories overlap.

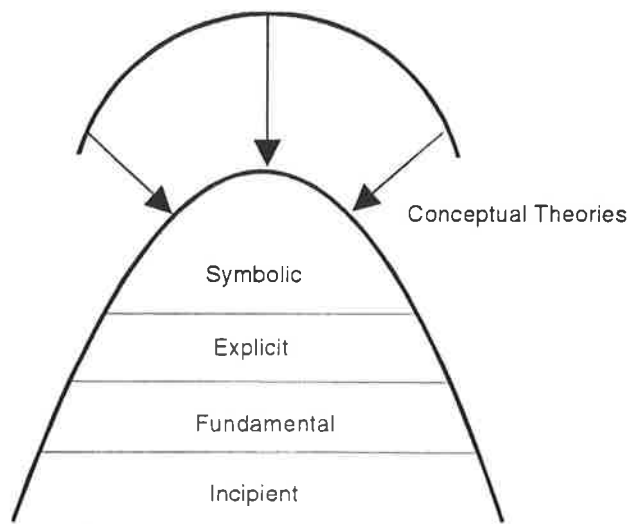


FIGURE 8: HIERARCHY OF THEORIES

Figure 9 indicates such a situation and again using the example of work and education it is possible to demonstrate that theories of education and theories of work can co-exist and be mutually supportive of one another. That is, education is theoretically necessary to work and work is one of the legitimating reasons for education.

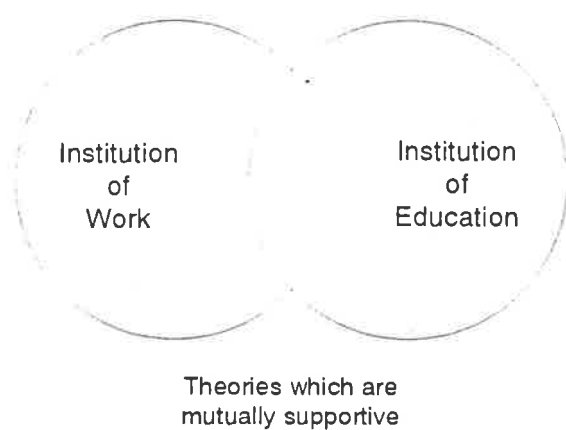


FIGURE 9: THEORETICAL CO-EXISTENCE

Technology is clearly one of the driving forces in social change. Rapid change forces upon institutions the necessity to realign their theoretical apparatus such that they become inherently meaningful.

There is, however, an alternative scenario using the previous example, as technology changes the meaning of work and at the same time puts pressure on the methods of educating then, the levels of pluralism which have existed in mutual co-operation for so long come under strain as their theories no longer adequately explain the present realities of day-to-day life.

Figure 10 suggests diagrammatically the type of tension which may exist between different institutions.

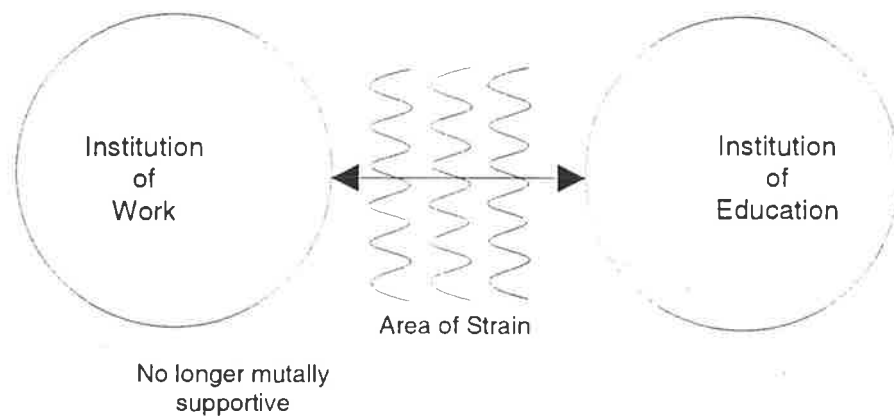


FIGURE 10: THEORETICAL TENSION BETWEEN INSTITUTIONS

This situation raises special problems for the 'experts'. As Berger and Luckmann summarise it:-

... whatever the experts do, the pluralistic situation changes not only the social position of the traditional definitions of reality, but also the way in which these are held in the consciousness of individuals (Berger & Luckmann, 1966 : 143).

The pluralism evident in modern technological society co-exists with rapid social change. The authors believe that this factor accelerates the change process by undermining the 'change resistant efficiency of the traditional definitions of reality' (Berger and Luckmann, 1966 : 143).

Under such circumstances the standing of teachers in society and their expertise may well be questioned in terms related to the curriculum, the process and medium of education.

A further matter of interest is the problem posited for bureaucracies by the pluralism of modern society. If pluralism leads to greater tolerance and further social change then bureaucracies must continuously make adjustments to maintain and legitimate their position in society. Such actions are destabilising for bureaucracies and teachers alike.

Reality is socially defined. But the definitions are always embodied, that is, concrete individuals and groups of individuals serve as definers of reality (Berger and Luckmann, 1966 : 134).

Hence, to understand the full implications of a particular institution, one must determine in whom the definitions are embodied.

Figure 11 illustrates the selection process in which the definers select the reality from the many alternatives.

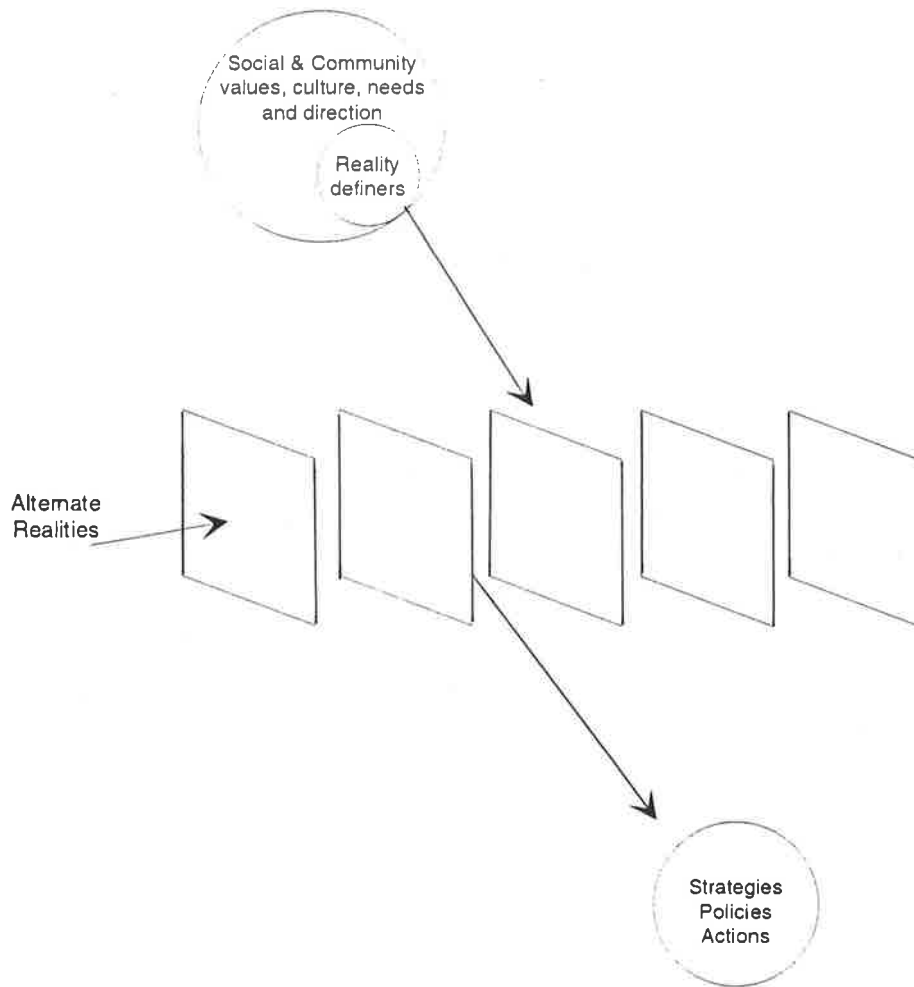


FIGURE 11: THE INFLUENCE OF REALITY DEFINERS IN DEFINING DIRECTIONS

This also implies that particular people within organisations have the power to be the definers of organisational reality.

3.9 THEORY IN CONTEXT

The acceptance of technology and the construction of knowledge about technology is a problem in the sociology of knowledge. The theory set out above will now be applied to the context of schooling from which further analysis will be made.

3.9.1 The Institution of Schooling

Schooling is apprehended by the participants (that is teachers, parents and children) as an objective reality. It has a history and a body of knowledge, it has an apparatus to maintain its function and it has a range of roles and rules to operate within. This is substantiated by the almost universal participation of society in the process.

Institutions are said to be persistent and generally resist attempts to change them.

Considerable theorising is being undertaken with respect to computers and computers in education. Hence, the potential exists for redefining the institution of schooling to incorporate such theories or evoke conceptual machineries to reject such theories.

The introduction of computers will place pressure upon the institution. However, institutions have mechanisms to evade or resist such pressure by dealing with the knowledge about external forces through the control they have over those filling institutional roles (see page 45). If such changes are to take effect it will be necessary to examine the institutional framework within which a new reality of education will be constructed.

3.9.2 **Roles**

Pre-eminently the main roles representing the institution of schooling are held by teachers and students. From the perspective of this study the role of teacher embodies the institutional knowledge about the importance of such matters as technology to education.

Likewise within the role of student and educators will be found the institutional values about education and technology imparted by the educational processes.

Any likely changes to the institution according to Berger and Luckmann, will be found within the knowledge of these role holders and their typifications about schooling.

3.9.3 **Typifications**

By examining the typifications about education and computers held by the different actors in the institution, it is anticipated that the knowledge presently held about computer technology will indicate how meanings are being changed. Meanings held about classes, teachers, students, curriculum, learning and school life in general are shared through a continuum of typifications which are the reality of schooling.

For most people these typifications do not include aspects of a technology used for teaching and certainly not computing technology. Any changes to the institution must first be found within these typifications.

3.9.4 **Conceptual Machineries**

As pointed out by Berger and Luckmann conceptual machineries (see page 52) are invoked to maintain and protect existing institutions. Schooling is a complex institution in a pluralistic society. Therefore quite sophisticated mechanisms may have been developed to maintain them.

One such aspect of maintenance is legitimation (page 46). Through legitimation and legitimization processes one would expect to determine the ways in which the conceptual machineries are being utilised to protect the institution or to incorporate changes brought to bear on it through computer technology. These would be found by examining the rules, policies and often formal structures of the institution.

In particular these mechanisms, if enforced, would be found within the bureaucratic information about how such changes would be tolerated.

This study therefore, must consider the information relating to computing issued by the educational and other bureaucracies engaged in providing information related to the use of technology in education.

3.9.5 **Theorising**

Theorising (page 60) is fundamental to all the previous factors. The development of theories is dialectic, that is, the theories can be used to legitimate existing institutions or the theorising can be the source of change. This depends by and large on who is promoting the theories.

The question to be asked in the present project is:-

Which group of individuals are engaged in constructing the reality for the use of computers in schools? Is the construction taking place within the schools or are the constructs those imposed from outside the institutions? For example, the definitions of 'education' must be found in schools and to develop a thorough understanding of the situation 'one must understand the social organisation that permits the definers to do their defining' (Berger and Luckmann, 1966 : 134).

The role of theories with regard to the institutional direction of computing can be represented as follows:

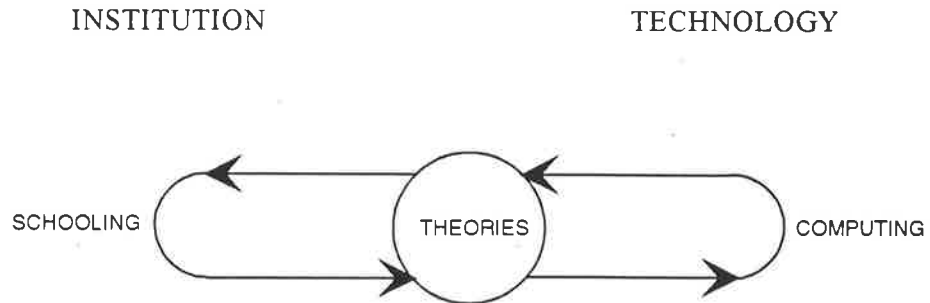


FIGURE 12: ROLE OF THEORIES ABOUT SCHOOLING & COMPUTING

3.9.6 Theorisers

For the purpose of this study a distinction has been drawn between those directly involved in the provision of education at a school level and all other bodies which may have a legitimate role in its provision but are not actively involved in its day to day operation. Such a division separates bodies, including the education department, as belonging to the general grouping outside of school.

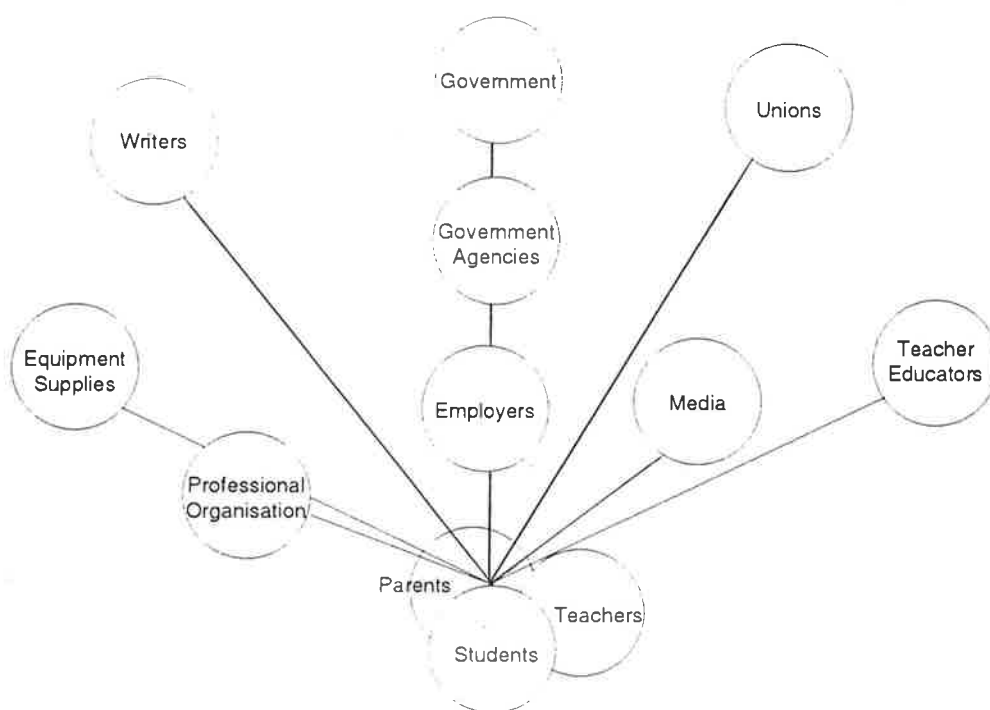


FIGURE 13: THEORISERS FROM SOCIAL GROUPS

Hence the above figure (Figure 13) reflects firstly this broad distinction and then the sub-division of that category into identifiable groups such as the media, unions, government agencies and suppliers of technology.

Berger and Luckmann tell us that each institution, and indeed, each social grouping, incorporates a body of knowledge specific to its role and function.

I encounter knowledge in every day life as socially distributed, that is, as possessed differently by different individuals and types of individuals (Berger & Luckmann, 1966 : 60).

The theorising of each group would reflect the institutionalised knowledge constructed within each group and would also reflect its function.

This is important with respect to computers, for part of the knowledge which is socially available derives from industrial and commercial uses of computers. For example, computers are used in banks and hospitals. The subjective intentions could be that patients can be better served by keeping their records on computers or the production process is better done by machine than humans. Perhaps some of the subjective knowledge is being reinterpreted by groups associated with industrial and commercial uses of computers into education. (See page 68 Reality Definers)

At the same time it must be stated that among parents are found representatives of the diverse groupings of all the other social groups. However, their perspective on schooling may be somewhat different than that taken when observing schools from their perspective as a member of a social group such as a union organiser or a writer.

3.9.7 **Technology As A Problem for the Sociology of Knowledge**

Using this theoretical framework we turn now to the specific problem of how knowledge is being constructed about technology and look to what knowledge is being objectivated, how individuals are interacting with this knowledge, and whose knowledge is being legitimated?

First, what knowledge about computing is being objectivated and by whom? This question is important because objects are both human products and objectivations of human subjectivity.

'Knowledge' about computers, like knowledge about all technologies, lies within a broad spectrum of beliefs, as demonstrated in the literature review.

In other words, technologies are developed for some specific purpose, for example, to produce power, to hold things together or to protect humans from the elements. However, beyond these pragmatic purposes, supporters of technologies develop values pertaining to social meanings such as the status of individuals, or indicators of the group to whom they belong. Likewise, knowledge about computers may have been developed and became far more pervasive than knowledge about their technical function.

Berger and Luckmann discuss the ability of objects to carry forward subjective intentions.

I am constantly surrounded by objects that 'proclaim' the subjective intentions of my fellow men (Berger & Luckmann, 1966 : 50).

The importance of the motor vehicle highlights this point. Motor vehicles not only transport people from place to place but they have value as status symbols which point to the commonly shared subjective knowledge held about technology.

For example, the subjective knowledge held about computers may suggest that all people who use computers must be important.

Notions of objectivation about items of technology are as much a part of our taken-for-granted life as are social customs. They form regular patterns of events in our lives which are widely shared with others. Consequently, those areas in which technology is widely applied develop a degree of familiarity which is shared by other users. Hence, comments such as 'you need to be reprogrammed' and 'you are suffering from overload' are widely understood. Likewise the complex nature of interaction is reduced by sayings which reflect the view that it is not difficult because it is done on computer.

We are reminded that reality construction is a dialectical process, hence, the knowledge one has about technology will act back on the subjective meanings of an individual. These meanings may have considerable consequences for action:-

...a problem-solving and deeply technological attitude may also carry over into the manner in which the individual looks at politics, the education of his children or the management of whatever psychological difficulties he may be afflicted with (Berger, Berger and Kellner, 1973 : 35).

In the course of this study it will be necessary to look at the objectivation of computers in education. What people say and write about this topic will provide the substance of their objectivations.

The second question considers how people are interacting with the technology of computing. As Berger and Luckmann point out, various groups may interact with this knowledge in different ways.

In advanced industrial societies, ... pluralistic competition between sub-universes of meaning of every conceivable sort becomes the normal state of affairs (Berger and Luckmann, 1966 : 103).

Since the meanings held by different groups may vary, their interaction would be expected to reflect this difference. Likewise if there are differences of meaning then they must be carried by the group which develops the meaning.

As Berger and Luckmann put it:-

Like all social edifices of meaning, the sub-universes must be carried by a particular collectivity, that is, by the group that ongoingly produces the meanings in question and within which these meanings have objective reality. Conflict or competition may exist between such groups (Berger & Luckmann, 1966 : 103).

This study will need to look particularly at the meanings held and translated by the separate groups and how they are interacting in the social arena with these meanings. For example, it must be established which groups are active at a political level and which are interested in establishing their meanings in competition with others.

A further point of interest made clear by Berger and Luckmann is that objects in the form of technology carry with them the subjective manifestations of their producers.

Such objectifications serve as more or less enduring indices of the subjective processes of their producers, allowing their availability to extend beyond the face-to-face situation in which they can be directly apprehended (Berger & Luckmann, 1966 : 49).

Hence, computer technology may carry with it the meanings of the designers, manufacturers and distributors.

In other words, this study will need to look at the meanings of this particular group and determine how other groups are interacting with their meanings.

The final point of concern relates to whose knowledge is being legitimated? As previously discussed legitimation refers to the process of 'explaining' and 'justifying' a particular version of reality. Berger and Luckmann (1966 : 103) argue that in pluralistic societies we can expect groups to attempt to legitimate their meanings.

Furthermore, they say:-

The limits of such ultimate legitimation are in principle, co-extensive with the limits of theoretical ambition and ingenuity on the part of the legitimators (Berger and Luckmann, 1966 : 115).

Hence, considerable competition may arise between legitimators.

Berger and Luckmann point out that ultimately,

... the success of particular conceptual machineries is related to the power possessed by those who operate them (Berger & Luckmann, 1966 : 126).

If this situation prevails in a modern society then extensive arguments might be advanced to support a particular position or power mechanisms may be employed to enhance a particular legitimation of reality. For this study the implication is that close examination will need to be made of the forms of legitimation used to substantiate a particular position and an analysis of the prevailing legitimations accepted by the population will need to be made to determine whose knowledge is being legitimated within this population.

3.9.8 **Reification**

Although computing has no extended history, nevertheless it is anticipated that some reification could be taking place due to the speed of introduction and the technical nature of much of the knowledge.

This study will examine the knowledge being created to determine if reification is occurring and to assess how this is effecting the theorising involved.

Throughout the rest of this text, the term reification is used to denote ways in which people reflect upon knowledge about computers which does not recognise such knowledge as a human product.

*Aims and Methodology of
Research Investigation*

4. AIMS & METHODOLOGY OF RESEARCH INVESTIGATION

4.1 AIM OF STUDY

This study aims to examine one particular aspect of the construction of knowledge about technology, namely, the role of contemporary social theorising about technology with respect to the ways in which such theorising locates technology in education.

This study proceeded from a number of research questions. It does not seek to test any specific hypotheses but rather following Berger and Luckman to establish the interpretation placed on computers and education in the 'world of schooling' by members of society. This position recognised that although

.... people may act within the framework of an organisation, it is the interpretation and not the organisation which determines action.
(Bogdan and Taylor, 1975 : 15)

The purpose of the study then was to interpret the 'meaning' held by the individuals involved in schooling and how this meaning was defining and constructing the 'world of schooling' with respect to computer technology.

4.2 RESEARCH OBJECTIVE 1

To examine the theorising being developed by social groups regarding the use of technology in education, namely:

4.2.1 Conceptualisation of the Role of Technology in Education by Different Social Groups

- (1) What theories are being constructed about the use of computer technology in education by different social groups.
 - (a) What theories are being constructed by government agencies?
 - (b) What theories are being constructed by technology providers?
 - (c) What theories are being constructed by political parties?
 - (d) What theories are being constructed by unions?
 - (e) What theories are being constructed by employer agencies?
 - (f) What theories are being presented by the newspaper media?
- (2) What is the connection between technology and computers as perceived by the different social groups?
- (3) Into which of Berger and Luckmann's levels of theorising are each of the theories located?

4.2.2 Conceptualisation of the Role of Computer Technology by the Participants in Education

- (1) What 'theories' are being constructed about the role of computer technology in education by teachers, students and parents? How is this theorising addressing the issues of:
 - (a) The effect of computers on the social interaction between student and student and teacher and student.
 - (b) The effect of computers on student learning ability.
 - (c) The motivational effects of computers.
 - (d) The effects on gender of using computers.
 - (e) The need to study the social effects of computers in society.
 - (f) The vocational needs for computing skills.
 - (g) The effect of computing on student creativity.
 - (h) The relevance of computers to different subjects.
 - (i) The relevance of computers to students future needs.
 - (j) The efficiency of using computers to simplify teaching.
- (2) Into which of Berger and Luckmann's categories and theorising do the theories belong?

4.2.3 Conceptualisation of a Technological Future by Teachers, Students and Parents

- (1) In what ways does the theorising of Teachers, Students and Parents address the future of schooling using computer technology?
- (2) What theories are held about computers and their effect on society in the future?

4.2.4 Subjective Reality of Teachers, Students and Parents, Towards Computers Used for Schooling

- (1) What role do teachers see for themselves within a future school in which computers may be widely used?
- (2) How do parents view schooling which is widely organised around computers?
- (3) What views do children have of schooling in which teaching is delivered by computers?

4.3 RESEARCH OBJECTIVE 2

To identify the processes and structures which are used to legitimate the use and inclusion of technology in education and to identify whose theories are being legitimated.

4.3.1 Typifications About Schools

- (1) What priority do parents and teachers give to computers and technology in the purposes of schools with regard to:
 - (a) the development of the individual's abilities including the use of computers
 - (b) intellectual development
 - (c) social development in a society which uses computers
 - (d) vocational preparation where the main emphasis is on skills for employment
 - (e) ability to fit into a society where most services are controlled by computers
 - (f) ability to be socially adaptive and able to cope with change such as those involving increasing use of computers.

4.3.2 Legitimation of Computer Technology in Education

- (1) If computer technology is to be widely used in education who are the principal legitimators?
- (2) Do educationalists support the view that technology will improve education and increase efficiency?
- (3) If educationalists are not the principal legitimators, who are?

Are they:-

- (a) Agents of government who believe that technology is necessary for national and economic survival or because it will improve education outcomes or reduce expenditure?
 - (b) Representatives of big business who believe that technology is required in education to support continuous expansion and profit margins?
 - (c) Technology suppliers who see education as a major market which has not yet been exploited?
 - (d) The media who believe they have a role in defining the type of education which is most desirable for the future?
 - (e) The unions who see jobs and incomes at stake if technology is not taken seriously by education?
- (4) A variety of knowledge may be employed to legitimate an innovation.
- (a) What knowledge has been used in this instance?
 - (b) How is the institution accepting and supporting the innovation?
- (5) Alternatively, steps may be taken to resist the changes - in this case:-
- (a) Is the institution ignoring the innovation which is not considered a threat to its institutional values,

- (b) actively promoting its own values in opposition to the innovation, or
- (c) accepting a multitude of ideas in a state of institutional pluralism?

4.4 **RESEARCH OBJECTIVE 3**

To explore the extent of reification within the knowledge and theorising of technology and examine reified aspects of educational theorising about technology.

4.4.1 **Reification of Technology**

- (1) Does evidence exist within the theorising about computer technology that reification has occurred?
- (2) If so, does the response by educationalists indicate a perception of lack of control by them over the introduction of computer use in schools?
- (3) Are teachers concerned about the non-human effects of computers?
- (4) Alternatively, are computers viewed as the ultimate level of human development in which education must be involved?

- (5) Do parents indicate an unquestioning acceptance for the need for computer education for their children?
- (6) Is there evidence that children believe computers are 'clever' beings with which they must work, i.e. that they are supra-beings or products of non- human activity?

4.5 THEORETICAL PERSPECTIVES OF RESEARCH METHODOLOGY

The research methodology used for this study draws upon the techniques and theoretical perspectives of phenomenology as articulated by Luckman (1978) and Bogdan and Taylor (1975).

This perspective,

... is concerned with understanding human behaviour from the actors own frame of reference. (Bogdan and Taylor, 1975 : 2)

For the researcher the

... important reality is what people imagine it to be. (Bogdan and Taylor, 1975: 2)

The methodology of the phenomenologist attempts to come to understanding

... through such qualitative methods as participant observation, open-ended interviewing, and personal documents. These methods yield descriptive data which enable the phenomenologist to see the world as the subjects see it. (Bogdan and Taylor, 1975 : 3)

Such methods as described above are said to be,

... able to explain the meaning of this life-world in a rigorously scientific manner. (Schultz, 1962 : 119)

Hersert is credited with the development of phenomenology as a theoretical perspective. Phenomenology is described as a methodology which provides a means of explaining human action and experience but the goal of phenomenology

... is to describe the universal structures of subjective orientation in the world, not to explain the general features of the objectivated world. (Luckman, 1978 : 9)

Luckman explains the significance of the orientation in the following way:

Phenomenology is not a science in the common understanding of the word. Its perspective is 'egological' (ie taking the individual human being as the centre of the system of co-ordinates on which the experience of the world is mapped) and 'reflexive' it reinstates human experience in its place as the primary datum about the world and it describes this experience by turning and returning to the intentional features of experience. (Luckman, 1978 : 8)

To remain faithful to the methods which seek understanding from the subjective orientation of the individual, the following research design was selected as the most appropriate approach for this study.

4.6 RESEARCH DESIGN

4.6.1 The Research Study

The selected research study consisted of the following elements:

- A sub-system of society focussing on schools, ie the students, teachers and school administrators in the private and public school system.
- Sub-groups of society including:
 - Politicians from major political parties
 - Government agencies
 - Employers
 - Unions
 - Educational Administrators
 - Equipment Suppliers

Each sub-group was assumed to hold a specific role in society and that role was defined by a body of knowledge dealing with the relationship between that body and all other associated groups in society.

4.6.2 Number of Cases

For the purposes of this research a school was defined as a single case and considered as a sub-system of society.

Therefore, this research was based upon a selection of cases representing the private and public schooling systems. Three schools were initially selected but only two were completed due to intervening industrial action.

Each of the sub-groups as defined in 4.6.1 above were represented by individuals holding the specific roles in the sub group. Original data was selected from each of the sub groups. For example, interviews were held with three educational administrators, three employers and three equipment suppliers.

4.6.3 **Socio-temporal Context**

The cases selected for research were typical secondary schools from Australian Society. Each case represented a particular facet of schooling. For example, a private single sex school in one case and a public co-educational school in the other.

Both cases represented the broad mix of nationalities found in Australian society as well as a small number of students studying in Australia from Asia.

The studies undertaken provided case data during the same time period. This approach was adopted to enable comparisons to be made between each of the cases as well as being able to analyse each case in its own right.

4.6.4 Timeframe

From the cases studied descriptions of the theories held by the individuals within the schools were prepared. The theories described represented a static description of the subjects' beliefs at the time of investigation.

The case studies were surveyed in May of 1990. Research undertaken prior to the field studies endeavoured to trace knowledge which was being constructed about the appropriateness and potential benefits of using computers for educational purposes.

The focus of the research was on the period beginning in the mid 1970s through to the early 1990s.

Further studies were undertaken regarding the theories held by particular groups who held specifically defined roles within the society. This was completed following the studies made within schools.

This field work was carried out during 1992 and explored in detail the perceptions held by the defined social groups about the relationship between computers and education and the role they considered appropriate for the technology in schooling.

The research particularly sought to establish more critically the views of the specific groups who were identified as having a considerable influence upon those in the school systems.

4.6.5 **Research Control**

In this study the approach taken was to determine the knowledge held by the participants in the school system without unduly influencing the participants.

To minimise any such adverse effects a survey questionnaire was designed which enabled the participants to be given a choice about taking part in the survey.

The questionnaire provided scope for personal views to be included beyond those framed in the questions.

All the interview questions were designed to be open ended and the participants' views explored as they evolved.

No attempt was made to control the systems under study in order to test specific hypotheses.

4.6.6 Sources of Data

The sources of information for analysis were:-

- Documents

policy papers, departmental position papers, administrative instructions, media releases and media articles, books and research papers.

(Refer to Application of Methodology, Document Study page 103 for details of research analysis.)

- School surveys

The types of schools chosen for investigation included a private girls school and two public co-education schools in the metropolitan area Adelaide. These schools were chosen to represent different types of schooling (private and public) and to determine whether locations representing different socio-economic levels presented different theorising. Students, teachers and parents were the subject of the surveys.

(Refer to Application of Methodology, page 104 for a detailed account of school surveys.)

- Interviews with influential role holders

Interviews were held with:-

- Head of SA Computing Centre (see Appendix 1)
- School Principals (Appendix 2)

- Employer representatives (Appendix 10)
- Educational Administrators (Appendix 11)
- Computer Consultants (Appendix 12)

4.6.7 **Properties Used in the Research**

Four key properties were selected as the subject of investigation in this study. They are as follows:-

- Theories about computers in education.
- Legitimation statements supporting or rejecting the theories.
- Reification of the knowledge about computers in education.
- The groups who held the various theories.

Theories held about computers, their place and effects on education, define the knowledge upon which people construct their reality of schooling. A profile of the 'theories' was developed using a range of questions which elicited people's beliefs at a number of levels and provided a map of their beliefs.

Legitimizing statements were examined to establish the acceptance or rejection of the technology in education. For the purpose of this study, reality definers were described as those people who due to their role and organisational positions have the power to impose their view on others.

Reification of knowledge about computers was sought from statements made by individuals during interviews, from documentation and from the surveys in schools.

Individuals and groups who held similar theories which could be attributed to specific roles in society were identified and compared. The social development of knowledge would suggest that specific roles and group interests would be identifiable within their version of reality and the theories they held which demonstrated that reality.

4.6.8 **Method of Handling Individual Properties**

Qualitative descriptions were chosen as the most suitable means to illustrate the particular dimensions of the property 'knowledge'.

Surveys, previously described, were designed to gauge the level of agreement or disagreement with opinions held about computers and education, from literature sources.

These opinions were aggregated under particular fields (ie Computers in Education, Future of Schooling) to define the map of 'knowledge' held by each individual.

A simple frequency analysis was used to examine the results for each question.

Interviews were tape recorded and the responses to a range of questions were examined to determine the typography of 'knowledge' held by the respondents in each case.

4.6.9 Method of Handling Relationships Between Properties

Relationships between the properties were established by tabular comparison and discursive analysis of the variations in the views expressed by specific individuals or sub groups. For example, variations in the 'knowledge' held by each respondent, as defined by a series of particular questions were compared across various roles and sub-groups.

4.6.10 Treatment of System Properties

'System properties' refers to the relationship between the role holders in the structure of the education system and society. In particular, the study compared the knowledge defined by the reality definers identified within their sub systems or social roles, with that held by the sub-system schools, eg politicians, educational administrators, employers, etc.



The system analysis sought to explain how the knowledge constructed by the various sub groups influenced the knowledge held within the school sub system, eg students, teachers and parents, and how this knowledge once created acted back upon the roles and knowledge of the reality definers.

The system properties were those found in documents, such as policies and instructional data, to teachers whom represented the educational system to the community.

The essential system properties are:-

- instructional roles
- knowledge held by these roles
- definers of reality

4.7 QUESTIONNAIRE DESIGN

The purpose of the questionnaire was to elicit responses to a range of questions which would enable a typography to be created which represented the theories and knowledge subjectively held by the respondents. By creating many such typographies it became possible to identify those parts of the map which were commonly held. This represented the knowledge about computers and education.

The questionnaire (Appendix 2) was divided into five (5) categories.

- Technological Future
- Computers and Education
- The Future of Schooling and Computers
- Control of Computer Technology in Education
- Evaluation of Schooling

Each of the categories above were designed to establish, in broad terms, the beliefs held by the respondents in each of the specific fields identified. For example:-

- Questions about the technological future were intended to determine the type of future in which computers would be used and the impact this would have on students.
- Questions about computers and education were intended to establish what people believed about the effects of using computers in education.
- Questions about the future of schooling and computers were intended to determine what people believed would happen to schooling as computers became widely used and the changes they thought they would make to schools.
- Control of computer technology in education was posed to establish if people felt any sense of control over the use of computers in schooling and whether this was viewed in a negative or positive sense.

- The evaluation of schooling was intended to establish if people had a positive or negative attitude to schooling at the present time and whether this might bias their present views.

After considering a number of questionnaire designs the Likert scale was chosen as the most suitable for the purpose of gauging respondents views. The Likert Scale is widely used in questionnaires due to its simplicity of presentation and relative ease of use. Furthermore the Likert Scale is considered to be highly reliable for defining the view held by people across a gradient of views (Moser and Kalton, 1958:357). The strength of the Likert Scale is the ability of the respondent to choose between several clearly defined categories which indicate the strength of agreement or disagreement with each statement.

Each question provides five categories of response; strongly disagree, disagree, uncertain, agree, strongly agree.

The choice of a rating scale rather than the simple yes/no answer format was based on the assumption that a measure of the opinion held by the respondent was both more useful in terms of the level of confidence in the answers and that it was more likely to elicit a valid and unbiased response from the respondent.

4.8 INTERVIEW DESIGN

The interview design was based on the structure and context of the questionnaire, however, the interviews were designed to be open ended and to explore the subjects' subjective interpretation of the research topic and to allow them the freedom to describe their beliefs and 'theories' from their own perspectives. Therefore, the interview instrument provided guidelines only (see Appendix 5), but followed the directions posed by the five key questions used for the questionnaire design.

Each interview spanned a timeframe governed by the participants themselves and lasted approximately 1-2 hours.

All interviews were tape recorded to enable a detailed and critical analysis to be made.

4.9 APPLICATION OF METHODOLOGY

4.9.1 Document Study

Documents from political parties, government members, government departments and commissions, employer agencies, unions and media articles were reviewed for evidence of theorising about education and computer technology with respect to the importance of education for technological development and the role computing may play in the advancement of education.

This data provided the source for the 'knowledge' about computers which was circulated before computers became widely available in schools. Newspapers provided evidence of 'knowledge' presented by the media about the use of computers in schools. The views of political parties were obtained from Policy Statements and media releases.

Government documents provided data about education policy and direction. Union and employer data was also sought from policy papers and publications.

Data from these sources and the literature review provided the basis for the construction of questions for teachers and parents.

Evidence was also sought for legitimating structures for the directions of educational development.

Information from this material was used when formulating questions for departmental officers and principals.

4.9.2 **Surveys**

The questionnaire prepared to conduct the surveys differed between the three subject groups under investigation only in the background material.

The three schools selected for survey were identified as School X (a private girls school), School Y and School Z both public co-education schools. The survey of School Z was never completed however, an interview was held with the Principal and is included in this research (page 257) along with the data from a survey of Principals of Schools X and Y.

Primary data was collected from the survey of schools to determine the views held by parents, teachers and students. It was anticipated that each of the groups would take a different perspective to the questions but the theorising of each group would become apparent. In particular, common elements of the groups answers would identify the general level of theorising about the technology which defined the current reality held in schools.

(a) *Parent Survey*

Berger and Luckmann suggest that speculation about the future affects the theorising about the present. Therefore, it was anticipated that speculation by parents about their children's future and the world in which they would live might create the theories from which parents make decisions about their children's schooling.

At a time of greater democratisation of the schools where parents are having a greater say in the direction taken by schools, their theorising about the use of computers will have a greater impact than in the past. Therefore, parents were encouraged to develop their ideas of the future, the technological needs for their children and the ways in which they believed schools should develop.

Parents were also asked to give their views on a schooling system which delivered its education largely through computer systems as suggested by some of the educational authors when speculating about the future use of computer technology in schools.

Parents' views on computer technology in education were gained through a survey distributed to their children attending selected schools.

The survey attempted to identify differences in theorising on gender lines and experiential differences. Statements were also designed to test parental responses to alternative definitions of schooling such as home education via computers. This attempted to identify the use of conceptual machinery to maintain or strengthen existing structures for schooling.

Parents were also asked to respond to questions regarding whose decisions they believed were influencing the direction of schools with respect to computers. Furthermore, parents were asked whether they believed they had any influence on the decisions taken about the direction of schools with regard to computer technology.

The questions included in the survey for parents were designed from typifications and theorising found in government policy statements, the literature and media addressing education and technology.

(b) *Teacher Survey*

Teachers are key role models in schools and therefore their attitudes to technology and education were fundamental to this study. Teachers were surveyed to identify their theorising about computers and education and to ascertain in what ways they believed computers might be used for educational purposes. These questions were designed to determine whether their theorising about the use of computers was negative or positive (or both).

A range of questions were asked of teachers regarding their attitudes towards the possible expansion of computer use across all areas of the curriculum and how this might affect teaching and learning practices.

Questions were included designed to elicit teacher responses to departmental and government policies about computing in education by indicating their level of agreement or knowledge of these policies.

An attempt was made to determine those who teachers believed were the main influencing bodies determining the direction of schools in incorporating computing technology into educational programs. A number of questions sought to identify why specific groups should attempt to influence education and particularly why a specific technology such as computing received attention from interested groups in society.

Of particular relevance to this study was the question of who teachers believed would be the main beneficiaries of computer use for educational purposes.

Teachers were encouraged to speculate through a range of questions about their role in a schooling system that extensively used computer technology for all educational purposes including the delivery of learning material to students, as well as theorising about the ideas of educational writers who supported the rapid extension of computer use for education. These questions were designed to enable the examination of the use of conceptual machineries to maintain or defend present techniques.

Finally, questions were asked such that teachers might indicate the degree of influence they believed they had in determining the direction and pace schools should take with respect to the use of computers and what the relative educational merit might be for students.

(c) *Student Survey*

School students from different locations and different types of schools were surveyed. The survey included students from secondary schools in the Adelaide metropolitan area, from Year 10, 11 and 12. This process was chosen to ascertain whether theorising by students differed from that of reality definers according to location and a number of factors associated with different types of schooling.

Questions included in the survey were intended to draw out existing knowledge held by students about computer technology and its use.

A further series of questions solicited rudimentary theorising about the effects computing technology might have on their lives and future job prospects.

Theorising about the educational use of computers by students was addressed in the survey by seeking to explore the responses students made to a school in which extensive use was made of computers for learning and how their perceptions of such a school might vary. This approach attempted to determine how students responded to the theories of educational writers who argued that schooling would be more efficient and effective if delivered through computer systems.

To determine whether common views were held about the definers of knowledge and reality, students were also asked who they thought should be making the decisions about what knowledge and skills they should have about computers.

4.9.3 Interviews

Primary data was collected from each of the groups in the research description, ie the Computing Centre, Employers, Educational Administrators and Computer Suppliers. Interviews were held with members of these sub-groups to elicit the data for an analysis of their theories. Further data was obtained from interviews with the key educational administrators of the schools (see above).

(a) *Angle Park Computing Centre*

An interview was held with the Head of Angle Park Computing Centre as the Department of Education and the Minister of Education had clearly indicated that the role of the Centre was to implement the introduction of computers in schools. This interview was designed to encourage theorising about the role of computers in schools and establish reactions to Departmental policy and political party policy statements.

Questions were included focusing on speculative matters about the future of education and the way in which technologies such as computing are used both within education and by society in general.

(b) *School Principals*

Principals' views on the application of computers to curriculum and methodology were explored to stimulate theorising about the way in which computers could be used in their schools.

In particular, views were sought regarding the way in which teachers might be used in schools and how their role might change as computer technology becomes more sophisticated and more widely used in schools.

(c) *Educational Administrators*

Interviews were held with three (3) educational administrators from the South Australia Department of Education. They were selected because their positions were considered crucial to the use and implementation of courses involving computer technology in the Department. The positions of Director of Curriculum, Director of Information Technology and Technology Advisor were selected to explore the beliefs held by such pivotal roles. Their views on the future and the impact of computers on education were thought to be significant as they were able to both influence the development of computers in schooling, approve expenditure and establish and monitor policy.

The Director of Curriculum was also responsible for the content and structure of the curriculum ultimately presented in the schools.

(d) *Employers*

Employers were included in the research due to the importance placed on employment, particularly, during the latter stages of schooling, as the goals and aspirations of students becomes focussed on career needs. Employers are regarded as an important source of the skills and knowledge required by students to enable them to move successfully into the workplace.

The Employers were selected to provide a range of views from the diverse employment setting. Employers were selected from the manufacturing, retailing and service sector.

It was anticipated that their theorising would be influenced by the changing demands in employment.

(e) *Computer Suppliers*

To examine the theorising of the Computer Suppliers, three (3) were selected from the companies operating in Australia. Suppliers representing a large multi-national computer

company selling mainframe computers, a large international company selling personal computers and a local South Australian producer of software focussing on the needs of manufacturing and design, were chosen for interview.

In particular, it was anticipated that the consultants' views would reflect a range of options about the future developments of the technology and the impact this would have on society and education.

4.10 METHOD OF ANALYSIS

4.10.1 Questionnaire Analysis

The results of the survey were summed for each question according to the category of answer chosen (ie strongly agree to strong disagree). The summed results are shown in table form using the raw scores. The raw score was then converted to a percentage to determine the preference across the population. A simple addition of percentages was then used to determine the strength of the belief for or against the particular question.

Each of the respondent types was then studied (ie student, teacher, parent) to decide whether a shared belief existed within each sub-group or whether a commonly held belief could be established for the total population under study.

If each of the subgroups shared the same belief then it was determined that evidence for a commonly shared belief existed.

4.10.2 Interview Analysis

The content of each tape recorded interview was analysed for illustrations of the theories held by the respondents according to the following categories:

- theories about computers and education;
- statements of legitimation of specific theories; and
- statements which showed evidence of the reification of knowledge about computers.

The results of the content analysis of each of the respondents was then compared to establish the level of shared meanings and beliefs between the respondents. Where shared beliefs were identified they were treated as the commonly held knowledge base of the particular social sub-groups concerned.

This method of analysis was selected as the most appropriate given that shared knowledge is imprecise and most difficult to measure by any other means. By directly comparing the descriptive statements of each of the respondents the essential features of their beliefs can be seen and the reader also has access to the source data to make an independent judgement.

4.11 METHOD OF PRESENTATION

4.11.1 Questionnaire

Results of the questionnaire were presented in both raw score and percentage of total responses according to the strength of answer to each question in the same order as that used in the survey. These were then placed in a tabular form for each question in a sub-section. The tables show the levels of agreement or disagreement for each question, the number of responses to each category, the percentage of each category and the total number of responses made. Results of each question are presented for students, parents and teachers for ease of comparison.

A secondary set of tables provides a listing of those statements which are either commonly held beliefs by all groups (students, parents and teachers) or a shared belief by either parents, students or teachers.

4.11.2 Interviews

The content of the interviews were examined and the results presented in two forms.

First, the knowledge of each of the respondents was discussed and essential elements presented in the discussion.

Second, the content of interviews was compared and listed in a table showing where significant correlation existed between all respondents. Significant deviations between the groups interviewed were also identified.

***Reality Definers in Society Generally :
Theorising in Documents***

During the 1987 federal election an article in *The Australian* expressed the view that "parties fail to focus on fresh policy proposals", the article went on to say that,

the science and technology sectors are still awaiting the announcement by any party of fresh policy proposals that address key issues affecting Australia's industrial future (*The Australian*, 30 June, 1987 : 29).

This comment adds weight to the view expressed by Jones that the Parliament showed a reluctance to deal with the social impact of technology.

Parliament appeared to have taken an attitude to technology and computing which reflected one of the following positions:

- (a) That the implications of computing technology was not a political concern.
- (b) That they lacked the knowledge and expertise necessary to debate the topic.
- (c) That the implications were inevitable and whatever they did would have little effect.
- (d) That the implications were too imprecise and they would deal with them when they occurred.

All the above possibilities suggest that the politicians have a reified knowledge of technology.

The Hawke Labor Government upon coming to office in 1982 created a portfolio of Science and Technology headed by Barry Jones, MP, who sought to create a framework from which a debate could be fostered.

5.1.2 **The Minister for Science and Technology**

The then Minister for Science and Technology, Barry Jones, had a unique opportunity to influence the direction of computer technology in education upon his appointment to the portfolio. Jones was able to implement many of the ideas found in his book *Sleepers Wake* (1982).

Theorising by Jones regarding the role of technology and education provided a strenuous argument for a broadly based education of two main elements.

First, he emphasised an inner development which concentrated on the well established educational goals of personal growth, creativity, independent thought, evaluation and aesthetics. These he argued had served the middle classes well and had caused no barrier to gaining employment.

Second, (and less importantly) he emphasised education for outer life. In this sphere he placed economic relations, employment, consumption patterns, tool using, income generation and group responses. He pointed out that although middle class education put a heavy emphasis on inner development, working-class education placed the emphasis upon qualifications for income earning.

He concluded that,

our primary emphasis in education ought still to be on the general rather than the specific and vocational (Jones 1982 : 186).

Furthermore, he pointed to the limitations of an education designed to meet technological objectives.

A person born, for example, in 1965 may well live to the year 2050: it is pointless to provide him with a basic education which is designed for the economic world of 1980, when that world will change out of recognition by the end of the decade (Jones 1982 : 168).

In light of the above view he argued for an education with an emphasis on personal development.

If a lifetime's professionalism can be acquired, replicated and disseminated in a few seconds by computerised technology, then what value can be put on human experience in the work place? In a period of increasing emphasis on high technology, it is essential that our education promotes humane and pluralist values and strengthens individuals vis-a-vis their environment (Jones 1982 : 172).

Finally, he concluded that it was necessary to avoid the polar extremes in personal and social development in

- the world of privatised experience and the technologically determined society (Jones 1982 : 172).

He further posited that many young people were unable to make sense of their education.

Many find that the education process is meaningless - they are trained for life in an industry which may have changed, or even disappeared, by the time they have spent a few years at work. Others are involved in boring, repetitive and meaningless work. A significant proportion can find no work at all (Jones 1982 : 182).

Jones posed two questions about the use of technology.

- (a) Must society be shaped by the available technology, or may society shape technology?
- (b) Is technology a monolith, or are there varieties of technologies and are we free to choose between them?
(Jones 1982 : 211).

In answer to his first question, he argued that society may shape technology if it engages in a political process to determine its priorities. However, he warned that lobby groups and vested interests continuously sell the notion that there was no choice and furthermore, he suggested that technological determinism crosses all

political boundaries. His second question was answered more directly.

The false premise on which technological determination is based asserts that technology is a single entity, monolithic and incapable of being differentiated.

This is the 'cargo cult' view of technology: we wake up one morning to find a computer in the garden, it has arrived impersonally and we must take it or leave it as we find it. (Jones 1982 : 216).

To the second part of his question regarding the freedom to choose, he claimed:-

We must assert the right to choose appropriate types of technology at our own pace, and to express a preference for those which enhance and extend human capacity, dignity, diversity and understanding. (Jones 1982 : 238).

How many teachers, parents and students felt that they had a measure of control and choice regarding computing technologies entering the schools and how might they be employed in teaching and other future human interactions will be pursued in this study.

Barry Jones argued that there was no absolute imperative about using advanced technologies for creating economic wealth, an argument that was clearly at odds with those of many of his political colleagues who claimed that Australia must be involved in the latest technologies to survive.

However, Jones resisted the opportunity to provide a vision of how, for example, education and technology might develop. He explained quite clearly that education must concentrate on personal development and avoid vocational emphasis. Furthermore, he claimed that education must be recurrent and life long but he did not delve into any suggestions about how these things might happen using 'appropriate' 'sensitive' technology.

Probably the clearest action suggested was for the formation of an Australian Information Utility as a Statutory Corporation which would have terminals for public use in schools, libraries and eventually homes. Hence, he saw technology used as a channel for information into schools.

In summary, the explicit theorising by the then Minister for Science and Technology included the following:-

- (a) The use of computers and information technology would proliferate in the near future.
- (b) The value of work in society would diminish as computers replaced many of the current work functions.
- (c) As the above occurs, education would have a diminishing role in providing vocational training.
- (d) People would therefore need to see education as a path to personal growth and development.

- (e) For this to occur, information and the control of information needs to be in the public domain, not in the hands of private corporations.

His most penetrating observation was that:-

Technology, while neutral or 'value-free' in itself, in the hands of its owners or controllers becomes a political instrument for reshaping society, and this power is exercised to a degree that even totalitarian governments would hesitate to attempt (Jones 1982 : 252).

Who then was reshaping education and what knowledge was being constructed to legitimate such change? Jones clearly theorised about the political use of technology to shape society. According to his theorising the reshaping of society was being done by the owners of the technology. As the ownership and control of computer based technology was in the hands of large corporations and multi-nationals rather than in the public domain, as he would wish, then those corporations by implication were shaping society.

5.1.3 Australian Political Party Policies

(1) *Labor Party Policy Statement*

The most recent policy statement was released on 23 June, 1987. Little was said within this statement about technology. However, the focus for education was made clear in the following statement:-

Curriculum reform to make higher secondary education more relevant to the world of work will be a high priority for Labor over the next term (Labor Party Policy Statement, 23 June, 1987 : 12).

The policy reflected a theorising about the purpose of education and the desire to bring education more closely in line with the needs of work.

This clearly implied a curriculum which included an emphasis on the needs of industry and commerce such as computing technology.

(2) *Liberal Party Policy Statement 1987*

The Liberal Party Policy on education began with a preface pointing out Australia's potential for,

developing into a leading technologically advanced society (Liberal Party Policy Statement, 25 June, 1987 : 19).

The responsibility for developing Australia's human resources was schools, higher education and TAFE. However, to develop this potential, schools would need to work in partnership with industry and governments, the document claimed.

Although there was no explicit statement with respect to technology the policy made clear the intention of schools to prepare for such an eventuality.

Primary and secondary education must accept the greatest responsibility to encourage the desire for learning, to encourage excellence and to ensure that our young people are fully prepared for the challenges of a rapidly changing society (Liberal Party Policy Statement: 1987)

By declaring Australia's future as a technological society and identifying the schools' responsibility to prepare students for this changing society, the Liberal Party displayed its theorising about schools and technology.

5.1.4 Commonwealth Government Agencies

(1) *Commonwealth Schools Commission*

Through the Schools Commission the Commonwealth Government administers a variety of educational initiatives by providing special purpose grants to the State Governments for specific projects.

The Commonwealth Government's involvement stems from the first National Advisory Committee on computers in schools and in particular their endorsement of

Recommendation 39 of the Advisory Committee's report, *Teaching, Learning and Computers* (1983). This led to the setting up of a working party on Educational User Requirements. In the document the authors provided (as requested in the terms of reference) the educational assumptions for computer use.

Two assumptions were made which supported recommendations for educational requirements.

- (a) Information in our society is becoming increasingly accessible through computer-controlled technology. Thus there is a responsibility for schools to provide experiences that enable children to acquire the knowledge and skills to operate comfortably with this technology.
- (b) The second aspect is concerned with teachers using computer technology within the existing curriculum to provide children with activities involving computers while at the same time providing efficient and valid experiences in the subject area. (Commonwealth Schools Commission, *Australian School Computer Systems, Educational User Requirements*, 1986 : 5).

Both the above assumptions rested on levels of theorising about the state of society, the development of schools and the educational practice of teachers. First, there was the notion that information would increasingly be incorporated in computer systems. This did not exclude other modes of information access, such as books and libraries but it

presented a picture of students having to interact with a computer when they sought information.

Furthermore, the statement of the Schools Commission presented a vision of society in which all participants would need to interact with computers to gain access to information. Such items as Government services, personal financial transactions, libraries, education (continuing) and news were cited.

Second, schools were identified as appropriate and responsible for preparing students for such a society. No alternative structures or organisational roles were suggested for this task.

Third, it was assumed that schools (or their departments) would provide a range of equipment funded in some way to enable children to engage in computer use.

Fourth, the Schools Commission Statement implied that such learning would prepare people for,

the life long process of shaping new information technologies to the requirements of their continually changing environment. (The School Commission, *Australian School Computer Systems, Educational User Requirements*, 1986 : 5).

This theoretical proposition placed on computing technology an ability, like that of books, to continually provide a basis for the on-going interaction with changing environments and giving it a casual quality. That is, society will continually change because computing technology will continue to provide the impetus for that change.

It is of considerable interest that the assumptions contained in the document gave no hint that computers would improve the output of education in any major way.

However, the Schools Commission did suggest that computer systems might improve teacher evaluation and diagnosis of learning.

Because of the information feedback it may also be possible that the monitoring system would 'learn' from the performance of students and in turn modify its decision rules. Such a system would have the potential to act as an expert system capable of assisting teachers in diagnosing and prescribing learning experiences for grouping learners, based on performance or sociometric profiles for classroom tutoring and other social activities.

(The Commonwealth Schools Commission, *Australian School Computer Systems, Educational User Requirements*, 1986 : 18).

Having identified such possibilities the authors pointed out that the developments of Intelligent Computer Assisted Instruction and expert systems were at that time, at a limited stage of development.

In summary, the document theorised about society and schooling and recognised an increasingly technological society. The document also legitimated and maintained the traditional structures and organisation of schools.

Moreover, the authors accepted that schools would incorporate computing technology where teachers carried out traditional functions but could be assisted with the aid of computer tutorials and student monitoring.

(2) *Commission for the Future*

The Commission for the Future, was established by the Commonwealth Government in June 1985 to,

act as a focus for raising community understanding, had a fundamental purpose of demonstrating that no-one should be the impotent victim of the march of science and technology, that we actually have choices, and that we can exercise these choices. (*In Future*, Issue No. 2, September/October 1986).

One of its priorities was education. Speaking on the direction of education it claimed:-

there are conflicting views about the direction our educators should take and the Commission has initiated several projects to allow the implications of all the choices to be intelligently considered and debated. (Papert, *The Program of the Commission for the Future*, February 1986).

The Commission set out to produce papers on curriculum for students, teachers and parents on such topics as the future of computers in schools and their role in a technological future.

Discussing the impact of the information revolution on Australia, the paper stated that the "single most powerful force for future change will undeniably be the computer". (*The Program of the Commission for the Future*, February 1986 : 3). However, in the opening address for the Bicentennial Futures Education Project, Senator Susan Ryan, then Federal Minister for Education took the following stance:-

The answer to change is not gimmickry. We do not need a computer at each desk. We need a creative, alert, trained child at each desk ... (*In Future*, Issue No. 3, November/December 1986 : 11).

As recently as December 1987 *In Future* examined the impact of the information society,

Gerry Tickell pointed out that educationists were often charged with being unresponsive to industry demands, yet in a world where education was so often expected to take on a range of new responsibilities, educators sometimes found it difficult to find out what was expected of them ...

(*In Future*, Issue No. 7 December 1987 : 9).

Given that the Commission had no role in policy formation but the initiation of debate (or theory formation), then it had been useful in that role. However, no consensus emerged.

5.1.5 State Government Policies

(1) *South Australian Minister of Education*

Between 1985 and 1987 the South Australian Government combined the Ministry of Education and the Ministry of Technology into a single portfolio. This move in itself was significant. It indicated a level of 'theorising' which recognised a nexus between education and technology signifying a new attitude to technology. Previous governments had accepted that education legitimately led to science development but to link education explicitly to technology showed that the purposes of education and its

outcome were both recognisable in technological terms. Furthermore, the explicit naming of the ministry legitimated many of the policies of education such that they led to technological ends.

Many of the comments made by the then Minister (Arnold, 1985) legitimated this stand. In a press release on the 27 September 1985, he reasserted the government's commitment to education about technology. He announced that grants were to be made available for the retraining of teachers dealing with technology and that a loan scheme would be set up for schools to buy computers. However, he went on to discuss one of the purposes of education in the following way:-

We are witnessing the start of a major period of change to our education system. Increasingly we will depend on the education system to ensure people are prepared for and able to adapt to technological change (Arnold, 27 September, 1985).

On an earlier occasion the then Minister explained:-

... there is a pressing need for the community to gain insights into the technology and how it can benefit them (Arnold, 2 August, 1985).

Furthermore,

The ability to cope with and understand computers is essential for the present generation of school children (Arnold, 28 August, 1985).

In each case the then Minister's comments legitimated the need for education to prepare people for technology. In the first instance the education system had the task of preparing people for technology and technological change. Second, computers could benefit the community and, finally, an understanding of computers would be essential to the present generation. When introducing three new subjects, Small Business Management, Word processing and Computing Studies the then Minister described them as "vital learning in our schools as we approach the 1990's" (Arnold, Press Release, 21 October, 1985).

The 'theorising' underpinning the then Minister's views was essentially economic in nature. While addressing departmental initiatives in the development of such subjects he made the claim that,

They are very much in line with the State Government's thrust of Economic and Technological Development. South Australia's long term success will depend heavily on the promotion of these areas through Education (Arnold, 21 October, 1985).

Focusing on the 'world of schooling' and addressing educators

Arnold said:-

Our task as educators is to supply the means - the skills, knowledge, entrepreneurial spirit and resource-fullness - to ensure our students can take full advantage of arising opportunities (Arnold, 21 October, 1985).

However, when addressing the opening of the Comtec Information Technology fair and speaking to businessmen he focused on the 'world of work'.

There is a need for the other levels of the education system to adopt a much broader approach to understanding computers from the present importing of keyboard and basic programming skills.

'Theorising' about what this meant, the Minister went on to say,

This demands a much greater ability to conceptualise and think abstractly than has previously been necessary. The educational system must therefore seek to develop these skills, and consequently a broadly based education, which develops a wide general knowledge, communication skills and a flexible approach to problem solving will be even more important in the future than it is now (Arnold, *Opening Address Comtec Information Technology Fair*, 19 August, 1985).

While addressing the same audience he pointed to the use of such technology in education.

It's ironic that the education system is the biggest and most complex information processing system in any country. Yet, to date, information technology has really only marginally influenced its procedures. If this situation continues, students and the general public will begin to see schools and colleges as anachronisms (Arnold, 19 August, 1985).

In the above statement, the Minister's 'theorising' legitimates the use of technology in education. There was also a recognisable return to the broad, whole person approach of earlier upper class education with an intellectual emphasis.

It was also apparent that the Minister legitimated a broadly based educational approach rather than focusing upon narrow vocationalism favoured by some business leaders but the Minister appeared critical of the rate of penetration of technology into education.

In his 'theorising' the Minister legitimated the present structures and organisational procedures for the provision of education. For example, in a press release on the 28th August, 1985 he identified the existing commitment to the

Angle Park Computing Centre, software development, staffing and in-service training for teachers as the focus for computing.

In summary, the Minister emphasised that:

- (a) The role of schools for preparing society for technological change.
- (b) The recognition that teachers required training to meet this need.
- (c) Children must be able to cope with and understand computers.
- (d) Their education required a high level of communication, a broad general knowledge and flexible problem solving skills including conceptualisation and abstraction.
- (e) Students needed to be able to take full advantage of the opportunities created by the technology.
- (f) The way to achieve this end was through existing structures and organisations of the department.

5.1.6 State Political Party Policies

- (1) *South Australian Labor Party, Education Policy Statement*

The Labor Party Policy Statement included a prominent section on education and technology which indicated that:-

it is important that we have a vision for education that looks to the year 2000 and beyond (Labor Party Policy Statement, 1986).

The directions for achieving the above, they claimed, included:-

- strong emphasis has been given to the 3R's, so necessary for technological literacy, and
- steps have been taken to improve the curriculum and make it more relevant and appropriate for the future with new subjects like technical, computer and small business studies being approved for Year 12.

Improvements for curriculum included:-

- providing programmes to enable our students to have access to computers and other new technologies to equip them for a technological society and make them technologically literate (Labor Party Policy Statement, 1986 : 2).

Further, they claimed they would provide a 'School of the Future' where secondary students visit and "come to grips with modern technology".

One of the methods to enable such visions to happen was the provision of a \$1 million school loan scheme with priority to less wealthy schools for the purchase of computer hardware.

On a social scale the policy mentioned both Aboriginals and girls. The way to assist Aboriginals was by support for the Aboriginal Information Technology Centre and girls by affirmative action to "guarantee participation in all educational developments in technology and science" (Labor Party Policy Statement, 1986 : 5).

Likewise, for the disadvantage of distance, the policy proposed to provide schools with videotex facilities.

With respect to junior primary, primary and secondary schools the policy identified two approaches to technology and the future.

First, it was necessary to

make improved provisions of money, physical resources and teacher development for secondary schools to respond to technological change.

and second to,

initiate studies to define realistically the expected role of both primary and secondary schools to the year 2000.

Conceptually, the document theorised that resources and teachers would require development to cope with the demands of a technological school and a technological society. However, it made no attempt to define such a school or society and only moved to initiate studies for this purpose. Its theorising identified computers as a catalyst and conceded that the future would be so technologically different that students would need to be technologically literate.

The document revealed little evidence of the debate and controversy found in the literature and media beyond acknowledging that girls and Aboriginals required affirmative action. Nor did the Policy suggest any major changes to organisational structures which would challenge the status quo.

However, the Labor Party may have left room for alternative points of view through the studies of the role of schools to the year 2000. As a political party they provided no evidence of speculative theorising about how computing might change the conceptual reality or psychological reality of individuals in society.

(2) *Liberal Party Education Policy Statement 1986*

The Liberal Party policy also showed an awareness of technology and computers in particular. The policy statement claimed that emphasis would be placed on the teaching of literacy, numeracy and technological skills, elevating technological skills to the same level as literacy and numeracy.

Computer education was so important to the Liberal Party that it was given independent attention.

A detailed examination of the statement showed a positive theorising towards computers in education. It acknowledged that they would be part of education and encouraged the possibility of further development and expanded resources. It invited private industry to produce 'local software'.

It committed itself to ensuring that all students were trained in computer awareness and the use of the computer 'learning aid'. It was also interesting to note that it sought to gain support from the Federal Government through the Schools Commission, once again demonstrating that funding for technological development was seen as a Federal Government responsibility.

Like the Labor Party the Liberal Party theorised that computing was going to occupy a central place as a technology in the future. However, it also made no attempt to indicate what shape that future may take beyond acknowledgment that a technological society was one in which enormous changes would take place.

The policy did not suggest that the technology might threaten existing institutions in any way.

For example, it implied that the Angle Park Computing Centre would have a major role in recommending equipment and software needs. It did warn, however, that the education system might fall behind the general community in the teaching of computer education, "if it has not already done so" (Liberal Party Policy Statement, 1986 : 35).

This statement suggested that theorising about the rate of technological change on schools was placing them under great pressure which could be solved by the purchase of more technology, more teacher training and more resources. They cited the British decision of purchasing computer systems as an example of ways of introducing technology into schools.

The Liberal Party conceptualised the need for technology in education as a crisis. This may indicate the presence of theorising about the role of computers in society and in the work force which held that it was imperative for economic development and for schools to take a vital role in introducing this technology.

5.1.7 State Government Agencies

(1) *Education Department of South Australia*

Schools Computing Policy

The South Australian Education Department's policy statement released in 1987 was a comprehensive document which signalled a change in emphasis from its previous direction. The new direction was towards computer literacy rather than computer awareness. Such a stance arose from a concept of literacy not limited to written or spoken forms.

It encompasses the ability to understand and express things using all the forums that society uses to represent what it knows. A part of that ability may be called computer literacy (Schools Computing Policy, 1987:4).

The term literacy had been redefined to include all knowledge, skills and understanding that enabled people to function in a computer related society. This institutionally

represented a 'theorising' to include the technology as a legitimate focus of its concern. Such an action was necessary so that the computer could be objectivated within its reality. Some sense of this action could be gauged from the fact that computers have been used in schools for many years but no explicit policy statement had been released to recognise its importance.

Computer literacy was given three levels of learning:-

- (a) the skills needed to use computers as learning and problem solving aids: to manage information and to have power over the medium.
- (b) Knowledge of the function of computers and related communication technologies, the range of applications of those technologies, their power and limitations and the implications for society.
- (c) The understanding needed to evaluate, and hence to reject or learn to use new applications and related new technologies as they became available (Schools Computing Policy, Education Department of SA, 1987 : 4).

Each level incorporated 'theorising' about education, technology and society. First, it assumed that students would need to use computers for learning and problem solving, if not at present, then in the future.

Second, it assumed that students would need a knowledge of computer technology including the implications for society. Presumably this indicated a need to examine the effects on work, leisure and every day living.

Moreover, this statement suggested that computers were seen as a special technology and as such were given a higher prominence than many other technologies such as transistors, polymers and bio-technology which have had a significant impact on society. The reason for this view was expressed in the background notes.

It is more important that students develop the ability to determine when the use of a computer is appropriate to assist in finding the solution of a problem, and the ability to use a knowledge of problem solving techniques and computer based tools to achieve a solution (Schools Computing Policy, Education Department of SA, 1987 : 6).

Hence, computers were viewed as a natural and compatible extension to learning and problem solving.

Finally, acknowledgment was made that some computer applications might not be desirable and should be rejected. This suggested a theorising which gave warning to some protagonist that computers were dangerous and might be used against society.

The actual policy statement defined that:-

teaching and learning with, through and about computers be further developed, in junior primary, primary and secondary schools;

All students will be provided with the means to take advantage of computer technology for learning; and should acquire the skills, knowledge and attitudes needed to use, understand and control computers (Schools Computing Policy, Education Department of SA, 1987 : 8).

Furthermore, this policy changed the priorities for the application of computers from computing studies for secondary students towards a wider approach by all students

... that support improvement in and greater student access to, the school curriculum (Schools Computing Policy, Education Department of SA, 1987 : 8).

The rationale for the policy was based upon the concept of the computer as a tool for the manipulation of information, in much the same way as the calculator was used in learning. Within the explanations of the document recognition was made of the potential for computers to improve and in some cases "transform teaching and learning in the school curriculum" (Schools Computing Policy, Education Department of SA, 1987 : 11).

While the document clearly articulated the important relationship between students and teachers the statement above suggested a pro-active level of theorising towards teaching which gave room for significant changes to the process and suggested a greater role for computer based learning.

In summary, the policy document reflected positive theorising about computers and acknowledged a wider application at all levels of schooling. In particular the computer was given a role of 'tool' for enhanced learning but within the document some cautions were noted with respect to inappropriate use in society. Furthermore, the document incorporated, within schooling, the use of computers to enhance learning, prepare people for the future, and promote equity of opportunity.

Responsibilities

The Department of Education sets out four levels of responsibility for the implementation of its policy:-

- (1) The Central Directorates
- (2) The Area Directorates
- (3) Angle Park Computing Centre
- (4) The Schools

The Central Directorates

Broadly speaking, the Central Directorate had responsibility for curriculum development, financial support and the provision of training for Area personnel. The vehicle for delivering these training services was the Angle Park Computing Centre. Its brief was broad and comprehensive and included the following elements:-

professional development programs for Area advisers and key school staff;

professional development activities for school staff in new or specialised applications of computing;

software and courseware development;

consultant advice on issues not serviced by Area advisers;

technical support for Area advisers;

advice on new hardware, software and approaches to school computer use;

research into schools' computer use;

liaison with schools computing centres outside SA, tertiary computer groups and the computer industry;

support of pilot projects, in co-operation with Areas;

the gathering, collation, analysis and dissemination of information related to schools computing, including software reviews;

school access to electronic mail facilities;

support for curriculum committees and Area teacher networks, on request (Schools Computing Policy, 1987).

Area Directorates

In addition to the services of the Angle Park Computing Centre the Area Directorates were charged with responsibility for:-

provision of advisory staff with skills in school computing;

support for teacher networks;

support for focus schools in computing, and the dissemination of models of effective school use of computing developed in these and other schools;

provision of professional development activities conducted in Area offices, and schools;

support for school based research into computer use;

school hardware purchase approval;

information to school communities on schools' computing activities;

provision of feedback on policy implementation and collaboration in policy review (Schools Computing Policy, 1987).

Angle Park Computing Centre

The Angle Park Computing Centre was given a prominent role in preparing the State's education system for the increasing use of computers. This was set out in the Education Department's Computer Policy document 1987 and in statements by the then Minister of Education (1985).

As part of this study, the Principal of the Centre was interviewed about the emerging issues in education caused by computers. A summary of the responses to these issues follow including his theorising about them.

The Computing Centre had the primary responsibility for developing teacher skills in the use of computers and in their implementation into schools. Some evidence of the theorising about the importance of the Centre in this initiative can be found in the Principal's description of the Centre as the 'machine at the front'. This description implied that the impetus for such innovation was motivated by the bureaucracy to manage and sustain the innovation.

A view was also expressed that much of the knowledge held about computers and education originated in the Centre which by its presence, as a function of departmental policy, dominated the direction of computer education within the state. Furthermore, through the distribution of computer programs and the training in programs presentation, the Centre's role was substantial. The Director also expressed the view that changes to the department's policy which placed a greater responsibility on the schools for their computing programs would have a detrimental effect on the department's long term computer program.

Essentially, the Director's theorising about the educational uses of computing can be summarised in the following discussion.

Computing was a 'defining technology' that is, a technology which captured peoples' imagination in a way which defined how and where the technology would be used in society. Education was one of many activities which were seen as an appropriate use for the technology and hence computing would be used in schools.

This understanding rested to some degree upon an acceptance of technological determinism but it was emphasised that choices about how the technology was used could still be made. However, in this case it was believed that the use of computers in education was inevitable.

The Director explained that the Government's response to this pressure was confusing although it was obvious that their focus was upon the economic ramifications of computing technology. Nevertheless, the Government seemed to have recognised the connection between education and technology and supported greater attention being given to the use of computers in schools.

Furthermore, the Director pointed out that parents also responded to this view and as a result the Department of Education was placed under great pressure to provide computer courses in schools. As a result of this drive teachers needed to learn about computers and their use in education but it was the teachers who posed the greatest resistance to the technology, far greater than that of parents or students.

The Director also believed that teachers needed staff development to enable them to see the benefits of computers as a 'tool' for use in all areas of education (history, drama, technical studies, maths and science).

Because of the magnitude of this task the Director expressed the view that it was important that computer technology be used to develop delivery systems capable of addressing the changing developments of computer technology facing teachers.

The Director expressed concern that part of the confusion caused by the Government's attitudes and policies, particularly with regard to the provision of loans for the purchase of computers, was the expanding gaps between the

resources of schools and the extent of computer use at all levels of the curriculum. This could also create considerable diversity in programs and directions between schools. It was perceived that this problem would be exacerbated as schools decided what should be taught, either;

- (a) Courses aimed at providing students with a social awareness of the issues associated with the use of computers in society, or,
- (b) Courses of computer applications.

Another matter of great concern to the Director was that teachers should address the misconceptions widely held in society that the use of computers would prepare students for jobs. For the Angle Park Centre the use of computers in schools was not seen as a vocational issue but rather as an educational issue.

Once the schools became autonomous in curriculum terms to some degree the Director felt that the Department lost touch with what happened in schools. This direction was considered by the Director as a policy of ignorance by the Department of Education.

The Director of the Centre believed that the longer term implications of computer development in the fields of artificial intelligence was not an immediate concern as it was too remote and little discussion was taking place about the effects on education.

As the technology of computing advanced, teachers would have to face the reality that they could be replaced in some circumstances, although the Department had a policy which did not support the replacement of teachers by computer technology. Such theorising was already being expressed in the USA and Europe.

Schools

The Department of Education deemed that schools had some general responsibilities which included the progressive integration of studies "with, through and about computers" into their programs.

Also, this was to be done within their general curriculum policy rather than as separate policy concerned with computers.

Guidelines to schools (Schools Computing Policy, 1987)

emphasised that:

the creation of opportunities for teachers to become acquainted with, and confident in, the use of computers in their programs.

Recognition of the fact that students' experience of, and access to, computers outside the school varies greatly, and there would be opportunities for students to learn from their peers as well as from their adult teachers. Particular notice was to be taken of student access to computers at home, the nature of that use and the opportunities that might be provided to foster parent/school co-operation.

Other factors that might affect students' opportunities in relation to computers, included gender, language, cultural background socio-economic circumstance, remoteness and disability of various kinds; providing equal opportunities in relation to computers, as in other aspects of learning, did not mean providing identical experiences for all students. It meant taking account of those differences and creating school programs that responded to them sensitively and effectively.

The use of computers as learning resources needed to be included in the school's affirmative action program for groups of students who had been educationally disadvantaged by past practices. The use of computers must develop in ways which acknowledged these disadvantages and were directed towards redressing them.

Teaching and learning with, through, and about computers should be relevant to computer applications in the wider society. While the emphasis with young children would be on teaching and learning with computers, that emphasis would change, as students move through school, to include applications with relevance beyond the school.

The creation of opportunities for parents to become informed about, and to contribute to, the school's program of computer use.

In summary, the Departmental policies and actions showed no reluctance to respond to the demands for schools to include computing in their curricula. Although an argument could be made about the resources applied to the task, the efforts of the Computing Centre and the directions given to all operational arms of the Department did not suggest any conscious obstruction to the inclusion of this technology into schools or to the educational process.

It is also worth noting that views held by the manager of the Computer Centre showed that an ambitious acceptance of the technology was being pursued and that within the 'knowledge' held were theories about the development possibilities including the use of computers in the learning process and the changing role of teachers.

Within the policy statement for schools was the direction that schools would use computers across all subjects. However, this was tempered with the precautionary note that equity and external experiences were important features of learning. Furthermore, schools were also encouraged to work closely with parents and social groups to enhance the use of the technology.

This policy recognised and legitimated both the use of the technology and emphasised that schools must actively involve parents when implementing the policy in schools.

5.1.8 **Employer Opinions**

In a submission to the Committee of Inquiry into Technological Change in Australia (CITCA), 1980, the Confederation of Australian Industry outlined its views with respect to what was required of the education system. The following points were made.

First, most graduates of the education system were oriented towards higher education. Second, of those students who did not continue to higher education they were ill-prepared to fulfill the jobs required by industry.

... with increasing developments in technology there is an ever-growing gap between the education supplied at the secondary level and that required to undertake the increasing range of technical and skilled occupations available in industry (*Confederation of Australian Industry Submission to the Committee of Inquiry into Technological Change in Australia, 1980 : 23*).

Third, the education required by industry generally required post-secondary education with a vocational bias to take up the positions industry had to offer.

By-and-large the theorising evident within this submission was essentially focused on a workforce for industry which was capable of taking advantage of the anticipated continuing growth in advancing technological manufacturing methods.

There was no evidence of theorising about how that education might be developed nor that any alternative educational approaches should be developed. In fact, they called upon governments to ensure structures which would enable the education system to provide for their needs.

The clearly expressed values from which these views originated were for economic growth which would create the wealth considered necessary to support Australia's standards of living in the continuing future.

5.1.9 **Union Policies**

Teacher Unions

The South Australian Institute of Teachers released its Computer and Education Policy in 1988. Although the policy acknowledged the importance of computing it took a far more conservative stance than that of the Education Department's policy (1987) by focusing more directly on the rights and responsibilities of students, teachers and the government.

The document included the following general principles which illustrated this point:-

- (a) Computers should be seen as an integral part of the whole school curriculum.
- (b) All students have the right to equal access to knowledge and understanding of computers. The special needs of disadvantaged groups should be met to enable this to happen.
- (c) Teachers have the right and the responsibility to appropriate in-service courses.
- (d) There is a need for on-going public debate, evaluation and consequent change, and it is the responsibility of Government and the Department to provide adequate funds for these
(Computers & Education Policy, SAIT 1988 : 2).

In particular the Institute of Teachers policy emphasised the need for computers to support the "present methods and forms of organisation" in schools. Moreover it went on to identify the present methods as computer assisted instruction, evaluation, language development and reinforcement.

The document provided some evidence of positive theorising about the use of computers to expand curriculum activities by simulating learning situations, encouraging lateral thinking, encouraging student directed exploration of topics, modelling complex situations;

using individualised learning, using self paced learning programs and becoming involved in communications and community involvement.

Special emphasis was given to equity issues such as distance education, special education and the education of women and girls.

Consideration was also given to the need for research to provide directions and future development of computer use in schools. This would suggest an element of caution within the theorising by the teacher unions.

A call was made for government to make a commitment to provide information for policy development and decision making by schools, school systems and governments;

to support and encourage widespread public debate on the educational uses of computers (Computers & Education Policy, SAIT 1988 : 11).

The purpose of such research would provide information on the educational use of computers, an assessment of their impact and effective teaching practices. Answers would be sought to the following questions:

- (a) the most desirable development in hardware, software and physical environment;
- (b) the effects on learning processes of students;
- (c) the implications for the teaching role, school and classroom organisation and teacher employment.

The third point suggested a degree of uncertainty within the teaching profession and theorising about the implications for teachers' future employment. Concern for confidentiality was apparent in the SAIT policy with regard to the use of computers for administration purposes.

The document called on the government and schools to develop policies to protect students from the indiscriminate use of school records by prospective employers and other users of such information.

A major feature of the SAIT Computer and Education policy was its conservative and protective stance towards the indiscriminatory use of computing without due consideration. A great deal of emphasis was placed upon governments to implement policies to initiate greater debate within the community about the use of computers for educational purposes, the role of teaching in schools and the protection of student records.

At this stage governments had made no attempt to implement such policies nor allocate funding to resource such action by the Education Department.

Australian Council of Trade Unions

The Australian Council of Trade Unions publish policy statements reflecting their interest in a wide range of social issues including education.

In July 1987 a report, *Australia Reconstructed*, was published in which the document was described as the most contemporary vision by the union movement of Australia's position in the world economy and the directions the ACTU considered essential for Australia's future.

In the document, the ACTU made its position clear on the direction which should be taken by education with respect to technology.

action is needed to ensure Australia's young workers have a higher technological awareness and are adept in current technology (Australia Reconstructed, 1987 : 124).

The ACTU argued that governments could promote these goals but that business would and should be more active in specifying their requirements to young people and to educational institutions.

The goals for schooling were also made explicit. The Government should find,

ways of ensuring that the education system provides adequate, even ambitious preparation for the world of work so as to exploit present and future opportunities in the labour market (Australia Reconstructed, 1987 : 125).

The means proposed to ensure that students were prepared for the 'world of work' was by a general 'technology' subject included into the curriculum as a compulsory unit. Within the document an emphasis was made on science related subjects with a view to all students, particularly girls, being encouraged to undertake studies in mathematics, science, economics and technical studies.

This statement was a clear indication of the union movement's stand regarding the direction required of education to equip students for a technologically-based society.

However, there was no suggestion within the document which challenged the basis of the institution of schooling nor did they suggest any radical changes to the way in which education was conducted or to the introduction of computer technology as a way of achieving their ends.

Essentially the ACTU expressed the view that a change in educational outcomes required the intervention of government and industry to change the conservative stance of educational institutions and make education more attuned to the 'world of work'.

This 1987 position showed a marked shift from the theorising adopted by the ACTU 1985 Statement of Congress which said,

Congress supports the view that the education system should provide skills appropriate to employment. However, Congress affirms the importance of a humanitarian education and rejects attempts by government and employer groups to impose vocational curriculum on schools particularly under the pretext of reducing unemployment and strengthening economic development (ACTU Policy Statement, 1985 : 55).

Having underlined the importance of a humanitarian education the Congress nevertheless drew attention to economic circumstances and the pace of technological change. In particular, the Congress called for funding to assist the education system to address the needs of technological change.

The new technologies place great demands on the education system, which should be assured sufficient resources to enable young people to be adequately equipped to understand and cope with its application and its effect (ACTU Policy Statement, 1985 : 203).

The ACTU statement above implied that by governments providing more resources, the educational issues of preparing students for a "changing society and a technologically advanced future" (ACTU Policy Statement, 1985 : 67) would largely be left to educators.

5.1.10 **Summary of Theorising by Political Parties, Government, Government Agencies, Employers and Unions**

Table 1 over the page, sets out a comparison of the theorising by the main groups outside of the school situation.

TABLE 1

SUMMARY OF THEORISING BY GOVERNMENT, GOVERNMENT AGENCIES, POLITICAL PARTIES, EMPLOYERS & UNIONS

SOURCE OF BELIEF	BASIS FOR BELIEF	LEGITIMATING BELIEF	CONCEPTUAL MACHINERY 'VALUE'	CONCEPTUAL MACHINERY 'MAINTENANCE OF INSTITUTION'	NOTES - REIFICATION - CONCEPT. MACHINERY - LEVEL OF THEORISING
COMMONWEALTH MINISTER FOR SCIENCE AND TECHNOLOGY <i>Sleepers Wake</i> (1982)	Education not preparing youth for future adequately.	Humans must be able to choose technology.	Choices of technology should enhance human dignity and growth.	Political processes must provide means of choosing.	Present structures of education self maintaining.
	Young unable to make sense of their education.			Schools must prepare society for technological change through human and pluralist values.	Shows no evidence of reification.
	Society needs to decide its technology.				Theories appear at the explicit level.
	Technology should enhance human capacity.				
	Owners of technology controlling decisions about use.	Technology must be used for the benefit of society.	Information must be available to the public and not restricted.	Public control must be established to enable choice by society.	Emphasising a change in direction for information control.
COMMONWEALTH MINISTER FOR EDUCATION <i>Commission for the Future</i> (Feb 1986)	Need to develop children for future.	Development of children did not rely on technology of computing.	People are of a higher importance than technological needs.	Schools are for the intellectual development of children.	- Rudimentary - Possible fear of technology - View towards maintaining traditional forms of education.

TABLE 1 CONT.
SOURCE OF BELIEF

SOURCE OF BELIEF	BASIS FOR BELIEF	LEGITIMATING BELIEF	CONCEPTUAL MACHINERY 'VALUE'	CONCEPTUAL MACHINERY 'MAINTENANCE OF INSTITUTION'	NOTES - REIFICATION - CONCEPT. MACHINERY - LEVEL OF THEORISING
POLITICAL PARTIES FEDERAL AUSTRALIAN LABOR PARTY <i>Policy Statement 1987</i>	Education must be more relevant to the world of work.	Curriculum reform of education to make it more relevant to world of work.	Economic benefits education for work = wealth.	The more closely the education system aligned to work the greater economic benefits will flow from it. Strengthens institutions but moves it to support 'world of work'	Policy reinforces the institutional value of schooling. Theories appear rudimentary and simplistic.
AUSTRALIAN LIBERAL PARTY <i>Policy Statement 1987</i>	Australian society must be technologically advanced.	Young people must be educated for technology.	Economic benefits and improvements of Australia's competitive position will flow from technology.	Schools have responsibility to prepare young people for technological future.	Some evidence of reification of knowledge. Policy reinforces institution of education. Theories appear simplistic and at rudimentary level.
COMMONWEALTH GOVT. AGENCIES COMMON. SCHOOLS COMMISSION <i>Teaching, Learning and Computers (1983)</i>	Information will be available through computer technology.	Need for students to use technology/computers for learning. Computer technology to be involved in existing curriculum. Teachers to use technology for learning.	Society will use sophisticated technology in the future. Scientific view of society.	Responsibility for schools to provide experience. Existing curriculum to be retained.	Emphasis on present institutional approach but technology included. Theories appear to be at explicit level.

TABLE 1 CONT.
SOURCE OF BELIEF

SOURCE OF BELIEF	BASIS FOR BELIEF	LEGITIMATING BELIEF	CONCEPTUAL MACHINERY 'VALUE'	CONCEPTUAL MACHINERY 'MAINTENANCE OF INSTITUTION'	NOTES - REIFICATION - CONCEPT.MACHINERY - LEVEL OF THEORISING
COMMISSION FOR THE FUTURE (1985) <i>In Future (1986)</i>	To develop choices about technology and education.	The most powerful force for change will be the computer.	Educators expected to take on new responsibilities but not given directions about expectations.	Political process must make decisions about the directions for education.	Some signs of reification of knowledge. Rudimentary theorising.
STATE GOVERNMENT SA MINISTER OF EDUCATION (1985) <i>Press releases</i>	Change required to the education system.	Preparation for technological change. Community needs to know how technology can benefit them.	Education is to develop society for the future, also whole person's intellect. States long term economic success depends on education doing this task.	Reasserting the role of the institution of schooling. Education system must develop people to use technology and develop people for <u>work</u> . If education systems do not respond they will be seen as anachronisms.	Technology is treated as a monolith - all technology yet reference made to understanding computers. There exist signs that computers in general = technology. Theories appear to be explicit but simplistic; warning given to schools. Some evidence of reification of knowledge.

TABLE 1 CONT.
SOURCE OF BELIEF

SOURCE OF BELIEF	BASIS FOR BELIEF	LEGITIMATING BELIEF	CONCEPTUAL MACHINERY 'VALUE'	CONCEPTUAL MACHINERY 'MAINTENANCE OF INSTITUTION'	NOTES - REIFICATION - CONCEPT.MACHINERY - LEVEL OF THEORISING
STATE POLITICAL PARTIES SA LABOR PARTY <i>Education Policy (1986)</i>	Necessary for party to have a vision to future.	Emphasis on 3R's; change to curriculum to make more relevant. Equip students for technological society. Technology and computers to be part of curriculum. Technology to be used to enhance education.	Education is to prepare individuals and society for future needs.	Educational institution to prepare teachers and students.	Evidence that technology in general = computers. Theories appear to be at rudimentary level. Some reification of knowledge evident.
SA LIBERAL PARTY <i>Policy Statement (1986)</i>	Computers important part of education.	Need to teach - literacy - numeracy	Economic development depends upon students well prepared to deal with technology of computers.	Education system must make changes through the schools and Computing Centre. Private Industry to participate.	General tendency to assume that computer = technology = economic dev. suggests reification of computing knowledge . Emphasis on role of existing structures. . Theories appear to be at rudimentary level.

TABLE 1 CONT.
SOURCE OF BELIEF

SOURCE OF BELIEF	BASIS FOR BELIEF	LEGITIMATING BELIEF	CONCEPTUAL MACHINERY 'VALUE'	CONCEPTUAL MACHINERY 'MAINTENANCE OF INSTITUTION'	NOTES - REIFICATION - CONCEPT.MACHINERY - LEVEL OF THEORISING
STATE GOVERNMENT AGENCIES EDUCATION DEPT OF SA - <i>Computing Policy</i> 1987	Understanding and expression now includes computers.	Students must have:- - Skills to use computers - Knowledge of computers - Ability to evaluate computer use Computers could transform teaching and learning.	Computer technology would be an integral part of future society. Computers are a tool for learning.	Education Dept says learning with and about computers should take place in junior primary and secondary schools.	Theories appear rudimentary although knowledge of the computer as a tool for use in society appears well developed.

TABLE 1 CONT.
SOURCE OF BELIEF

SOURCE OF BELIEF	BASIS FOR BELIEF	LEGITIMATING BELIEF	CONCEPTUAL MACHINERY 'VALUE'	CONCEPTUAL MACHINERY 'MAINTENANCE OF INSTITUTION'	NOTES - REIFICATION - CONCEPT.MACHINERY - LEVEL OF THEORISING
<p>EMPLOYERS CONFEDERATION OF AUSTRALIAN INDUSTRY <i>Submission to CITCA (1980)</i></p>	<p>Need for labour force with a vocational bias.</p>	<p>Gap growing between education and need of the world of work in a technological world.</p>	<p>More relevant education would add to Australia's wealth.</p>	<p>Schools must provide for the needs of work.</p>	<p>Theories at rudimentary level.</p> <p>Calls on government to make changes.</p> <p>No specific call challenging the means used by educators.</p> <p>No specific demand for computers but call for ability to handle technology.</p>
<p>TEACHER UNION COMPUTER <i>Education Policy 1988</i></p>	<p>Computers should be seen as part of whole curriculum.</p> <p>Equity of access. Teacher training. Public debate.</p>	<p>Computers should be used for computer assisted instruction, evaluation, language development and to expand curriculum activities.</p>	<p>All students should have access to relevant education</p> <p>Teachers should have stable career supported by government.</p>	<p>Need to support present methods and forms of organisation in schools.</p> <p>Call on governments to provide policies of protection for students and teachers.</p> <p>Some uncertainty expressed about teaching role and future employment of teachers.</p>	<p>Theories generally described at rudimentary level.</p>

TABLE 1 CONT.
SOURCE OF BELIEF

BASIS FOR BELIEF

LEGITIMATING BELIEF

**CONCEPTUAL
MACHINERY
'VALUE'**

**CONCEPTUAL
MACHINERY
'MAINTENANCE OF
INSTITUTION'**

NOTES
- REIFICATION
- CONCEPT.MACHINERY
- LEVEL OF THEORISING

ACTU
Policy Statement 1987

Need for higher
technological awareness by
young.

Students should have an
education relevant to work
and be technologically
adept.

Education should prepare
students for work life.

Support for schooling via
technology in curriculum.

Calls on government and
industry to specify
requirements.

Theories at rudimentary
levels.

5.1.11 Discussion of the Theorising by Political Parties, Government Agencies, Employers and Unions

Theorising by the political parties at the national level, reflected by their respective policy statements, clearly differentiated the hierarchy of responsibilities. The theorising at this level showed no specific recognition of technology as an issue for education.

However, in the broad context of national development, education was given the task of preparing for the future human resource needs of the country.

Education in this context was discussed at the explicit theoretical and symbolic level. That is, education's purpose was to prepare the population such that it might contribute to the wealth of the nation. From this perspective the symbolic universe was an economic universe.

Both major political parties shared a symmetry of views with respect to the role of education in society even though their sedimented knowledge and theoretical propositions regarding the means by which this might happen, varied widely.

If technology was important within the theorising of the federal politicians then it was subsumed under the economic goals of the parties. For example, it may be that technology, far from being unimportant, was viewed as the engine which would drive industry and provide the Government's economic ends. In any event, technology was not articulated as a critical ingredient in the theorising of politicians. This suggested that the politicians had reified the knowledge of computers such that they would produce wealth wherever they were used.

At a state level the theorising became much more explicit. Here the theorising about the role of technology was seen as important both to education and the purposes of education. Once again, this was not for altruistic reasons such as developing the whole person but for what appeared as a self-evident goal, namely, to make people technologically literate. Neither of the major political parties attempted to theorise about the future but both indicated explicit theories to achieve their aim. The government (1987) saw the curriculum and subject choices as the mechanism for achieving its aim.

Within the State Government policies (1985) it was obvious that theorising about technology and theorising about computers was synonymous. The way to prepare children for the future was to provide the technology for them to use - technology was interpreted as computers.

This indicated a particular theorising which distinguished computers from the many technologies in everyday life and elevated it to one which would define the future.

At the same time the (1986) Labor Party Policy Statement legitimated the role of computers in schools and shifted the emphasis towards the use of technologies in schools and schooling towards technological ends.

The Education Department of South Australia at a more pragmatic level produced the term 'computer literacy' to prepare the society for a technological future which would presumably feature computers in almost all aspects of life.

Such a legitimating stand enabled and made acceptable a degree of computer experimentation not before possible.

Furthermore, it institutionalised computer education and use within its mode of operation.

The educational union, the Institute of Teachers, gave acknowledgment to the legitimisation of computer studies by the Education Department. However, its theorising incorporated in a more explicit way the needs of teachers for training, protection from changes in organisational structures and changes to their role.

In summary, the theorising undertaken by the above groups accepted and legitimated the need to seek a wealth creating direction for society. However, for society to create wealth, it was argued, it must be a technological society, therefore, its education must produce a technologically literate society and a technological literate society was a computer literate society.

Although these theories were simplistic the policies in which they were contained provided no evidence of an argument for an alternative future nor raised any substantive argument which questioned whether the premises of the theories were sound. It seems that the knowledge, once sedimented, provided no room for alternatives.

Theorising which legitimated 'knowledge' about computing technologies appeared to have been based on limited specific 'knowledge' about the benefits or social consequences of their use but was based on the 'knowledge' about the supposed power of computers to support other imperatives such as economic need.

Commonly held knowledge about computers appears to have already become sedimented and is being acted upon in a manner consistent with Berger and Luckmann's theories of conceptual machineries.

These conceptual machineries seem to have acted to align the existing theories and knowledge about education to support the use of computers in the education system.

None of the theorising found within the policies explicitly explain where computers should be used. There appears to have been an implicit faith in the knowledge about computers that by placing them in the educational context they would prove to be of such benefit to all concerned that the question about how they should be used was not considered relevant.

This leads once more to the question: What is the knowledge about computing technology which leads political parties and governments to use that knowledge to support new direction in education? The propaganda value found within the knowledge of such technologies appears to be considerable. The belief in computers which mobilises parents to act for the best interests of their children needs to be closely studied.

5.2 **AUTHORS OF COMPUTER PUBLICATIONS**

It was apparent from a review of the literature on computer technology that the computer had captured the imagination of many writers leading them to speculate about the ultimate technological development and social impact of the computer on society.

It was also clear that they saw the computer as the prime mover for further technological development and immense social change.

The following diagram, Figure 14, illustrates the diversity of perspectives from which the writers about computers formed their opinions.

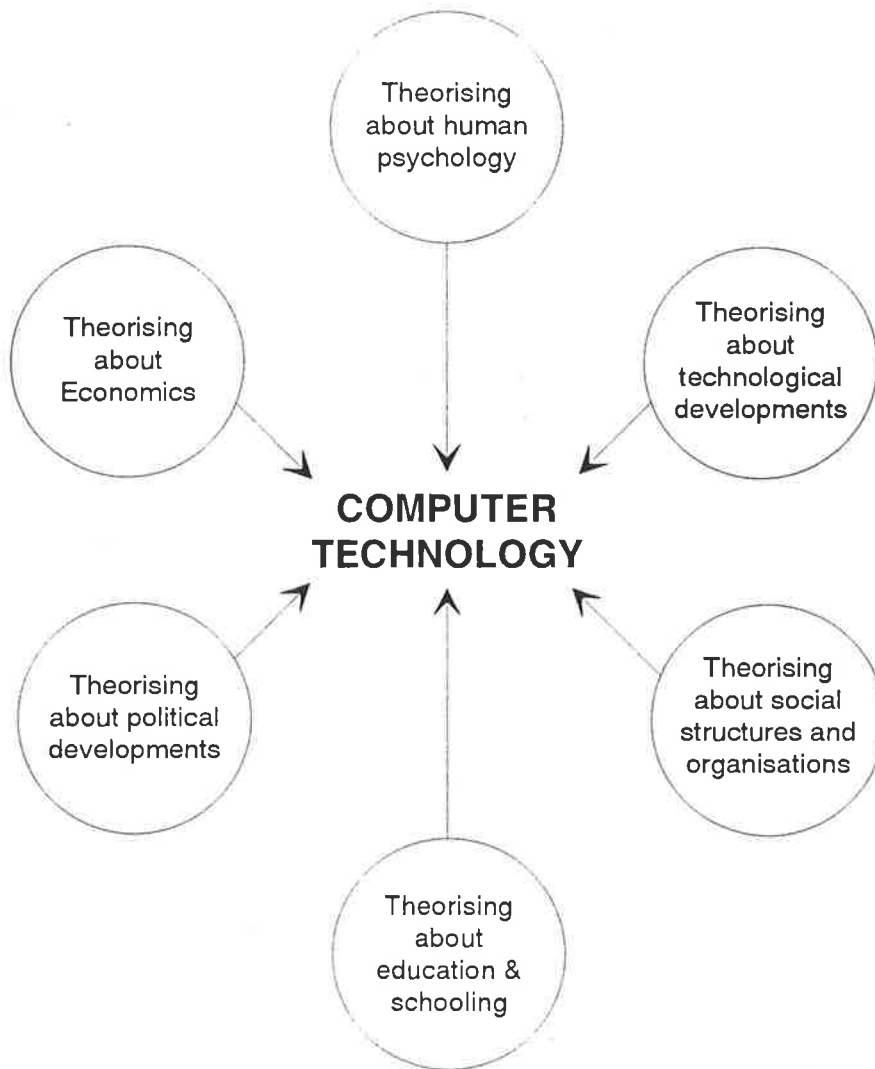


FIGURE 14: PERSPECTIVES FROM WHICH WRITERS ABOUT COMPUTERS FORMED THEIR OPINION

As illustrated above the theorising by the authors was both diverse and extreme. However, collectively the theorising represented a spectrum of ideas presenting both pessimistic (George 1979) and optimistic (Evans 1979) forecasts for society.

These beliefs could be the basis for a wide range of rudimentary theorising. For example, the pessimistic views described a potential reality which included a totalitarian world dominated by an intelligent machine species - a world in which work was limited and leisure the only alternative - where governments knew our every move and where human interaction was given a lower priority than machine interactions.

The more optimistic forecasts presented a 'world' where machines produce all our material needs, where education, research, the arts and freedom of choice were the principal characteristics of society and where war and strife were only found in historical records.

Obviously, the potential reality of the collective theorising may be a mixture of the descriptions above, but the theories once created may be selectively used to form the basis for the rudimentary theorising of reality definers to promote their cause and reify the knowledge in such a way that complications and social difficulties are removed.

The ability of authors to present such alternative realities suggests that authors have a specific role in a modern society of shaping the knowledge with which society interacts, producing rudimentary theorising about such matters as the use of computers. Nevertheless, the extremes of the opinions of the authors writing in this field needs further exploration, particularly, for example, the legitimising of psychological terms applied to machines and the

general acceptance of machines' capabilities as a model for human 'thinking' (c.f. Boden 1977). One of the extreme views is the notion by George (1979) that machines will ultimately have the intellect to subjugate humans and dominate them. This notion is also reflected in the implication that the world will be a place so hostile that human beings have to be replaced by machines to carry forward their accumulated intelligence. This by implication suggests that machine 'thinking' and human 'thinking' are synonymous or perhaps indicating that machine 'thinking' will be superior to human thinking.

A further issue is the general legitimation of the economic imperative for continuing to adopt computer technology in order to create wealth (c.f. South Australian Council on Technological Change, 1983). In many cases the premise of such beliefs were not established. The dependency of society on economic solutions rather than other alternatives which may reduce social upheaval is scarcely examined.

The uncritical acceptance of such views generally suggests a reductionist approach which seeks rapid solutions to political problems.

However, the writers' theories may also be limited by the boundaries created by theories generally held within society such as the tendency towards the technological and the economic solution to problems referred to by Barrett (1978).

An examination of the predominant issues identified by the literature indicates three broad categories into which they can be subdivided. These categories also reflect Berger and Luckmann's dialectical model for the construction of reality.

For example, the effects of computer technology on:-

- (1) The external environment. This includes such matters as changes to work, schooling, weapons and services such as banks. (Coombs and Green 1980, Evans 1979, Naisbitt 1984)
- (2) The individual or internal psychology. This includes the responses of individuals to technology such as fear, avoidance or attraction. (Shallis 1984, Turkle 1984, Frude 1988, Weigenbuam 1976 and Boden 1977).
- (3) Responses or reaction to the imminent effect of the technology. This can best be described as the deliberate attempt to modify or react to the perceived effects of the environmental changes of (1) above, as discussed by Naisbitt 1984, Cooley 1980, or individual changes (2) above, as discussed by Papert 1980 and Frude 1983.

Figure 15 sets out the relationship between these three areas.

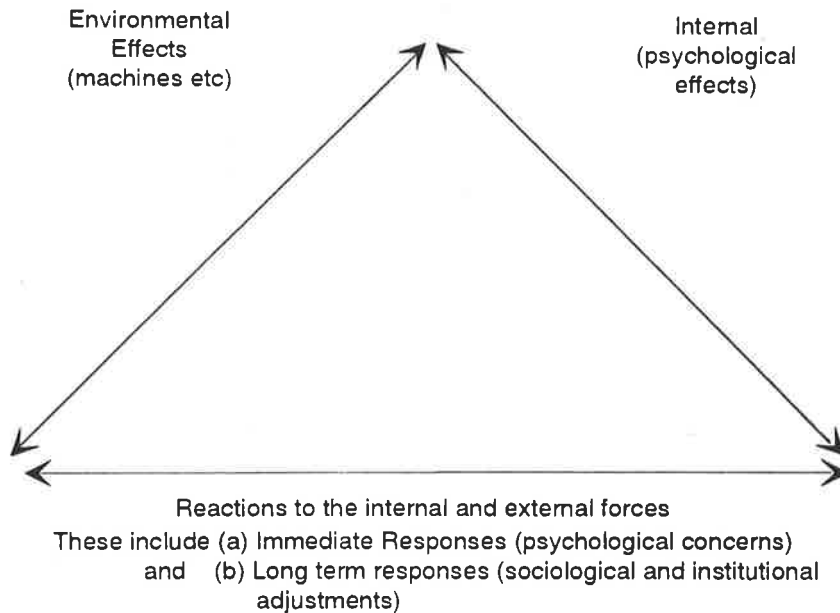


FIGURE 15: RELATIONSHIP BETWEEN THE FORCES OF ACCOMMODATION

Within the third axis of this triangle of forces exists the measured, considered, long term responses from the institutional structures created to prepare society for the future. In here would be found the organisational responses to computers, for example, by the educational bureaucracies. According to some of the authors (Papert 1980, Bork 1985) the structures previously considered appropriate are no longer adequate to prepare for the universal changes envisaged by them. These authors have chosen to embrace the technology as an answer to many of the other problems confronting schooling, for example, cost, curriculum content, methodology etc.

Table 2 below, summarises the theorising by educational authors about the use of computers for educational purposes.

TABLE 2

SUMMARY OF THEORISING BY EDUCATIONAL AUTHORS

SOURCE OF BELIEF	BASIS FOR BELIEF	LEGITIMATING BELIEF	CONCEPTUAL MACHINERY 'VALUE'	CONCEPTUAL MACHINERY 'MAINTENANCE OF INSTITUTION'	NOTES - REIFICATION - CONCEPT.MACHINERY - LEVEL OF THEORISING
Authors seeking to construct alternative models of schooling through computers.					
PAPERT (1980)	Children not learning along developmental lines.	Computers will enable the learning environment to be modified to support learning.	Return to the individual the ability to determine the pattern of education.	Technology of computers can be developed to better integrate education for individuals.	Theories highly explicit. Alternative views for learning.
HEAFORD (1983)	Education must change to equip students for technology-based society.	Computers will provide the basis for a new learning system.	Individuals could better learn by the use of computers outside of schools.	Schools should concern themselves with accreditation and learning arrangements outside the institution.	Explicit theories. Alternative theory of learning with most learning taking place outside of schools.
BARKER & YEATES (1985)	Education cannot escape developments of technology.	Computers can:- enrich learning environment, enhance learning process, make learning more available, be cost effective.	Process of education can be improved through the use of technology.	Computers should be used in institution of education. Computers can make good teachers.	Theories explicit. Integrated view of computing into education.

TABLE 2 CONT.

SOURCE OF BELIEF	BASIS FOR BELIEF	LEGITIMATING BELIEF	CONCEPTUAL MACHINERY 'VALUE'	CONCEPTUAL MACHINERY 'MAINTENANCE OF INSTITUTION'	NOTES - REIFICATION - CONCEPT.MACHINERY - LEVEL OF THEORISING
BORK (1985)	Education systems were in decline and required change of direction.	Computers will become the dominant delivery system in education at all levels.	The future of industry and maybe society will depend upon computers. Equity of computer access will be a problem governments must address.	Institution of schooling might not survive. Computers are the most practical way to establish new educational systems.	Theories explicit. Alternative view of changes to education. Does not support institution for its own sake.
O'SHEA & SELF (1983)	Computers could improve education.	Computer knowledge needed for present and future technological development. Computers could improve learning process.	Computers remove drudgery from learning.	The institution of schooling was not coping well with the technology of computing.	Theories explicit. Alternative view of way to improve learning. Raises concern about ability of schools to change.

TABLE 2 CONT.
SOURCE OF BELIEF

Authors seeking to integrate computing into the existing system of schooling.

COBURN, KELMANN, ROBERTS, SWYDER, WATT & WEINER (1982)

CONABERE AND ANDERSON (1985)

BASIS FOR BELIEF	LEGITIMATING BELIEF	CONCEPTUAL MACHINERY 'VALUE'	CONCEPTUAL MACHINERY 'MAINTENANCE OF INSTITUTION'	NOTES - REIFICATION - CONCEPT.MACHINERY - LEVEL OF THEORISING
Computers are inevitable in schools for society.	<p>Teachers need training.</p> <p>Easily used computers needed.</p> <p>Suitable goals required.</p> <p>Computer learning potential needs to be used.</p>	<p>Schools needed to respond to computer technology with some awareness of social problems which might accompany their introduction to schools.</p>	<p>Parents would not wish to deprive children of experience of schools.</p> <p>Teachers needed to educate themselves to maintain the institution.</p>	<p>Evidence for rudimentary level theories.</p> <p>Cautious response to pressure for change.</p> <p>Raises issues that educators cannot expect assistance from outside the institution.</p>
<p>Disaffection of students and inability of schools to respond to need for change.</p> <p>Schools conservative. Schools never had competition.</p> <p>No commitment from Government for improvement.</p> <p>No research and development to provide direction.</p>	<p>Teaching methods must improve and change to meet current needs.</p> <p>Computers can enhance learning.</p> <p>Students showed increased motivation etc.</p> <p>Students may learn to 'think about computing'</p>	<p>Schools must provide the service required by society.</p>	<p>If schools can change their technology society will want their services, if not, seek alternatives.</p> <p>Computers offer schools the means to reassert their importance to society.</p>	<p>Theories essentially rudimentary level.</p> <p>Seeks to maintain the institution.</p>

5.2.1 Discussion of the Theorising by Educational Authors

Although all the authors views had in common the use of computing in education, they differed fundamentally in the theories they held about education.

Two extremes can be identified:-

- (a) Those who believed that the computer would become the dominant delivery system in education and had the potential to replace the institution of schooling, and
- (b) Those who believed that the computer was a powerful learning tool which must be integrated into the existing institution of schooling.

Papert, in particular raises a technological answer to the 'de-schooling society' argument posited by Illich (1971), whereas Conabere and Anderson, and Coburn and associates believe that the computer gives teachers the tool which will enable them to return the institution of schooling to a place of importance in society. However, all the authors offer 'theories' which accept the computer as a necessary and essential medium to revitalise education.

However, educational writers are not the only ones involved in developing and creating the knowledge required to shape the future. As already discussed, writers have contributed to the process with various controversial views but other powerful sectors such as politicians, political parties, employers, unions and the media are each contributing to the debate in some way.

Nor are they likely to be the only ones creating theories of the future. School administrators, parents, teachers and students, although their thoughts are perhaps not so well articulated as those of the authors, may also be creating tentative theories about the place of computing technology in education and also responding to the immediate perceptions of how this technology may affect them personally.

The question remains, what reality, assuming that different realities are held by different groups, is accepted by teachers, parents and students? This will be investigated below.

5.3 THE MEDIA

An examination of the printed media reveals a general lack of analysis of the role of technology in education. The main South Australian papers, *The Advertiser*, *News* and *Sunday Mail* reported on computers and schooling but tended to provide brief details of events throughout the period from late

1986 until 1992. Early reports focussed on Government funding arrangements for the purchase of computers, political statements, administration of schools, the promotion of computers for schools and education purposes and the promotion of major computer companies.

Earlier reports were clearly rudimentary and generally disjointed. For example, discussions on funding arrangements by State Government and parent associations were reported in *The Advertiser* on 21 August, 1986, 28 February, 1987 and 1 May, 1987.

Political statements promoting the use of computers for education were reported on 22 July, 1988, 4 July, 1991, 26 June 1987 and 31 July 1989. *The News* printed a statement from a member of the opposition on 30 August, 1989 where he claimed that some districts were being discriminated against due to the lack of funds for computer equipment. The argument implied that students were deprived of future opportunities. *The Advertiser* presented details about the use of computers for administrative purposes and for networking between schools with low enrolments in specific areas such as in some music and science subjects and how with the use of appropriate computer technology students could still be taught the subjects of their choice by linking with a teacher in one of the locations offering that subject.

This solution was reported on 4 March, 1986, 22 April, 1986, 18 June 1987, 2 November, 1987, 23 June, 1989 and for Catholic Education 3 October, 1989.

The greatest attention given by the media addressed the promotion of computers. Chronologically this took place on 6 November, 1988 in *The Advertiser*, on 23 February, 1989, 25 May, 1989, 27 May, 1991, 29 May, 1991, 14 June, 1991 in *The News*; on 1 June, 1991 in *The Advertiser* and 25 May, 1992 in *The News*.

In reports in *The Advertiser* on 29 September, 1990, theorising was presented which claimed that the number of teachers should be reduced in order that money could be redirected to the purchase of computers on which students could learn themselves. Although this theorising was contentious it was not followed up with any similar arguments until 1992. In particular, this article advanced theorising on a number of issues including a change in the knowledge required for future employment needs which required greater skills of problem solving and decision making, that children should be introduced to computers from the age of five years, that computer use makes children think differently (that is, enables them to map their thinking), that much greater use will be made of technology for learning, that the role of teachers will change considerably and that those children who were not competent in computer skills would be disadvantaged in life. Although none of these theories were elaborated to any great extent it did suggest that the scope and level of theorising presented in the printed media had advanced considerably since 1987. However, a concerted attempt to provide a continuous and detailed explanation of computers for educational purposes was not provided in these papers. This argument was clearly supporting computer company interests.

Much more confident theorising was evident on 16 May, 1992 when The Advertiser presented theories about the skills required by children for the twenty first century and, in particular, claiming that parents can no longer leave learning and the future requirements to teachers but must take responsibility in the home.

Exceptions to this position were, found in *The Australian* and *The Age*. These newspapers recognised the role of technology in society and devoted a section of the paper to the impact of computers on sectors of society such as business, manufacturing and education. However, the supplement on education, introduced by *The Australian* at the end of 1985, was short lived and was discontinued towards the end of 1987. It was significant that the newspapers introduced these topics at approximately the same time as Governments, Political Parties and Unions were releasing policies on computing in education. The newspapers discerned a level of interest by the community and moved to provide information in this field.

Although the section on computers in education was removed from *The Australian*, the influence of technology as an item of news may be increasing. *The Advertiser* (Adelaide) announced, June 1989, that it would also include a supplement on the topic. However, it was important to recognise that the market penetration of these papers was relatively low.

For example, the average circulation of *The Australian* (1987-88) was 0.9% of the population, based on ABC data source. Even when using readership figures of those older than 14 years, the market penetration only represented 5.3% of the population. According to data provided by *The Australian*, the reader profile, based on a Morgan survey, October 1987 - September 1988, showed that the sex of its readers was 66% male and 34% female, 37% of its readers were aged between 35-49, most of its readers were professionals of which 38% had university degrees. Such a socio-economic analysis would tend to suggest that this group would have had considerable influence in decision making.

The content of *The Australian* was examined over the twelve month period (1986) to provide some indication of the weight placed on the views of different theorists by the editors at a time when the introduction of computers into schools was relatively new. It was found, for example, that little comment was included about the theories of parents or students. Two articles about parent associations discussed the disadvantage to students if they could not access computers. Far more prominence was given to the theories of Governments (12 July 1986, 20 May 1986, 6 May 1986, 18 February 1986, 3 June 1986, 20 May 1986), Government agencies, academics, writers, teacher educators (27 May 1986, 18 February 1986, 18 March 1986), teachers (15 July 1986, 17 June 1986) and equipment suppliers (29 April 1986, 15 April 1986, 26 November 1986) as the main source of information on computers, in education.

In the following section I present an analysis of the theorising of each of the above groups as their views were presented in the media at the early stages of the construction of knowledge about computers in schools.

The purpose of this approach was to consider the theories as selected by the media for publication and hence determine the direction generally presented by the media as an influential body in its own right. That is, the media was able to report selectively what it thought was important and as a result display their own theorising.

5.3.1 **Analysis of Media Reports About Government Theorising**

Although the theorising by governments was difficult to analyse from the media it was clear that the directions taken towards the role of computers in education was similar throughout the western world.

Government theorising was essentially presented as rudimentary and mainly addressed the allocation of resources for computers to be placed in schools. Examples of such theorising were found in *The Australian*, Tuesday, 3 June, 1986 and *The Australian*, Tuesday, 16 May 1989. In the first instance the European Economic Committee's DELTA Program (Developing European Learning through Technological Advance) proposed to spend an estimated 100 million pounds to promote its project. In the second, the British Government proposed to get as many computers in schools as fast as possible.

In Australia, the Victorian Government was reported to be investing \$20 million to make computers a priority in education.

Computers will be used to assist in almost all subjects at primary and post primary schools - for example in language development, to assist in gathering data, in maths and science, or for simulation exercises in economics and social sciences (*The Australian*, Tuesday 18 February, 1986).

The Federal Government was also reported to have allocated \$36.8 million to disadvantaged schools to ensure that poor schools did not miss out on the technology. The South Australian Leader of the Opposition also stressed this concern in his theorising about the need for access to computing to avoid a future in which a 'new elite' was created who could take advantage of computing knowledge (*The Advertiser*, 22 July, 1988).

Perhaps the clearest aspect of political theorising was given by the Leader of the Opposition when he was reported to have said that

... greater emphasis on computer education in schools would also lead to a more meaningful link between school and work (*The Advertiser*, 22 July, 1988).

From the previous examples it can be demonstrated that governments at all levels were legitimating the importance of computing technology to schools and also the importance of schools in teaching

computing within the curriculum. Furthermore, from the reports of government representatives there appears to be a considerable degree of reification of the knowledge about computers.

5.3.2 Media Reports About the Theorising of Government Agencies

Government agencies of various kinds including Education Departments were reported in the media with reference to a broad range of topics associated with computing in education. Principally, their concerns were best described as rudimentary theories taking into account such matters as the stage at which students should be introduced to computers (*The Australian*, Tuesday 17 June, 1986), the need to encourage women to take a greater interest in computers (*The Australian*, Tuesday, 26 November, 1985 and *The Australian*, Tuesday, 20 May, 1986), and who uses the computers in schools (*The Australian*, Tuesday, 4 March, 1986).

The need for parents to become aware of the technology was reported in *The Advertiser* on 26 September 1982, 13 December, 1986 and 5 September, 1987. Evidence of more elaborate theorising focussed on the use of computers to improve the link between schools and work. This was reported in *The Advertiser*, 22 July, 1988, in *The News*, 29 August, 1989 and 8 July, 1991 and the *Sunday Mail* on 5 February, 1987.

Reports addressing the ways in which students will be better prepared for the future as a result of learning to use computers and arguing that those students who begin to use computers at a young age, namely six year olds in particular, would develop skills required for the twenty first century. These arguments were advanced in *The Advertiser* on 9 June, 1987, 3 December, 1991 and in *The News* on 15 February, 1991 and 20 September, 1991.

The News of 29 August, 1991 presented a report on teachers keeping up with the technology by learning what could be achieved on computers and how computers might be applied in education. However, *The News* on 29 September, 1990 presented a story which claimed that the benefits to education of computers far outstripped the reality of what was achieved but concluded that computers were good for education regardless of these shortcomings. This appeared to be the only critical report presented in the South Australian printed media throughout the period from 1987 to 1992.

From the media reports there seemed to be little pressure to legitimate computing into education by government agencies even though theories about a number of problems were canvassed.

5.3.3 Media Reports About the Theorising of Teacher Educators

Teacher Educators on the other hand, seemed far more concerned either about legitimating computer education in schools or alternatively pointing out the fallacy of such approaches. A strongly worded argument about the need for an educational revolution based on computer technology was expressed in an article in *The Australian*, (Tuesday, 15 July, 1986) along with one from *The Australian*, (Tuesday, 6 May, 1986) which argued for teachers to be trained in computing. In another reference, *The Australian*, (Tuesday, 18 March, 1986) the point was made that teachers were to be blamed for the disillusionment of students towards education. All articles acted to legitimate the need for change and pointed to the computer as the vehicle for such change.

Other perspectives such as software bias and concerns about using computers for education were expressed in *The Australian*, (Tuesday 27 May, 1986) and *The Australian*, (Tuesday, 6 May, 1986).

A strongly argued case was found in *The Australian*, (Tuesday, 27 May, 1986) which challenged the widely held assumption by parents that they needed to be concerned about students' access to computers. This was a deviant position running against the mainstream of media reports which, in general, supported the use of computers for educational purposes and although expressing caution, legitimated the inclusion of computers into schooling.

5.3.4 Media Reports About the Theorising of Suppliers

Suppliers of computing equipment were in a unique position within the media reports as such reports appeared to be the main avenue in which they expressed their theorising about computers in schools.

The theorising by software writers and computer suppliers was quite extensive. Examples of theorising about computer games was reported in *The Australian*, (Tuesday 26 November, 1985), *The Australian*, (Tuesday, 29 April, 1986) and *The Australian*, (Tuesday 15 April, 1986).

The software writers challenged the legitimate role of teachers and argued that their own work was highly educational. However, not all software writers or computer suppliers took such a stand. *The Australian*, (Tuesday, 18 February, 1986) suggested that the technology was moving too fast for teachers and the educational system. Nevertheless, the view was expressed that equipment suppliers had expectations for dramatic change in how educators teach. (*The Australian*, Tuesday, 1 July, 1986).

Likewise, in *The Australian*, (Tuesday, 11 February, 1986) it was claimed that computers were inevitable and, therefore, educationally there was no choice but to accept their use for educational purposes.

All these reports had in common the legitimization of computers for educational use. Furthermore, educational suppliers were also legitimating their own role in providing the equipment necessary for this transition.

5.3.5 Media Reports About Teacher Theorising

In general terms, teacher theorising in the media concentrated on pragmatic matters. For example teachers were asking whether keyboard skills were now necessary, *The Australian*, (Tuesday 13 May, 1986). Vocational relevance also appeared to be an important item reported in *The Australian* (Tuesday 17 June, 1986).

Amidst these pragmatic considerations the reports suggested that teachers were also questioning the future of teaching. An example cited in *The Australian*, (Tuesday 15 July, 1986), had a teacher exploring the question - can computers take over from the traditional school environment? This level of theorising was rare in the media reports where in letters to the editor *The Australian*, (Tuesday, 18 February, 1986) the role of the teacher was firmly legitimated with the words - "Education professionals will never be supplanted". However the discussion raised the subject of the role of teachers indicating that their future was an issue.

An analysis of the theorising of the media about computers in education now follows in Table 3.

TABLE 3

SUMMARY OF THEORISING FOUND IN THE MEDIA

SOURCE OF BELIEF	BASIS FOR BELIEF	LEGITIMATING BELIEF	CONCEPTUAL MACHINERY 'VALUE'	CONCEPTUAL MACHINERY 'MAINTENANCE OF INSTITUTION'	NOTES - REIFICATION - CONCEPT.MACHINERY - LEVEL OF THEORISING
MEDIA REPORTS (1986) ON:- GOVERNMENTS	Computers will assist education and make education and work more relevant.	Resources must be made available to place computers in schools.	Schools must prepare students for future technology and its use.	Schools as institutions of government were valued.	Theories rudimentary levels. Knowledge about computers appears to be reified.
GOVT. AGENCIES	Concerns about the levels at which students should be introduced to computers. Lack of interest by women. Who uses computers in schools.	Little pressure for legitimization of computers.	Uncertainty about need and importance.	Not questioned.	Theories appear to be at incipient level.
TEACHER EDUCATORS	Concern expressed about need for computers in education and training for teachers.	Educational methodology must be changed.	Schools need better quality teachers.	Schools require computers for educational purposes.	Most theories at rudimentary level. Some views expressed about need for computers competing with traditional views.

TABLE 3 CONT.

SOURCE OF BELIEF	BASIS FOR BELIEF	LEGITIMATING BELIEF	CONCEPTUAL MACHINERY 'VALUE'	CONCEPTUAL MACHINERY 'MAINTENANCE OF INSTITUTION'	NOTES - REIFICATION - CONCEPT.MACHINERY - LEVEL OF THEORISING
COMPUTER SUPPLIERS	Computer games are educational. Technology moving too fast for teachers.	Computer programs have an educational role.	Private industry has a role in education.	Uncertain position about role of schooling.	Theories at rudimentary level.
TEACHERS	Need for keyboard skills. Vocational relevance. The future of teaching.	Legitimation statements not clear.	Questions about role of teachers.	Uncertain.	Theories generally rudimentary. Some questions about the future role of teachers in a computing environment.

***Reality Definers in Society :
Theorising by Employers, Computer
Suppliers & Educational Administrators***

6. REALITY DEFINERS IN SOCIETY : THEORISING BY EMPLOYERS, COMPUTER SUPPLIERS AND EDUCATIONAL ADMINISTRATORS

6.1 SUMMARY OF INTERVIEWS HELD WITH EMPLOYERS, COMPUTER SUPPLIERS AND EDUCATIONAL ADMINISTRATORS

6.1.1 Discussion of Interviews Held with Employers, Computer Suppliers and Educational Administrators

Interviews were held with each of the above groups to determine the theorising and the process of knowledge construction regarding the application of computers to education and schooling (Appendix 5). The three groups were selected for interviews because of their influential role in the society and their ability to influence the directions taken in schools. (See Methodology, page 84)

An independent examination of the theorising of each group follows. The groups will be examined to establish the 'world' views of the theorists, the nature of their theorising, the level of the theorising (ie Incipient, Fundamental, Explicit or Symbolic), the application of legitimisation statements and evidence of reification.

The full interview transcript followed by a summary of each of the groups in which appropriate sections have been aligned to assist either interpretation and comparison is found in Appendix 11, 12 and 13. A more detailed examination of the theories held by each group follows in Appendix 11, Appendix 12, and Appendix 13.

The following Table 4 has been arranged to enable a comparison of the theoretical propositions held by Employers, Computer Suppliers and Educational Administrators and to assist with the analysis and discussion of their theories.

SUMMARY AND CONSTRUCTION OF KNOWLEDGE ABOUT THE TECHNOLOGICAL FUTURE
Comparison of Knowledge Constructed by Educational Administrators, Employers and Computer Suppliers

TABLE 4

EDUCATORS		EMPLOYERS		COMPUTER SUPPLIERS	
Technological Work Impact	<ul style="list-style-type: none"> - Technology will force changes at a rapid rate. - Information will be easily accessible via computer in a variety of forms. - The technology will be transparent (invisible) in many cases. - Homes will have computers for recreational and employment purposes. 	Technological Work Impact	<ul style="list-style-type: none"> - Greater use of technology in the future. - Greater levels of automation will result. - Job profiles will change. - Work will become more integrated and more highly skilled. - Equipment will become easier to use (user friendly). - Workers will need to be very conversant with computers. - Skills more basic than assumed (keyboard skills). - Children should be taught use of computers when very young. 	Technological Work Impact	<ul style="list-style-type: none"> - Computer technology will precipitate great change. - Some people will react against technology. - Most homes will have computer technology. - Computers will be used to link homes to offices, shops, businesses etc. - Computers will be used to link people directly. - Some aspects of life may involve virtual reality (simulated reality). - People will use computers to teach themselves (ie languages, crafts, leisure activities). - Teachers will become consultants to learning rather than dispensers of information.

TABLE 4CONT.

COMPARISON OF KNOWLEDGE ABOUT THE TECHNOLOGICAL FUTURE

EDUCATORS		EMPLOYERS		COMPUTER SUPPLIERS	
Economic and Organisational Impact	No knowledge presented	Economic and Organisational Impact	<ul style="list-style-type: none"> - Computer technologies will be damaging. - Organisations will reduce in size. - Middle management will be eroded. - People will have less work time. - Unemployment will rise. - Some people will have a very high standard of living. - Others will have a poor standard of living and wait to be used. 	Economic and Organisational Impact	<ul style="list-style-type: none"> - Computer technology can assist in solving the world's problems. - Computers will become the basis for operations in industry. - Industry must build on computer technology, national development and competitiveness depend upon adopting technology. - All functions within the work environment will be integrated through computer technology. - People who work in information systems will be able to work from anywhere including home. - Working from home solves ecological problems of pollution and assists in conserving resources (ie oil). - Government policies and educational policies are not supporting appropriate development.

TABLE 4CONT.

COMPARISON OF KNOWLEDGE ABOUT THE TECHNOLOGICAL FUTURE

EDUCATORS		EMPLOYERS		COMPUTER SUPPLIERS	
Sociological Impact	<ul style="list-style-type: none"> - The technology human interface is a problem. - Employment opportunities will depend on technological understanding and skills. - Informational technology will enable many students to research information at the same time which will change the concept of education from teaching to learning. - People will become comfortable with technology in the home but be suspicious of technology at the macro, social levels (government). - Schools suffer from criticism in a macro sense although parents satisfied at their local level. - Invasion of privacy will not be an issue because people only have the capacity to deal with so much information. - Legislation to protect privacy may be able to be reduced if information is held electronically. - Governments have more 	Sociological Impact	<ul style="list-style-type: none"> - Rate of change will increase. - There will be greater use of technology (computers). - No perceived control over the increasing use of technology. - Concern expressed about the isolation of some people due to the nature of the technology. - People need to maintain social interaction now found at work places. - Concern for privacy of information. 	Sociological Impact	<ul style="list-style-type: none"> - Computer technology will greatly change people's lives. - Many people will work from home. - Many work tasks will be replaced by computer. - Job sharing is likely to develop. - Greater flexibility of work and other activities (time of work etc). - More time for social activities. - Computers will be liberating. - Direct interaction is needed and would be for social reasons only.

TABLE 4CONT.

COMPARISON OF KNOWLEDGE ABOUT THE TECHNOLOGICAL FUTURE

EDUCATORS	
Relationships	<ul style="list-style-type: none"> - Computers can increase interdependence and they can also lead to independence. In the education sector it should be used for improving interdependence and sharing of information. - The capacity to increase interdependence should lead to better personal relationships between teacher and student. - Computers will enable students to become more independent as learners thus developing their self esteem and improved relationships. - Learning via computers will reduce human capability of socialisation. - Classes may become slightly smaller. - Many teachers not comfortable with the technology. - Computer learning might be more effective but can be less flexible than education.

EMPLOYERS	
Relationships	<ul style="list-style-type: none"> - Relationships would not be damaged and may be improved due to additional time teachers can give to their students. - Students learn as much from the behaviour of teachers and interaction from them as educational content. - There is some risk that students may reduce their listening skills.

COMPUTER SUPPLIERS	
Relationships	<ul style="list-style-type: none"> - Computers will teach facts. - Relationships will mature and teachers and students would discuss issues at a higher level than at present. - Teachers will become knowledge navigators, facilitators. - Computer will relieve teachers of the burden of information giving.

TABLE 4 CONT. CONSTRUCTION OF KNOWLEDGE ABOUT THE CONTROL OF TECHNOLOGY IN EDUCATION

EDUCATORS	
Learning Ability	<ul style="list-style-type: none"> - Students will learn how to access and use information, problem solve and how to work at analysis and synthesis rather than repetition.
Motivation	<ul style="list-style-type: none"> - Students writing improves when they use keyboards. - For some students the computer can be demotivational. - Removing the drudgery from learning by the use of computers is motivating. - Total reliance on individualised learning will produce more intolerant people.

EMPLOYERS	
Learning Ability	<ul style="list-style-type: none"> - Computers will speed up the learning process and give them access to more information. - Education provides for more needs than technology. - Some students will not be able to learn successfully by computers.
Motivation	<ul style="list-style-type: none"> - Computers will motivate children. - Computers themselves will not motivate but their use may motivate due to the desire to gain more information. - Their motivational effect is because they are new - but after a while will not be any different from pen and paper.

COMPUTER SUPPLIERS	
Learning Ability	<ul style="list-style-type: none"> - Learning ability will be enhanced.
Motivation	<ul style="list-style-type: none"> - It will motivate students especially those who are gifted or slow. - Only those students who are taught well.

TABLE 4 CONT. CONSTRUCTION OF KNOWLEDGE ABOUT THE CONTROL OF TECHNOLOGY IN EDUCATION

EDUCATORS	
Creativity	<ul style="list-style-type: none"> - Children who use computers are more creative than those who do not. - Computers are limiting to creativity due to the lack of freedom in the technology. - The education system is restricting children's creativity.
Equity	<ul style="list-style-type: none"> - Public schools are there to provide access to certain levels of technology regardless of economic circumstances.
Gender Effects	<ul style="list-style-type: none"> - Without controls applied boys are more attracted to computers than girls. This bias is reflected in society.

EMPLOYERS	
Creativity	<ul style="list-style-type: none"> - Computers will not enhance creativity.
Equity	<ul style="list-style-type: none"> - Inequity will always exist with respect to resources; but governments through schools must enable students to gain at least limited access.
Gender Effects	<ul style="list-style-type: none"> - Computing does not differentiate between the sexes.

COMPUTER SUPPLIERS	
Creativity	<ul style="list-style-type: none"> - If managed well can enhance creativity, especially if schools stay at the leading edge of technology.
Equity	<ul style="list-style-type: none"> - Computing will not have any impact on equity issues.
Gender Effects	<ul style="list-style-type: none"> - Will provide a common platform. - A problem that has to be addressed. Girls have to have more time on them (computers). - I think society is still saying that science is for boys and needlework is for girls.

TABLE 4 CONT. CONSTRUCTION OF KNOWLEDGE ABOUT THE CONTROL OF TECHNOLOGY IN EDUCATION

EDUCATORS	
Career Needs	<ul style="list-style-type: none"> - Technology cannot be stopped. - People cannot win against technology. - All people will be affected. - Fear that technology is de-skilling. - Many skills are throw away skills. - Need to move skill levels up away from the mechanised aspects of work.
Relevance to Subjects	<ul style="list-style-type: none"> - Information is the basis of all disciplines and the computer is a generic information technology suitable for all subjects.

EMPLOYERS	
Career Needs	<ul style="list-style-type: none"> - Career understanding will not improve as it comes from areas outside of schools. - Careers databases help students. - Many jobs will require using the computer as much as reading and writing skills.
Relevance to Subjects	<ul style="list-style-type: none"> - Computers more relevant to the science disciplines. - Computers are relevant to all disciplines. - Computers presently are more relevant to some subjects than others but in future will be an extension of the typewriter and calculator.

COMPUTER SUPPLIERS	
Career Needs	<ul style="list-style-type: none"> - The way the school system is going it will be more difficult to move people into menial jobs. - Technology enhances people's careers. - 50-60% of jobs not invented yet.
Relevance to Subjects	No knowledge presented

EDUCATORS	
Redundancy of Knowledge	<ul style="list-style-type: none"> - Curriculums must be constantly reviewed to relate to the society in which the schooling is located. - Education should provide a common set of experiences upon which further learning can develop. - All children do not have to do the same thing. The focus must be on the skills that are used rather than the content.
Efficiency and Effectiveness	<ul style="list-style-type: none"> - Schooling is about personal relationships. - If the teacher focussed on managing and monitoring learning they may get better outcomes in terms of student performance.

EMPLOYERS	
Redundancy of Knowledge	<ul style="list-style-type: none"> - There is a need to replace the old with the new. - Problem solving process is more important than solving the answer.
Efficiency and Effectiveness	<ul style="list-style-type: none"> - Computers will enhance the efficiency and effectiveness of schools. - If teachers had computer skills schools would be more efficient and effective. - Efficiency should improve. - It's not the students who cannot cope it's the teachers.

COMPUTER SUPPLIERS	
Redundancy of Knowledge	<ul style="list-style-type: none"> - With access to information important to teach way of resolving problem. - Technology needs to be introduced at Grade 1.
Efficiency and Effectiveness	<ul style="list-style-type: none"> - Will free up teachers, not necessarily reduce the number but they will need new skills. - New delivery systems will cut out whole levels of infrastructure.

TABLE 4 CONT. CONSTRUCTION OF KNOWLEDGE ABOUT THE CONTROL OF TECHNOLOGY IN EDUCATION

EDUCATORS	
Future Directions	<ul style="list-style-type: none"> - Public education provides access to all children regardless of their economic background. - Schools should be flexible enough for some children to be studying at home supervised by the teacher. - If the learning environment is enriched many of the present behaviour problems will disappear. - Society likes schools to be places where children are supervised and controlled by people who know what they are doing. - Schools ought to be places where leaning is managed but not be places of instruction. - Many of the behaviour problems stem from the home. - Teachers ought to perceive themselves as managers of learning rather than as custodians of children.

INDUSTRY REPS	
Future Directions	<ul style="list-style-type: none"> - Will stay as they are for next 20-30 years. - Will be technologically advanced. - Will have same organisational structure. - Buildings will be less relevant.

COMPUTER SUPPLIERS	
Future Directions	<ul style="list-style-type: none"> - Schools will be a mixture of private companies and public schools. - Learning will have to be individualised. - Schools will have to provide some of the social development. - Schools will not become irrelevant. - Teachers will manage learning. - Computers will test and assess. - Access to computers will be at schools but may be available in other formats. - Classes should span different age groups. - A lot to be gained from a computer orientated learning system. - Computer learning which directs students to varying exercises in various centres. - The lead should be provided by industry. - Industry has to set the goals.

TABLE 4 CONT.

CONSTRUCTION OF KNOWLEDGE ABOUT THE CONTROL OF TECHNOLOGY IN EDUCATION

EDUCATORS		EMPLOYERS		COMPUTER SUPPLIERS	
Beliefs Held About Social Response	<ul style="list-style-type: none"> - Most people have not made a decision about the use of computers in schools. Most only have a surface notion, change is not a conscious process for most people. - Most people believe that schools which use computers are better than those which don't. - Schools will use more technology. - Schooling must focus on socialisation and individual learning may create problems in this respect. - Education will be constrained by lack of resources to purchase the latest developments in computer technology. - Schools need substantial change in methodology. - Current environment discourages teachers from taking risks with use of the latest computer technology. 	Beliefs Held About Social Response	<ul style="list-style-type: none"> - Parents do not think about how computers should be used in education. - Parents expect computers to make their kids smarter. - Teaching may be taken over by computer programs. - Computing in schools is inevitable. - The society expects computers to be in schools because they are in society. - Technology is pushed as a competitive advantage between schools. - Students will be doing interactive work on a computer and therefore will get more out of it. - The potential of computer learning will be dictated to some degree by the investment put into software development by companies. - Schools will ultimately be reshaped but teachers and teacher unions will provide considerable resistance. - The fixed hours of schooling will be removed. - The teacher will act as a mentor to a group of students. 	Beliefs Held About Social Response	No knowledge presented

TABLE 4 CONT.

CONSTRUCTION OF KNOWLEDGE ABOUT THE TECHNOLOGICAL FUTURE

EDUCATORS	
Social Response	No knowledge presented

EMPLOYERS	
Social Response	<ul style="list-style-type: none"> - Schools used as child minding centres. - Society will not want home based learning. - Society will not allow education to be handled over to private companies. - Schools will form closer links with industry. - Closer links with industry will improve student motivation.

COMPUTER SUPPLIERS	
Social Response	<ul style="list-style-type: none"> - People do not understand how the computer can be used although many are concerned - There is the potential for society to be more in-human. - No choice about the use of the computers, it will be accepted as a tool. - Yes, schooling will be reshaped. (Industry has to do it) - Future full of hope on the one hand but for some people very frightening. - Teachers will lose control of the curriculum. They do not have control now. - Education will not be constrained, technologies will provide more opportunities. - Education will flounder unless government and industry develop the

6.1.2 Examination of Theorising by Employers

This examination is based upon the beliefs held within the group and is not concerned with the particular beliefs of individuals.

The particular 'world' of Employers was determined by analysing the purposes to which computers would be employed. The following applications were identified.

Computers would be used for:-

- increasing automation
- integrating work
- reducing the size of organisations
- reducing the levels of management
- reducing the time people work
- enabling work to be conducted from home.

Further, by examining the beliefs held regarding the casual effects of the application of computers the following consequences were identified. Computers will cause:-

- greater use of technology
- greater use of automation
- job profiles to change
- work to become more integrated and more highly skilled

- workers to require computer skills
- organisations to reduce in size
- a reduction in middle management
- a reduction in work time
- unemployment to rise
- some people to have a high standard of living
- others to have a low standard of living
- the rate of change to increase.

A similar approach was used to determine the concerns raised by the Employers about the use of computers. They are as follows:-

- damaging effects of wide application
- the level of unemployment and the consequential social effects
- isolation of some people
- privacy of information
- maintenance of social interaction.

The Employers presented a vision of the future which suggested that computers would be the dominant factor in life and, particularly, in the workplace. Although they believed that the application of technology would continue to expand and have a significant impact on the workplace they presented them as being essential and fundamental to the growth of industry and the economy.

However, they also demonstrated a high level of concern about the perceived social effects of their wide application.

A detailed examination of the theorising by this group revealed that the theories were predominantly incipient and fundamental, that is, they were generally statements which were self evident such as 'technology will increase', or, pragmatic statements which lead to concrete actions such as, 'computers will speed up the learning process by giving students more access to information'.

Legitimizing beliefs appeared to stem from the notion that technology must develop in order to fuel economic growth and, therefore, the basis of business activities. The conceptual machinery for such beliefs rest upon a value that technology must be implemented to maintain the necessary economic growth. Moreover, computers must be implemented throughout society in order to sustain economic growth even in the face of social and individual difficulties.

Legitimizing statements supporting such a view include,

"everybody else has to take up that technology regardless of the cost because it's a matter of survival,"

and,

"... for each manager or each person of a technical nature they will have to be fully conversant with the ability to use computers to get out of the jam we're in."

Employers broadly supported the wide introduction of computers for educational purposes but they were circumspect about the benefits to be derived from using computers to achieve specific improvements to behaviours such as creativity or to motivate students. However, when considering the future of schooling their statements generally legitimated the existing organisational structures, purposes and public control of education.

Equally, the Employers expressed explicit theories which legitimated the relationship between industry and schools, arguing that closer links were necessary. Employers also legitimated the role of technology in education by arguing that teachers must respond to the technology by using it in schools.

Some evidence of the reification of knowledge was apparent in the expressed belief that no control was perceived over increasing use of technology. There was a sense of helplessness about the effects of change by some of the spokespersons

"I don't think we have any control, I do fear that we have lost control as individuals over what is being done in the community."

The diagram below represents a simplified summary of the theorising about the future of schooling by Employers.

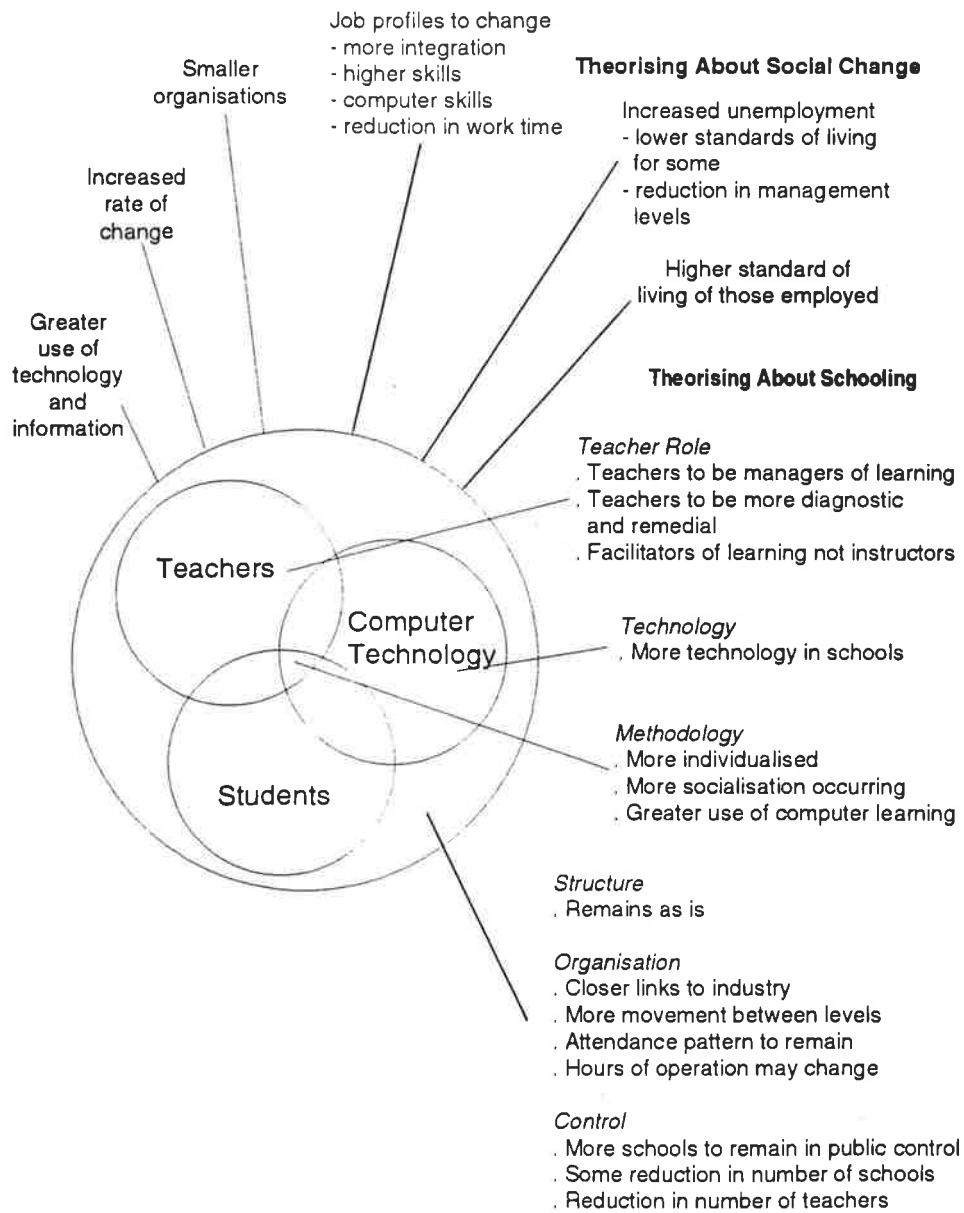


FIGURE 16: THEORISING ABOUT THE FUTURE OF SCHOOLING BY EMPLOYERS

6.1.3 Examination of Theorising by Computer Suppliers

A perspective on the 'world' of the computer suppliers can be defined as follows. Computers would be used for:-

- linking homes, businesses, shops, etc
- communications between people directly
- teaching/learning (self learning)
- solving world problems, eg pollution, resources, etc
- operating industrial plants
- integrating all elements of work
- working from home
- replacing people in dangerous environments
- increasing the flexibility of work.

Computers will cause:

- great change
- some people to react against the technology
- people to change the way they learn
- changes to the role of teachers
- changes in the operation of industry
- work to be more integrated
- job sharing
- changes to traditional work schedules and times.

Computer suppliers raised the following concerns about the use of computer technology:

- government and educational policies for development were not adequate.

Computer suppliers presented a vision of computers as the motivator of significant change in society to which they are most favourably disposed. Their theories were also much more global than other groups, suggesting that world problems, economic problems and domestic organisation would all benefit from the use of computer technology.

Theorising by the Computer Suppliers were also predominantly incipient and fundamental, however, their legitimating statements focused mainly on the application of the technology to educational tasks. For instance statements such as:-

"the computers will test and assess, the teachers will not"

and,

"I do not think there is any limitation, I think it's just a matter of commercial possibility."

All these statements reinforced the legitimate place of technology in education. At the same time Computer Suppliers were redefining the role of teachers.

Comments which defined teachers as consultants to learning rather than by the more traditional role of providing direct instruction and coaching. This approach justified the application of computers as information dispensers which can be found in statements such as,

"the volume of information and with the turmoil that education is in right now ... the teacher, I feel, will become, if I can use the term, it's not my own, a knowledge navigator, a facilitator, a leader."

The role of the computer was redefined in the following statement to that of the source of information,

"... it's more information, is landing on him. So more and more the computer will play the role to relieve him of some of that burden ..."

Similarly,

"... the computer will be teaching the facts ..."

Computer Suppliers were also suggesting that with information readily available through computers the purpose of education must change to focus on how to use information to solve problems rather than be absorbed in finding answers to set problems.

Many teachers would not cope with this new role claimed the Computer Suppliers. It would only be achievable following a massive relearning process. A more ambitious claim argued that people from industry may take up teaching roles,

"... teachers will not be suitable as teachers and maybe industry will be the teachers."

Industry should play an even more significant role according to two of the theorists. Their statements legitimated the role of industry to play the predominant role in redefining education.

When considered independently the theories were incipient or fundamental but when linked together a more coherent image emerged and the theories take on a more explicit form.

The data shows that the image presented by the Computer Suppliers was one in which schooling takes places in an environment of rapid change. Furthermore, schooling must prepare students to confront this environment.

Within the context of schooling the Computer Suppliers depicted teachers as struggling to cope both with the external environment and with the new roles which they perceived them to need. The perceived role was one in which computers were the main tool for both teaching and learning. Perhaps a more deviant position presented was that industry may be better prepared to deliver education than teachers.

Diagrammatically the theories of the Computer Suppliers can be shown as follows:-

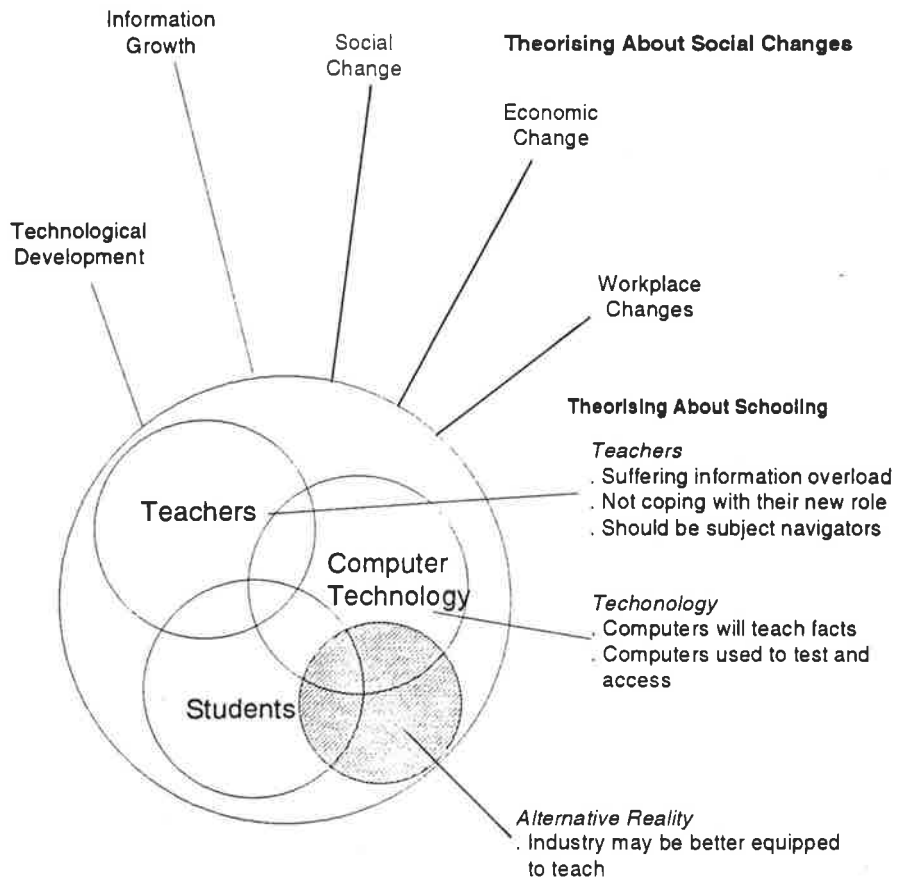


FIGURE 17: THEORISING ABOUT THE FUTURE OF SCHOOLING BY COMPUTER SUPPLIERS

6.1.4 Examination of Theorising by Educational Administrators

The 'world' of the Educational Administrator was defined by the following statements. Computers would be used for:

- accessing information
- recreation and employment in homes
- researching information by many students at the same time
- improving independence and interdependence of learning
- improving the effectiveness of learners.

Computers would cause:

- change at a rapid rate
- information to be easily accessible
- a problem for the human interface
- employment to depend on technological skills and understanding
- people to be comfortable with the technology in the home
- people to be suspicious of the use of technology by governments and organisations including education departments
- a reduction in legislation to protect privacy.

Educational Administrators expressed a concern for only one issue; that of the computer/human interface. This aspect appeared to be partly a response to their perception of how teachers had adapted to computers and to a lesser extent the student interface.

As their 'world' view suggested the Educational Administrators focused upon the more limited concerns of education rather than the global perspectives which defined the impact of computer technology on society. In a similar vein to the previous reality definers, the theorising by the Educational Administrators was predominantly of the incipient and fundamental type. Examples of this level of theorising were found in comments such as:-

"I don't know that a lot of teachers are yet comfortable,"
"... kids writing improves when they use a keyboard,"
"...we accept the telephone but most people do not know how it works", and
"the technology is not free enough at this stage."

In general terms the educators' views were more theoretical in nature than the Computer Suppliers or the Employers. For example,

"there is also a significant fear amongst the general community that technology is de-skilling and it's true that one becomes an operator of a machine where as one did what the machine did and, therefore had a set of skills."

Many of the statements by the Educators were clearly legitimisation statements, however, it was also possible to differentiate between the statements which supported the existing institution of schooling and those which attempted to consider alternative perspectives of schooling. In each case the educators appeared to be integrating the alternative definitions of reality into their 'world of meaning'. Their interpretation of technology was defined by the following statements:

"what technology does is give people access to information and enable them to massage and manoeuvre the information in new ways."

"... with technology at its current stage allowing students to use generic software or communication software to get access to information to process data and leave the curiosity to them ..."

"information technology is at the basis of the lot, every area of study and the computer is a generic tool."

In a similar way the role of technology in society was redefined.

"as technology provides opportunities for some of the more routine tasks which are undertaken within the manufacturing sector, for example, to be done with fewer and fewer people that, that liberates people, removes some people from the dead ending and restrictive activity."

"... society as a whole has got to bear the fact that we are looking at a change in our work ethic and I believe that there are people who are going to go to formal work, say what I am doing here now and there are people who are in different types of work such as people who may be classified as unemployed."

Education was being defined to accommodate the technology

"It ought to increase the capacity for teachers to enable students to be much more independent as learners."

The legitimization of schooling as an institution can be identified from

the following comments:

"schooling is about personal relationships and so you do need that interaction."

"I don't think it [computers] will make a lot of difference. If learning was just stuffing facts it might but it is about relationship and I don't think society will tolerate that much change."

"... if the teacher is still the monitor and the manager of the range of learning techniques that will still need teachers but maybe they may get better outcomes in terms of student performance."

"One thing schools can do is to provide a level of access to technology and information which is common to all children."

However, the following comments appeared to be attempting to integrate the technology into the institution of schooling without threatening the institution itself.

"There are huge changes in approach which teachers have to go through and I think that's going to be the thing which will impede the development."

"The system ought to be free enough so that if you have a number of students and parents who stay at home and work in this way and link the supervision with a leader."

"It's moving away from what I call the custodial view of teaching to the other end where it's giving kids the power and responsibility ..."

"I would like to think that the learning environment becomes more intimate and I think the outside shape remains the same."

This particular statement accepted the intrusion of computers into the institution but reinforced the belief that schools should not be drastically changed in structure or purpose.

Some evidence of reification of the knowledge was also found within the Educational Administrators beliefs. Comments such as,

"I don't think that is an individual teacher's role it is the system",

imply that the 'system' rather than the individuals who make up that system are responsible. However, in general terms the Educational Administrators show little tendency to rectify the knowledge they are creating.

A summary of the theorising of the Educational Administrators follows in a diagrammatic form.

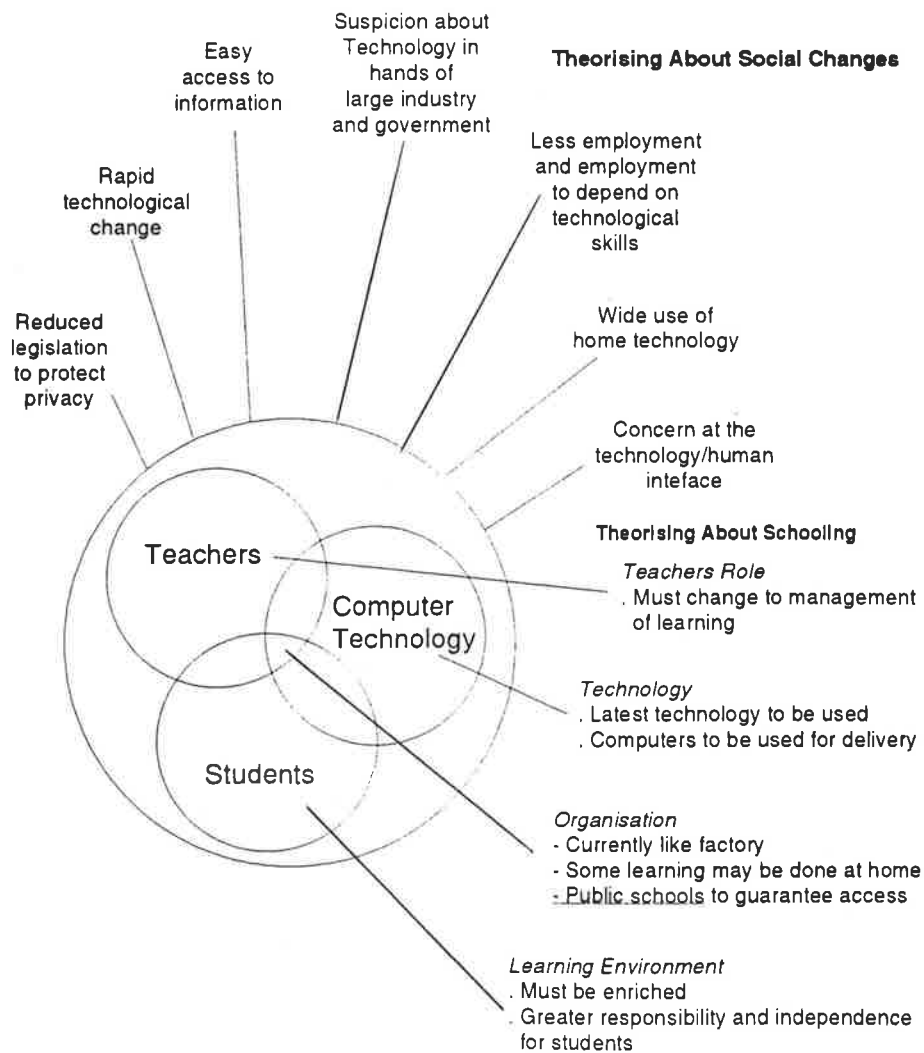


FIGURE 18: THEORISING ABOUT THE FUTURE OF SCHOOLING BY EDUCATIONAL ADMINISTRATORS

6.2 **COMPARISON OF THE KNOWLEDGE CONSTRUCTED ABOUT THE TECHNOLOGICAL FUTURE**

A simple comparison of the beliefs held about the use of technology in the future by Educational Administrators, Employers and Computer Suppliers indicated that they all believed that technology was going to precipitate great changes but generally, their theories were confined to their 'world' view.

For example, the Educational Administrators claimed that information would be readily accessible on computers; the Employers believed that automation would follow and that all workers would need to be conversant with the technology. The Computer Suppliers claimed that the technology would be widely available within the community linking homes, work places and businesses.

They also believed that the technology would become easier to use and would also be used for recreational and learning purposes. Theories about computers which expressed organisational aspects of the future were expressed by the Employers and Computer Supplier groups. The most notable feature of their theorising was the different attitudes adopted towards the future. For instance, the Employers appeared to view the effects of technology on the future relatively negatively while the Computer Suppliers provided an optimistic vision. Little else could be directly compared but the theorising of the Employers appeared to be based on their experiences, and

was at a relatively fundamental level, while the Computer Suppliers appeared to be much more explicit and relied upon theoretical assumptions. Both theoretical propositions were equally valid from the perspectives of the theorists.

Theories which addressed the sociological impact of computers on society were proffered by all three groups of reality definers.

A comparison between the groups raised a number of issues. The Educational Administrators identified the technology/human interface as a major issue. The Employers identified the isolation of users and the need to maintain social interactions usually found in the work places where computers are not presently used. Computer Suppliers, on the other hand, presented this issue as an opportunity to develop social relationships.

Employers identified the increasing use of technology as an issue while the Computer Suppliers admitted that many jobs would be replaced by computers and that job sharing would probably be the result. Employers also expressed a concern for privacy of information but the Educational Administrators claimed that privacy would not be an issue because people would not be able to cope with further information even if it was available.

The impression given by the theories of the Educators was that people would adjust and adapt to the technology. According to the Employers; the increasing influence of the technology was inevitable and that the social problems identified within the theorising of the Computer Suppliers were worth the sacrifice created by the introduction of the computer to gain the future benefits which would flow from its use.

6.3 COMPARISON OF THE CONSTRUCTION OF KNOWLEDGE ABOUT THE FUTURE OF SCHOOLING

6.3.1 Future of Schooling

When comparing the three groups a number of their beliefs were shared. The sharing of their beliefs does not mean that those beliefs are directly comparable due to the different 'worlds' which they occupy. Nevertheless, many of their beliefs were similar in intent.

All three groups shared a belief that public education would remain a substantial force in society and provide access to all children. The Employers argued that society would not allow education to be privatised. The Computer Suppliers emphasised that schooling would remain a mixture of public and private organisations.

The Employers made statements which suggested that the present structures of schooling would also remain unchanged for at least two or three decades.

On home based learning the Educational Administrators claimed that it should be flexible enough to be done at home under the supervision of a teacher. However, the Employers did not believe that society would allow such innovations.

The Computer Suppliers made no direct reference to home based learning but did reiterate that teachers would **manage** learning but not necessarily be the source of information.

Educational Administrators claimed that society wanted schools to supervise and control children where as the Employers emphasised that schools were used as child minding centres. This was not addressed by the Computer Suppliers but they did believe that schools would have to be responsible for some social development of students.

According to the Educational Administrators if the learning environment was enriched many of the behaviour problems would disappear. Employers claimed that if closer links were formed between schools and industry, students would be more highly motivated to learn. Computer Suppliers stressed the need for the direction of schooling to be provided by industry.

6.3.2 Role of Teachers

A comparison of the role of teachers appeared to be a little less defined. Educational Administrators believed that teachers should be managers of learning but not necessarily instructors of learning. This function was described by the Computer Suppliers as 'knowledge navigators'; somebody who guided students through their knowledge development. The Employers claimed that teachers should be more responsible for student performance and furthermore, they should be more diagnostic and remedial of that performance. These theories appeared to be broadly comparable.

A further examination of the role of teachers by the Educational Administrators suggested that teachers should bring their experience and mature judgement to students. Employers believed that teachers would require greater experience to achieve the appropriate learning goals.

Coping with these new roles may be beyond the teachers present skills according to the Educational Administrators. Teachers would need a 'massive retraining process' claimed the Computer Suppliers and some are not going to be capable in this new role.

The Employers were not so pessimistic about this matter and claimed that although teachers must respond to the changes and the use of technology within learning and teaching, productivity would improve.

Responding to the question regarding the number of teachers required in this environment the Educational Administrators believed that the number of teachers would not reduce due to the nature of teaching. However, Employers believed that the number of teachers would reduce but this would be independent of the introduction of computers and more a factor of economics.

6.3.3 Educational Methodology

Some common beliefs were found in the methodology responses. For instance, Educational Administrators acknowledged that open access methods would increase in scope. The Employers also believed that individualised learning methods should be used where students can learn at their own rate. Computer Suppliers expressed a belief in the benefits of individualised learning.

When discussing the technological approaches to learning the Educational Administrators expressed the belief that portable computers would be widely used. The Employers made the point that schools would be technologically advanced and that technology would be an integral part of learning.

The Computer Suppliers argued that much could be gained from the use of computer orientated learning systems. These systems would, according to their theories, direct students to various exercises in different centres and test and assess them when appropriate.

6.4 COMPARISON OF THEORISING ABOUT COMPUTERS IN EDUCATION BY REALITY DEFINERS

6.4.1 Relationships

The theorising of all groups reflected a belief that computers would provide the potential to improve relationships if used for learning. Educational Administrators displayed a more complex theoretical structure which described the independence of learning as the means of increased self esteem in student which would lead to improved relationships.

The Employers and Computer Suppliers both argued that improved relationships would be a result of the removal of the responsibility of teachers to provide information to students; this would be provided by the computer. Both the Employers and the Educational Administrators expressed the belief that the use of computers would also lead to a loss of social skills in students.

The Computer Suppliers argued that relationships would 'mature' as teachers took up a new role as facilitators of learning and assisted students to 'navigate' through the knowledge.

6.4.2 **Learning Ability**

Educational Administrators justified the implementation of computers in education by arguing that students would work at a higher level in the taxonomy of learning. That is, students would be involved in conceptualising, 'analysis and synthesis' instead of the more frequent approach of repetition. Employers, on the other hand, held the belief that learning ability would accelerate as computers gave students enhanced access to information.

Theorising by the Computer Suppliers appeared to be based on the simple belief that the use of computers would directly improve the learning process. This view did not appear to have to be justified in

any way and was self evident to the Computer Suppliers. Within the theorising by Employers lay a concern for the narrowing of education through the use of computers and an acknowledgment that some students would not learn successfully via computers.

6.4.3 **Motivation**

The theorising of Educational Administrators appeared to focus on the removal of drudgery from learning by the use of computers. This was reflected in their belief that students writing improved when using keyboards.

However, their theorising also identified concern that computers could be demotivational for some students, and further, that total reliance on computers in education may produce greater intolerance in students.

Employers in this instance expressed a diversity of beliefs ranging from the belief that computers would motivate students, that the ready access to information itself may be motivational or that the motivational effects were due to the novelty effect which would soon wear off.

Computer Suppliers theorising suggested that computers would especially motivate the gifted or slow students but also placed an emphasis upon good teaching as the main ingredient in the motivational effects of computers.

6.4.4 **Creativity**

The Educational Administrators professed the belief that computers would enable students to be more creative than those not using them but they also acknowledged that computers were limiting to creative expression due to the lack of capabilities of the computers themselves.

Computer Suppliers also argued that the use of computers would enhance creativity but added the qualifying belief that the technology must be well managed and at the leading edge of the technology.

A contrary belief was advanced by the Employers who simply stated that computers would not enhance the creative ability of students.

6.4.5 **Equity**

The perceptive difference between the groups and the legitimated role of the public education system became clearly visible on this issue.

Educational Administrators claimed that the role of the public education system was to provide access to the technology regardless of economic circumstances. This view was shared by the Employers although they believed that such support may be limited to a safety net effect.

Computer Suppliers, in this instance, argued that computers would not have any impact on equity. One of the suppliers likened computers to books and claimed that the book sellers would face competition from Computer Suppliers in future.

Another argued that those people who had resources would continue to provide private tuition to their children.

6.4.6 Gender Effects

Comments about gender effects provided a degree of diversity in the theorising of the groups. Educational Administrators pointed to the bias against females in society and argued for a measure of control on the boys in order to improve the opportunities for girls.

The Employers held the belief that the technology of computing did not differentiate between the sexes and therefore was not an issue for gender bias.

Computer Suppliers, on the other hand, acknowledged the gender bias in society and claimed that computers themselves provided the opportunity to address the social bias by providing a common platform for the development of equity in education.

6.4.7 Career Needs

The theorising applied to career needs was complex and demonstrated the groups attempts to delve into the future.

For instance, the Educational Administrators put forward a number of theories which attempted to explain why the technology must be addressed. They claimed that technology could not be stopped, all would be affected, that there was a fear that technology was deskilling and in order to combat these effects there was a need to move the skill levels away from the manual levels to more conceptual levels.

The Employers held a variety of theories but the most compelling justified the need for computer skills because they would be in as much demand as reading and writing. Computer Suppliers also put forward the view that computer training would make it difficult for employers to place students into menial jobs but they also advanced an argument that technology would enhance people career's and that

new types of employment would be created around the technology in the future.

6.4.8 **Relevance to Subjects**

Educational Administrators believed that computers were a generic technology suitable to all subjects. Employers were less cohesive in their beliefs but generally claimed that computers were relevant to all subjects. The Computer Suppliers in this instance did not advance an argument.

6.4.9 **Redundancy of Knowledge**

The Employers claimed that with the technology of computers the focus of education should be on the process of learning rather than on the outcome. This view was further advanced by the Computer Suppliers who argued that because computers gave ready access to information it was more important that the focus of learning be on the processes of problem solving.

The Educational Administrators addressed the redundancy of knowledge in a theoretical manner. No recognition was given that the computer may change the need for teaching some types of knowledge. This may have been a form of nihilism in which changes to the institution of education were denied.

6.4.10 Effectiveness/Efficiency

The Educational Administrators theorising appeared to emphasise the legitimate purpose of education as that of developing relationships. This emphasis seemed to be directed at any suggestion that relationships could be considered in the context of effectiveness or efficiency. Such suggestions were viewed as competing or conflicting theories. However, they did concede that if teachers focussed on managing and monitoring student learning it may lead to improved outcomes.

Employer representatives believed that computers would improve efficiency and effectiveness of schooling but in order to do this teachers required computing skills.

Computer Suppliers also believed that computers would provide efficiencies but they stressed that teachers needed new skills to make this possible. They also advanced the theory that teacher numbers would not necessarily reduce but the use of computers would impose reductions to the management layers in the organisation thus presenting a divergent opinion to the other groups.

6.5 CONSTRUCTION OF KNOWLEDGE SUPPORTING COMPUTERS IN EDUCATION

An examination of the theories held by the three groups of reality definers according to those who supported computers in education, those who were non-supportive and those who could not be defined as supportive or non-supportive (Appendix 7, 8 and 9) are displayed below (Table 5).

TABLE 5: Support for Computers in Education by Educational Administrators, Employers and Computer Suppliers

Type of Statement	Employers		Computer Suppliers		Educational Administrators		TOTAL	
	N	%	N	%	N	%	N	%
Supportive	13	56.5	19	86.4	14	50.0	46	63.0
Neutral	5	21.7	3	13.6	9	32.1	17	23.3
Non-supportive	5	21.7	0	0	5	17.9	10	13.7
TOTAL	23	100.0	22	100.0	28	100.0	73	100.0

This simple analysis displays the relative disposition of the theories of each of the groups towards the application of computers in education.

As a collective group there was a considerable level of support for computers to be used in schooling. Comparatively, it can be seen that the most supportive theorising was being done by the Computer Suppliers. The next most supportive theorising was undertaken by the Employers and the least supportive level of theorising was undertaken by the Educators.

When theorising by the Employers is compared to the level of theorising by the Educational Administrators (ie in non-supportive statements) it is difficult to explain why the Employers are more cautious about the technology than the Educational Administrators unless their experience has lead them to treat technology with a greater degree of care than the Educators who have not had a history of using technology in their field.

However, it is clear that the Educators have not yet made a firm decision about many of the issues as evident in the level of neutral (uncommitted) statements made.

This table demonstrates the complexity of the theorising which was being carried out. Although each of the groups quite clearly supported the use of computers they also held theories which reflected their concerns.

For example, the theories held by the Employers which were non-supportive represent 21.7% of all theories. People clearly make their decisions after weighing up the issues on matters such as, the use of computers may cause reduced interpersonal skills but conclude that the benefits created make this acceptable.

6.6 COMPARISON OF CONTROL OF COMPUTERS IN EDUCATION

All groups were asked to respond to the following question:

Have people made a choice about the use of technology in education?

The Computer Suppliers generally failed to address this question directly but they did indicate that, on the one hand, it was an issue for all people involved in schooling while on the other hand they did not have sufficient knowledge to make a decision.

The Educational Administrators expressed the view that people do not make decisions about these sorts of issues but just accommodate and adjust to them. It was also explained that the level of decision making was trivial and based on the notion that the number of computers in a school determined which was the better school regardless of how they were used. This idea justified that administrators had to make these decisions.

Employers argued from two perspectives. One, that computers in school just happened and; two, that computers ought to be used if they would make the children 'smarter'. This perspective presented parents as people who purely respond to the pressure of technological advancement but who also sought to take advantage of the benefits of technology as presented to them for their children. It also indicated the level of theorising by individual representatives was limited.

To the question, "*Will society be more inhuman in future,*" the Computer Suppliers suggested that if society did not pay attention to the human aspects then the advent of computer technology could well create a more inhumane society. The view was also expressed that without exploiting the technology society could not use technology as a means of restraining acts of violence. This gave the two opposing and dialectic views of technology. On the one hand technology created social problems but on the other hand social problems could be improved by the use of technology. A mixture of views were presented by the Educational Administrators. On the one hand, computing technology would 'liberate' people from some manufacturing tasks which were seem to be dull and restrictive. Alternatively, concern was expressed about the individualisation which computer technology encouraged causing a detrimental effect on social relations. A third position indicated that it was inevitable in schools because it was 'in society' and that parents could, if they so desired, make the decision by changing their spending patterns. This argument depended upon a consumer demand model of education which says that schools would continue to use computers if parents put their money into the purchase of equipment.

Employers who responded to this question suggested that students would be in a more active environment and therefore this would be an improvement over the passive classroom behaviour currently employed, enhancing relationships and thereby minimising the risks associated with the use of the technology.

Will people have a choice about where computers will be used in education?

This question was only addressed by the Computer Suppliers who argued that people would not have a choice about where computers would be used in education in the same way that individuals did not have a choice about where a telephone was used. Furthermore, their arguments pointed out that for economic reasons industry had to use them, and consequently, that pressure would dominate the direction of education.

Will education be constrained by the use of computers? This question was addressed by the Employers, the Computer Suppliers and by a Curriculum Director. By and large the predominant view expressed was that education would be constrained by the inability of schools to keep up with the development of the technology.

An Employer put the view that education would be subjected to the dictates of the industries who were prepared to invest in developing the software for educational purposes. An alternative perspective indicated that the teachers themselves would produce the educational programs and hence the restrictive control would not be a problem.

The Computer Suppliers who were also large suppliers of equipment to schools claimed that education would not be constrained in any way, and, in fact, would continuously find new opportunities by using the technology. However, the Supplier whose market was in the industrial sector claimed that education would flounder due to a lack of government policies which favoured manufacturing and business. Elsewhere this spokesperson expressed the view that industry should lead education and shape the direction and outcome of the students.

"Would schooling be reshaped by the use of computers in education?" This question received a considerable degree of agreement by all participants. One of the Educational Administrators expressed the view that he would like to see the environment become more intimate as a result of the use of computers. One of the Employers thought that a fair degree of resistance would be encountered in the process while another expressed the view that the change would be a consequences of economic pressures rather than technology.

"Is the future of computers in education a frightening prospect?" This question evoked a qualified answer from most respondents which again demonstrated the complexity of theory construction in a modern world. All but one respondent expressed the view that the future of education and technology was an exciting one. One individual from the Employers

explained that the future would be exciting on the basis that 'change is exciting'. However, he went on to explain that this was not something that you look forward to. The corollary to the exciting future perspective was the view that the present direction of education was frightening, that for some people the prospect of using computers was equally frightening and if handled badly a deterioration of human relationships would be the result. Furthermore, if those who could not cope with computer learning, were not supported, then this would be a frightening future for education and schooling.

"Will teachers lose control of the curriculum if computer technology were used for educational purposes?" This question was answered by the Employers and the Computer Suppliers who claimed that they did not believe that teachers ever had control over the curriculum. One of the Employers explained that control was really in the teachers hands which meant that the level of control was dependent upon how much responsibility teachers wanted to take, but added, that he thought teachers would have a lot of trouble changing to deal with the new technology.

6.7 COMPARISON OF EVALUATION OF EDUCATION

The Educational Administrators were asked to respond to a question regarding how they currently rated schools. Two of them responded to this question. In their view schools needed substantial change and particularly in the area of methodology. Responding to the supplementary question that

schools may need radical change the view was expressed that schools needed continuous change. It was explained that teachers ought to be risk takers but that the environment discouraged teachers from taking such a stance.

The Computer Suppliers all claimed that schools were generally unsatisfactory and that they needed radical change. One felt that they needed to implement the technology available while another argued that a third dimension of vocational education must be addressed more vigorously. The view was also expressed that students should be taught to meet the needs which would confront them when they finished schooling.

The Employers also expressed the view that schools needed change. One claimed that radical change was necessary to take schools in new directions although he conceded that the direction itself was hazy but that technology was a major part of that future. Another argued that schools needed to continuously change and that continuous pressure needed to be applied to Educational Administrators to ensure that change.

The predominant theme identified throughout this analysis was that technology was the essential factor in change for schooling and that it had to be adapted to education regardless of the concerns expressed about its inappropriate use. Of equal concern was the lack of support from teachers and the perceived danger to human relationships if learning were to depend totally on computers for learning.

6.8 COMPARISON OF PROMOTION OF COMPUTERS IN EDUCATION

The responses to the promotion of computers in education were quite revealing in terms of the knowledge held by the three groups. The Curriculum Director explained that he recognised a number of influential people within the Education Department who pushed the use of computers within the Department for teaching purposes and as a result gained a high profile for their use in the Department.

The Computer Suppliers shared the view that computer companies were the main sponsors of computers for educational use. All acknowledged that the Education Department had also supported their use within their constrained budgets. Teachers and parents were given some recognition for promotion but to a much lesser degree than that of the Education Department and the computer companies.

The Employers argued that employers as a group did little to effectively promote the use of computers for education. Furthermore, they expressed no consensus on who were the main promoters. One held the view that teachers had a great deal to say on the subject while another identified computer companies as the main promoters of computers for education.

However, both agreed that parents had some influence although according to one Employer, it was the pressure groups, but after some thought appeared to retreat from this view.

6.9 SUMMARY OF THE THEORISING OF EMPLOYERS, COMPUTER SUPPLIERS AND EDUCATIONAL ADMINISTRATORS

Theory construction by all the groups displayed a strong orientation to the future. Each group dealt with the way technology would effect schooling and all believed that the technology of computing would have a major impact on schooling, work and life in general.

Each of the groups displayed a unique 'world' view which defined their theorising to the confines of their experience and also placed a unique focus on those issues where shared theorising was identified.

Most of the theory building was defined as rudimentary in nature although there was evidence of some explicit forms of theorising by the Educators in particular. However, the fragmentary nature of the theories constructed did not limit the extent and direction of the theorising when viewed as a whole. For example, quite complex arguments could be developed when the independent theories were linked. (However, although this was evident to the researcher, it may not have been so obvious to the theorists themselves.)

The rudimentary nature of the theorising was also emphasised by the complexity of the theories which were not all inter-related or congruent.

Furthermore, many of the theories were contradictory both within the groups and by individuals which demonstrated the speculative nature of the subjective reality of the future.

The nature of the theorising by the groups of reality definers examined, still presented a plausible guide into a new reality although shaped by the various perspectives. For example, all groups defined a future in which computer technology became a common aspect of life and a strong component in education and schooling. All groups agreed that teaching, the role of teachers, the methodology and the outcomes of education would be modified. The commonality of their theories suggested that much of this reality was already objectified. Their views were generally compatible with those expressed by the media, by government and authors commenting on this matter.

Some tension between the groups of reality definers was apparent and each of the groups attempted to define their particular 'world' view by making legitimating statements to substantiate their claims. For instance, the Educators sort to legitimate the role of schools by claiming that the prime purpose of schooling was the social development of students. The Computer Suppliers agreed with this position but sort to legitimate the role of computers to enable schooling to be organised to provide the time for such relationships to develop.

The Employers also agreed that relationships were important in schools and in the workplace and sort to legitimate their role in the structure to make the decisions about the direction of schools.

The conceptual reality evoked by all the theorists was that the integrating theme of computers in education was the economic imperative for the future creation of wealth and for the growth of industry.

Collectively, the knowledge constructed presented a clear image to all that schooling must adopt computing technology, that the educational process must be modified to accommodate the technology and that the institution of schooling should be preserved when making these changes.

*Theorising Within the 'World'
of the School*

7. THEORISING WITHIN THE 'WORLD' OF THE SCHOOL

7.1 THEORISING ABOUT COMPUTER USE IN SCHOOLS BY PRINCIPALS

Interviews were conducted with three Principals of Schools. (Two of these schools responded to a questionnaire [see below].)

7.1.1 The Present Use of Computers in Schools

Each of the School Principals interviewed put the view that the computer was a necessary element of schooling. This was reflected in the variety of ways in which computers have been used, which may be categorised in the following way:-

- (a) Work related uses,
 - word processing
 - computer programming
 - drawing and design
 - computer aided design and manufacturing equipment.

- (b) Supplement to traditional teaching approaches,
 - home economics
 - maths, geography
 - business studies
 - science

7.1.2 Theorising About the Computer Skill Required by Students

Each of the Principals considered it essential that students were able to use computers and have some computer knowledge. The use of computers was seen as having keyboard skills and the general ability to use the computer as a tool in all subjects.

In one case, School X (a girls' school) committed all students to undertake a term of computing and all girls were taught keyboard skills from year four onwards.

7.1.3 Theorising About Further Computer Uses in Schools

All Principals were seeking to expand the application of computers into subject areas not presently using computers and all sought to expand their use into fields which reflected current commercial or industrial uses.

The theorising by all the Principals clearly reflected an awareness of technology as a major influencing factor on modern life. Furthermore, the Principal of School X admitted that computers presently represented the major and only significant inclusion of technology into the school's program. In particular it was pointed out that there was a need to extend the involvement of students in areas of technology such as wood and metal. However, because girls may not feel comfortable about traditional approaches, jewellery was

envisaged as a field in which they could involve a range of technical skills and the use of computers for design purposes.

7.1.4 Theorising About the Computer Skills of Teachers

The Principal of School X considered that staff should be encouraged to use computers and to use them as a tool in the process of teaching and learning but the Principals of School Y and School Z felt that all teachers would need to gain considerable computer skills as they would be used more extensively in education.

The Principals of Schools Y and Z expressed the view that computing was an essential skill of teachers whereas School X considered it desirable.

7.1.5 Theorising About Students Future Vocational Needs

All the uses of computers in schooling outlined above, suggested that the Principals saw a future society in which all students would be involved in some way in the use of computers for work related needs. It was also suggested that schools were far more concerned about preparing their students for employment in a world in which computer technology would play a much more important role than had been the case in the past.

Although the Principal of School Y had not considered that the use of computers might also reduce the skills required by some people, the other Principals recognised that the gap between the skilled and non-skilled would widen. Furthermore, work would change rapidly in the future and as a result students would need to learn new skills more frequently as computers become more widely applied in society.

7.1.6 Theorising About the Use of Computers for Learning

All Principals saw a shift in the focus of learning from the group or class to the individual. All three Principals affirmed the importance of the interaction between students and teachers and pointed out that they could not see a situation in which computers would eventually replace teachers.

Furthermore, they believed that computer learning had the potential to create an increased relationship between the students and teacher.

The Principal of School Y explained that if schools became dependent on computers as part of the delivery system for learning, then schools would need to provide social contacts and links between people to enable development of social skills. This view implied that social skills would be diminished due to the use of computers. He also acknowledged that some students would prefer to be taught by computers rather than by teachers.

There was some divergence of opinion about whether students' learning ability would improve if they were to use computers. The Principal of School X believed that some aspects of rote learning would improve by using computers but that computers would not be useful for attitude development.

School Y's Principal on the other hand had no doubt that the learning ability of students would improve from the use of computers.

The Principal of School Z considered that computers would not contribute to the ability of students to learn but felt that they held some potential for students to better research their subjects and that marginal benefits in student results could be predicted.

The Principal of School X pointed out that a great deal depended upon how the computers were programmed. The Principal's view was that if computers were programmed for open ended inquiry then student ability to learn may be enhanced.

The major advantage cited by the Principal of School X was that teaching would be able to move away from the lock-step approach and students would learn at their own pace.

In terms of the motivational effect of the computer, all the Principals thought that little advantage would flow from computer use even where the students controlled the learning material. The problem according to the Principal of School Y was that the Australian culture was not that of a learning society at this stage.

None of the Principals felt that the use of computers for learning was in any way a problem of gender and the Principal of School X expressed the view that any gender effects were tied up with other issues in society and not related to computers. However, the Principal went on to say that because the computer was a mechanical device it might attract males but be unappealing to females.

Using computers in schools did not pose any problems for students' creativity according to all the Principals concerned. The Principal of School Y considered that it might be possible that computers could restrain creativity but that this was unlikely as humans would always be divergent. The Principal of School X felt that their use should enhance problem solving while the Principal of School Z expressed the view that students would be more creative if they were well taught using computers.

All Principals were of a like mind in respect of the view that all subjects would be relevant for computer learning. However, there was some doubts expressed by the Principal of School X about whether arts subjects were as relevant as science subjects to computer learning. A vision of how schools might develop using computers was provided by the Principal of School X. It was suggested that schools would develop along the lines of distance education eventually replicating the paperless office.

7.1.7 Theorising About the Need for Students to Know the Effects of Computers on Society

Responding to questions concerning the need of students to study the social effects of computers on society the Principals gave a variety of theories. One Principal (School Y) suggested that schools did not do enough of this sort of inquiry while another (School X) felt that although students should be concerned about the effects of computers in society they should not be attempting to determine the effects themselves.

Whether students should be concerned about the ways computers were being used in society produced equally divergent thinking. For example; the Principal of School Z was concerned about the need to maintain a materialistic lifestyle (ie, production of goods such as cars, machines etc) while at the same time reducing the problems this created such as the greenhouse effect.

The Principal of School X, on the other hand, considered that the way computers were being used in society was almost a moral question.

7.1.8 **Theorising About Future Curriculum Requirements**

Discussing the likely changes to curriculum brought about by the extensive use of computers for learning elicited the following beliefs. The Principal of School X expressed the view that because information would be readily available it should release teachers enabling them to use data more effectively rather than spending so much time imparting it. However the Principal of School Z thought that such ideas were a 'Red Herring' and that basic knowledge would still need to be imparted.

Answering the question: 'will the use of computers for learning change what students need to learn in future?', brought agreement from all Principals with qualifying comments. The Principals of Schools X and Z felt that change would only occur after the basics were first established. School Y's Principal expressed the opinion that present curriculum would be irrelevant in terms of actual knowledge but that the computer would enable the process of learning to become more important, that is, thinking, problem solving etc.

7.1.9 Theorising About Issues of Equity

Considerable divergence of opinion was expressed about the issue of equity. The Principals of School X and Y both thought that those students who could learn using computers would become elite students. The Principal of School Y explained that schools already have an elite group of students in a sense, but teachers have not extended them sufficiently, and if computers could facilitate this then it would be welcomed. The Principal of School Z disagreed on this point and also disagreed that computers would create an elite student group.

All Principals agreed that computer learning would not benefit those who could afford expensive, private learning material to any extent pointing out that books could be considered in a similar way.

Likewise all Principals were in agreement about the benefits computer learning would bring to the slower learners.

Regarding the ability of students to select learning material according to what they wished to learn, the Principal of School Z considered that this was not practical given the need to direct students along specific directions according to curriculum agreements. Both School X and Y Principals felt that computers would enable students to have this flexibility.

7.1.10 **Theorising About the Efficiency of Using Computers for Schooling**

The Principal of School Z pointed out that the use of computers might cause a revolution in schools if the government increased the percentage of GNP to education as in other countries.

The Principal of School X explained that questions of efficiency depended on what was meant by success in schools.

However there was no disagreement about the question of how many teachers would be required in a school using computers for learning. All agreed that fewer teachers would be required. The Principal of School Y pointed out that schools could no longer sustain the level of student/teacher ratios for such things as language courses and that computers were the obvious solution to such problems providing greater efficiency in teacher use.

Likewise to the complementary question regarding being able to use teachers more effectively there seemed to be general agreement.

The Principal of School X in particular, suggested that schools could use teachers more like universities. That is, higher qualified teachers could handle greater numbers for some subjects and better value would be gained from auxiliary staff teaching small groups. The

Principal provided the following example:-

For instance classes of 50 could be conducted by qualified teachers then the less qualified could work with smaller groups.

The Principal of School X suggested that overall teacher numbers might be the same but they could be used more effectively, for example, with slower learners etc.

However, all Principals felt that students who did not have a strong desire to learn would fall behind in a computer learning school.

The notion of using home terminals instead of attending school did not gain any degree of support as it was felt that most students would seek the human and social interaction of the school although the Principal of School X suggested that it was a possibility somewhere in the future.

7.1.11 Theorising About the Future Direction of Schooling

The theorising about the future direction of schooling was quite divergent. The Principal of School Z considered that schools would remain much like they were at present but would rely on increasing amounts of computer technology for learning.

The Principal of School X argued that the future could see schooling become more divergent including schools much as they are at present but using more computers, private computer packages produced for social learning but where knowledge would be gained through personal computers. Some of these already existed, she claimed, if all forms of learning currently used in the world were considered.

The Principal of School Y stated that schools would change somewhere down the track to reflect the following characteristics:-

- become resource centres;
- places which manage social activities;
- manage practical programs especially for equipment which individuals could not purchase;
- co-ordinate physical education programs;
- be centres for music training etc.

Furthermore, it was explained that much learning would also be undertaken through other agencies, and schools would no longer hold the monopoly they presently enjoyed.

All the Principals expressed the view that schools were in need of radical change. The Principal of School X qualified this notion by indicating that the changes should not occur too rapidly while the Principal of School Y expressed the view that Schools should change quite drastically but questioned whether society would allow this to happen. He did not think that money was the issue but rather a question of where educational priorities were placed. He also explained that perhaps money should have been spent improving teaching methodology and reducing the dependence of teachers on the talk-and-chalk methods widely in use.

7.1.12 Theorising About the Role of Teachers

According to the view of the Principal of School Z the most important aspects of the teacher's role would be counsellors and study advisers, developers of students' social skills and evaluators of computer programs. The Principal of School X on the other hand considered that the teachers' role was to develop values and attitudes in students and that if students had appropriate values they would be able to cope with most aspects of life.

7.1.13 **Theorising About the Reification in Schools of Knowledge About Computers**

In general terms there appears to be some evidence that the Principals have reified knowledge about computers to some degree. All expressed some notion of excitement about the future and all appeared to show that they would play an important role in implementing computer use into the schools. Equally, due recognition was given to the potential for computers to be used in unhelpful ways detrimental to society.

However, none of the Principals questioned the ability of computers to improve the learning process of students. This seemed to be self evident.

When asked who was most responsible for the promotion of computers into education there was some measure of agreement by all the Principals. For example, those seen to be most responsible were, computer suppliers, some teachers, business and industry, and to a much lesser extent, the expectations of parents.

The Principal of School X (a private school), however, identified parents as being a major influence. A dichotomy of opinion was clearly evident between the Principals of the public school and the private school in the study.

The Principals from the public school section expressed the view that neither the Government nor the Education Department were placing adequate emphasis on resources into this important area. However the Principal of School X, although placing little responsibility on the Government for the promotion of computers into education, felt that the Education Department was equally responsible with computer suppliers for their promotion in schools.

The media were not considered important by any of the Principals. One of the reasons why the computer companies featured in this respect was that two of the three schools had equipment supplied by the computer companies or had staff involved in on-going arrangements providing access to computer software.

7.1.14 Theorising About the Purpose of Schooling with Respect to Computing

All Principals were in accord regarding the essential objectives of schooling with regard to the use of computers.

- (a) Students should learn how to use computers.
- (b) They should have computing skills necessary for employment.
- (c) They should have the skills which enable them to live in a computer society.

- (d) They should be adaptable and be able to cope with the changes in a computer society.
- (e) Computers should be used to enhance students' intellectual development.

This response to the normative statements shows a high degree of agreement between Principals - such support shows the development of a correspondence of beliefs between Principals about the meaning attached to the use of computer technology in schooling.

The views held by Principals are summarised in the following table, Table 6.

TABLE 6

**SUMMARY TABLE OF BELIEFS HELD BY PRINCIPALS ABOUT THE USE
OF COMPUTERS IN EDUCATION**

	BELIEF	SUPPORT FOR BELIEF (x)		
		SCHOOL X	SCHOOL Y	SCHOOL Z
1.	Essential that all students are able to use computers	x	x	x
2.	Schools would continue to expand their use of computers in schools	x	x	x
3.	A greater emphasis would be given to the use of computers for vocational subjects	x	x	x
4.	Computer technology would become a major influence on modern life	x	x	x
5.	Teachers need to use computers as an extension of the tools for teaching and learning	x	x	x
6.	Teachers would need considerable computer skills to manage learning	x	x	
7.	All students would need computer knowledge and skills for work needs	x	x	x
8.	Some job skills would decrease in future because of computers	x		x
9.	The gap between skilled and non-skilled would widen	x		x
10.	Work would change rapidly and students would need new skills more frequently	x	x	x
11.	Focus of learning would shift from the group to the individual	x	x	x
12.	Affirmed the importance of relationship between student and teacher	x	x	x
13.	Computers have the potential to create increased relationships between student and teacher	x	x	x
14.	Schools would need to emphasise social relations if computers widely used in schools		x	
15.	Computers would not replace teachers in the learning process	x	x	x
16.	Extensive use of computers could reduce social skills		x	
17.	Students learning ability would improve if computers used	x	x	x
18.	Computers would not be helpful in developing attitudes	x		

TABLE 6 CONT.

BELIEF		SUPPORT FOR BELIEF (x)		
		SCHOOL X	SCHOOL Y	SCHOOL Z
19.	Computers may be useful to improve rote learning	x		
20.	Computers would help students research their work	x	x	x
21.	Computers would enable teaching to move from the lock-step approach	x	x	x
22.	Computers would not motivate students	x	x	x
23.	Computers do not have any gender effects	x	x	x
24.	Because computers were mechanical devices they may be unappealing to females	x		
25.	All students should be concerned about the way computers are used in society	x	x	x
26.	Computer learning would not stifle creativity	x	x	x
27.	All subjects are relevant for computer learning	x	x	x
28.	Science subjects may be more relevant than arts subjects for computer learning	x		
29.	Information availability through computers would free up teachers	x	x	x
30.	Basic knowledge would still need to be imparted	x	x	x
31.	Computers would change what students needed in future	x	x	x
32.	Process of learning would become more important (thinking, problem solving)	x	x	x
33.	Computers would create an elite	x	x	
34.	Private access to private learning material would not provide any advantage	x	x	x
35.	Computer learning would benefit slower learners	x	x	x
36.	Some benefit from ability of student to select learning material	x	x	
37.	Use of computer learning would require fewer teachers	x	x	x
38.	Teachers would be used more effectively in schools	x	x	x
39.	Students without a strong desire to learn would fall behind	x	x	x

TABLE 6 CONT.

BELIEF		SUPPORT FOR BELIEF (x)		
		SCHOOL X	SCHOOL Y	SCHOOL Z
40.	Students would rather come to school than use home terminals	x	x	x
41.	Schools would change and rely much more on computer technology	x	x	x
42.	Schools would not hold a monopoly on learning in future	x	x	x
43.	Schools are in need of considerable change	x	x	x
44.	Role of teachers would be: study advisers, developers of social skills, evaluators of computer programs, development of values and attitudes	x		x
45.	Future of schools was exciting	x	x	x
46.	Which groups most responsible for the promotion of computers in education			
	computer suppliers		x	x
	teachers		x	x
	businesses		x	x
	industry		x	x
	parents		x	x
47.	Are parents most responsible for promotions of computers in schools	x		
48.	Purpose of schooling:- all students to learn to use computers, employment skills, live in computer society, be adaptive to computer society, enhance students intellect	x	x	x

7.1.15 An Analysis of the Theorising of Principals

- (a) A considerable degree of theorising was evident by Principals about computing.
- (b) Although there was some personal uneasiness about where the direction of computer use in education was taking schools, Principals did not appear to have reified the knowledge about computer technology except in respect of its ability to improve learning. However, they expressed some doubt about how much change to schools would be tolerated by society.
- (c) The degree of theorising was surprisingly uniform between the schools and colleges given the difference in educational philosophy held by the different Principals, eg values versus knowledge and skills.
- (d) However the institutional basis of schooling was not challenged by the Principals even though they suggested that radical changes be made. All emphasised the relationship between student and teacher claiming that this would not change regardless of the technology.

This point demonstrated that the knowledge of institutional relationships held in the roles of the teachers has not changed as a result of the introduction of computers and, in fact, affirmed the institutional relationship between student and teacher.

- (e) A disjunction was evident between the position of the Public School Principals, the bureaucracy and politicians with respect to who was responsible for creating the changes necessary to include the computer in education.

The Principals clearly saw a conflict between the statements of politicians and Education Department with respect to the commitment to make the investment in computer technology to enable changes to schools to become a reality. Equally the Principals were concerned about schools acting in an uncoordinated manner and doing their own thing which would be in conflict with the detailed instructions in the Department's policy statements.

It seems that Principals see little connection between these statements and the real needs of schools. It is doubtful whether the Principals concerned had any knowledge of the Departmental directions, or if they did, then they gave each view little credibility.

- (f) It was also apparent that the Principals were engaged in legitimating the role of computers in the school and the educational process. Although the Principals could have chosen to reject the technology they have legitimated its role in education. However at this stage it appears that they are incorporating the technology tentatively into their own 'world' and in so doing have begun to construct theories to explain why computers should be used, how they should be used and where they should be used in schooling.

Furthermore, although much of the theorising seems tentative and rudimentary in nature there is evidence of an emerging explicitness within some of the theorising which shows how rapidly the computer is being established as a legitimate technology of learning and which will, as in other industries, reduce the labour intensiveness of current teacher practice if

the theorising continues at its present pace and in the same direction.

It was also interesting to note that none of the Principals attempted to prove or question the validity of the claim that computers would improve the learning process of students. The acceptance of the claim by writers and suppliers that computers would improve learning suggests that Principals have been susceptible to the general mythology of computers, that they have a role in education, as they have elsewhere, and they will be made to work. This seems to have been accepted at face value which shows that Principals are not immune to reification of the knowledge being constructed about computers.

7.2 RESULTS OF SURVEY

Two schools, one independent, single sex (female) and one state (co-education) were selected to provide insights from the school situation relating to issues raised by the 'theorising' of reality definers outside the world of schooling.

The following data provides the results of the Computers in Education questionnaire (see Appendix 4).

It had been planned to survey three schools, but industrial action in schools resulting in 'work-to-rule' made the administration of the questionnaire possible in only two schools.

The survey, however, was seen merely as providing insights into evidence of theorising at the school level, and not as supporting any particular hypothesis.

The survey was completed by:-

44	Teachers
222	Parents
308	Students from Years 10-12

Results are presented for each question and are recorded for each category of response by total number of response for each category and percentage of total response.

Parents, Students and Teachers are designated P, S and T in the tables (Appendix 5). The tables show results in number of responses 'n' and percentage '%',

The following sections of the survey results are displayed as follows:-

1. Source of Knowledge About Computers
2. Beliefs About a Technological Future
3. Computers and Education
4. Role of Teachers in a Computerised School
5. Control of Technology in Education
6. Purpose of Schooling
7. Satisfaction with Schooling
8. Promoters of Computers in Education
9. Selected Results by School, Sex, Age and Teaching Specialisation

7.3 ANALYSIS OF RESULTS

The survey results were analysed using the following criteria:-

- (1) A belief was determined to be commonly held by a group if agreement for a statement was greater than 50% of all responses.
- (2) A converse belief was determined to be commonly held by a group if disagreement for a statement was greater than 50% of all responses.
- (3) A belief was determined to be not commonly held by a group if agreement or disagreement for a statement was less than 50% of all responses.
- (4) A belief was said to be shared if values greater than 50% in agreement or disagreement was found for all groups (ie, students, parents, teachers).

Discussion of Results

8. DISCUSSION OF RESULTS

Results from the analysis of the survey of schools (Appendix 5) are presented in the following tables to facilitate discussion.

8.1 SOURCE OF KNOWLEDGE ABOUT COMPUTERS

(A) Personal Experience

TABLE 7: Have used a computer

	TEACHERS (N=48)		PARENTS (N = 222)		STUDENTS (N = 310)	
	YES	NO	YES	NO	YES	NO
No.	41	2	181	41	307	3
%	93	7	81	19	99	1

Table 7 above shows an extra-ordinary penetration of computers into schools, homes and work. Perhaps the importance attached to computers can be demonstrated from the figures above and shows that the theorising of the reality definers has to a large degree become a reality. Concerns by educational writers about the acceptance of computers by teachers is clearly repudiated by the results found in this survey.

Also of significant interest is the high proportion of parents who have at least handled a computer at home or at work.

TABLE 8: COMPUTER EXPERIENCE

Respondents	Yrs Exper.	1<	1	2	3	4	5	6	7	8	9	10	>11
Teachers (N=35)	Number	1	3	5	3	6	5	2	-	3	-	4	3
Average exp. = 5.2 yrs	181	1	3	10	9	24	25	12	0	24	0	40	33
Parents (N=168)	Number	13	14	24	20	24	23	12	7	7	-	9	15
Average exp. = 4.6 yrs	788	13	14	48	60	96	125	72	49	56	0	90	165
Students (N=293)	Number	27	27	31	39	57	38	36	23	8	3	4	
Average exp. = 3.9 yrs	1159	27	27	62	117	228	190	216	161	64	27	40	

Table 8 above shows the following information:-

- (1) Teachers on average have had five years experience with computers. This means many teachers were engaged in exploring computing at about the same time as the mainstream political reality definers began their public thrust to legitimate the inclusion of computing into schools in about 1985. Furthermore, it indicates some teachers (approximately 20%) began exploring computing at approximately the same time as the Educational Writers began publishing their views.
- (2) Parents, with an average experience of 4½ years may have been influenced to some degree by the reality definers.
- (3) Students on average appear to have followed their parents in exploring computing by as little as 9 months although reified accounts of computing would have been well established by this time. Anecdotal evidence suggests that they progressed at a much faster rate than their parents.

(B) Beliefs Held About the Source of Knowledge about Computers

The importance of each source of information about computers for teachers, parents and students when considering all three groups together is shown below.

TABLE 9 (All figures in percentages)

SOURCE OF KNOWLEDGE	MOST KNOWLEDGE	SOME KNOWLEDGE	NO KNOWLEDGE	NOT SURE	N
Newspapers	0.30	42.22	53.35	4.11	509
Television	5.34	45.09	45.13	4.43	509
Magazines	3.81	42.28	50.80	3.09	511
Radio	0.49	12.26	80.98	6.26	504
Books	13.84	54.00	28.37	3.78	509
Talk	35.34	53.22	8.48	2.94	523
Work/School	58.32	30.33	10.80	0.54	550
Computer Training	32.04	24.51	39.49	3.94	528

Table 9 above suggests that the most important source of knowledge about computers was derived from direct experience with the technology. This result was also supported by the respondents' experience with computers. (Refer Table 7; page 282 and Table 8 page 283).

The next most significant source of knowledge was derived from talking to others about computers. This result supports the view by Berger and Luckmann that theories about social changes are derived mainly from significant others as a result of explaining and sharing meanings about that experience with others.

This result also suggests that the theories of writers, politicians and employers, for example, are not as important as the direct theorising between individuals. This does not suggest that theories by such bodies are not important but theories such as those put forward by George (1979) are not sustained from their direct experience nor from their sharing of those experiences with others.

8.2 BELIEFS ABOUT A TECHNOLOGICAL FUTURE

TABLE 10: Commonly Shared Beliefs Held by Teachers, Parents and Students in no particular order

1	Computers would have a great effect on my life.
2	All people would need to know about computers.
3	Computers would change things greatly in my life time.
4	Computers would store personal information about people.
5	Those who can use computers would gain good jobs.
6	Computers would change jobs greatly.
7	Our leisure time would not be spent on computer games.
8	No new religions would arise based on computers.

In addition to the above common shared beliefs, the following beliefs are held by either parents or teachers (ie individual groups agree or disagree with the survey statement with greater than 50% support. Refer Analysis of Results).

TABLE 11: Additional Beliefs Held by Parents in no particular order

As a result of the introduction of computers:-

1	Most work would not be part-time work.
2	Computers would not put people out of work.
3	Governments would know much more about people.
4	Most information would come from computers.

TABLE 12: Additional Beliefs Held by Teachers in no particular order

As a result of the introduction of computers:-

1	Most work would not be part-time work.
2	Computers would not put people out of work.
3	Governments would know much more about people.

From Table 10 the following points can be made. First, theorising about computers includes great expectations of change which would affect people at a personal level. Second, the most significant changes would occur in the work place where most parents have already gained some experience. Third, knowledge about computers is believed to be of great importance in maximising employment opportunities. Further, beliefs about work suggest the computer will be in some way central to the type of work which will be

available in the future. Four, a reality of futuristic homes with all entertainment and services controlled by a computer is not accepted as feasible (ie this statement was rejected in the survey).

An analysis of the question, "*Computers are likely to have a great affect on my life*", shows that support for this belief was equally held when discriminated by sex, by schools and by age. Clearly, such a widely held belief suggests that some reification of the knowledge about computers must have taken place and would have an impact on the theorising about education.

Views held by parents, Table 11, that most information would come from computers may be the basis from which theories about education originate. Certainly, the strong belief by teachers and parents that computer skills are necessary in the work place and the strong disagreement (Table 30 and 31) that computers would have any depressing effect on the job market reinforce the view that computers are important to education and also indicate that those theories put forward by writers such as Bennett (1981) and others regarding unemployment being caused by computers is not the knowledge held by teachers and parents.

8.3 BELIEFS HELD ABOUT COMPUTERS AND EDUCATION

TABLE 13: Commonly Held Beliefs by Teachers, Parents and Students in no particular order

	Relationships:
1	Computer learning would not improve student relations.
2	Students would not prefer to be taught by computers.
	Learning Ability:
3	Students would not achieve better results.
	Gender Effects:
4	Males would not be better able to use computers.
5	Females are as interested as males in using computers.
6	Males and females are equally able to use computers for learning.
7	Females are no more likely than males to need computer skills for future jobs.
8	Same sex classes would not necessarily be best when learning using computers.
	Career Needs:
9	Most people will need to use computers in future work.
10	Most school leavers will need to know how to use computers to gain employment.
	Need to Study Social Effects of Computers on Society:
11	Computers will greatly effect society in future.
12	Students should be concerned about the way computers are used in society.
	Creativity:
13	Students would be more creative if using computers to learn.
	Relevance of Computers to Future Needs:
14	Learning about computers would not be irrelevant to students future needs.
	Equity Issues:
15	Those students who can use computers for learning will not become an elite group of students.
	Efficiency Issues:
16	Teachers will be able to give students more personal attention if computers used for learning.
17	Students without a strong desire to learn will fall behind in a computer school.
18	Students will be able to learn at their own pace.
19	Some work could be done from home terminals.
20	Students will have instant access to information.
21	Student records could be updated rapidly.
22	Testing could occur when students felt ready.

TABLE 14: Additional Beliefs Held by Students in no particular order of importance

	Learning Ability:
1	Computers would help organise work.
	Gender Effect:
2	Group learning would not be best for females when using computers.
	Equity Issues:
3	Those students who can afford private learning material will not be advantaged.

TABLE 15: Additional Beliefs Held by Parents in no particular order of importance

	Relationships:
1	Computers would not reduce friction between students and teachers.
2	Students would discuss computer related problems with other students.
	Learning Ability:
3	Computers would not complicate learning.
	Gender Effects:
4	Group learning would not be best for females.
	Career Needs:
5	Future work would not be less skilled because computers were used.
6	Many jobs students aspire to will not be replaced by computers.
7	Computers would cause work to change rapidly and students would have to learn for new jobs frequently.
	Need to Study Social Effects of Computers on Society:
8	Students should study the effects of computers on society.
9	Computers would most likely have a personal effect on people's lives in future.
	Creativity:
10	Computers would not cause students to think in a similar way.
	Relevance of Computer Learning to Different Subjects:
11	Computer learning is relevant to all subjects.
	Relevance of Computers to Future Needs:
12	Most of present studies would still be required.
	Equity Issues:
13	Those who can afford private learning material would not be advantaged.
	Efficiency Issues:
14	Slower learners would not be at an greater disadvantage using computers.
15	Computer learning would not reduce teachers.
16	Teachers would be more effectively used.
17	Computer learning would enable students to spend more time on problems with teachers.

TABLE 16: Additional Beliefs Held by Teachers in no particular order of importance

	Relationships:
1	Computers would not reduce friction between students and teachers.
2	Students would discuss computer related problems with other students.
	Learning Ability:
3	Computers would not complicate learning.
	Career Needs:
4	Future work would not be less skilled because computers were used.
5	Computers would cause work to change rapidly and students would have to learn for new jobs frequently.
	Social Effects:
6	Computers would most likely have a personal effect on people's lives in future.
7	Students should study the effects of computers on society.
	Creativity:
8	Computer learning would not limit students problem solving ability.
9	Computers would not cause students to think in a similar way.
	Relevance of Computer Learning to Different Subjects:
10	Science subjects would not be more suitable to computer learning.
11	Computers should be used for career studies.
12	Computers would be relevant to all subjects.
	Relevance of Computers to Future Needs:
13	Most present studies would still be required.
14	Slower learners would not be at a greater disadvantage using computers.
15	Schools which used computer learning would be more successful than those which did not.
16	Computer learning would not reduce teachers.
17	Computer learning would enable students to spend more time on problems with teachers.

An examination of Table 16 above demonstrates that the theories put forward by Papert (1980), Heaford (1985), Bork (1985) and others that 'computers would enhance the learning process' are generally held by students, teachers and parents in the 1990s.

A summary of the theorising found in schools can be expressed as follows:

- (1) Although computers are desirable they should not cause any impediment to student/teacher relationships nor be used in order to reduce the numbers of teachers in schools.
- (2) Gender effects on computer use by students are totally rejected and are not seen as a relevant issue in schooling.
- (3) Future demands make the knowledge and skills of using computers essential for all students. These future needs are determined as employment and future learning needs.
- (4) Students need to know how and where computers are being used in society. This point suggests that although computers must be used in learning there exists some concern that they might be used for undesirable ends.
- (5) Learning could be more creative and beneficial as long as (1) above is maintained.
- (6) Computers will make learning more efficient by enabling students to:-
 - work at their own pace
 - work from home terminals
 - have access to information
 - have access to rapid reporting
 - be involved in improved assessment methods
 - use computers for all subjects
 - benefit slower learners.

In addition to the above theories, teachers and parents believed that schools which used computers for learning would be more successful.

There is some evidence to suggest that computers were being viewed as a panacea to learning in some respects but this may also be a result of the reification of knowledge about computers and how they could be used.

By and large, Table 13 shows no evidence of a lack of confidence in the schools' ability to prepare students for the future and tends to indicate the emerging reality of schools which will use technology wherever possible to enhance learning.

8.4 THE FUTURE OF COMPUTERS & SCHOOLING

TABLE 17: The Future of Schooling

MOST LIKELY DESCRIPTION OF THE SCHOOL OF THE FUTURE (ie 5-10 yrs)	TEACH. N=42	%	PRNTS N=225	%	STDS N=319	%
A place which conducts lessons as at present but which uses increasing amounts of computer technology for learning.	39	92.8	181	80.0	166	51.7
A place from where student progress is managed, records kept and advice given but with much of the learning occurring out of the school in houses, libraries and other public institutions.	1	2.3	10	4.4	26	8.0
A place where students spend time on individual study programs monitored and recorded by computer.			6	2.6	33	10.2
A private company which manages computer learning programs for individuals for a fee in their homes or in small learning centres.					7	2.1
A place where students gather for group and social activities but specific knowledge is gained personally using computer technology.			1	0.4	9	2.8
A place which becomes irrelevant as technology removes the need for separate institutional education and replaces it with centralised data banks of learning material which can be used as required throughout life.			4	1.7	3	0.9
None of the above	1	2.3	12	5.3	59	18.3
Not sure	1	2.3	11	4.8	16	4.9

Table 18 summarises the beliefs held about the role of teachers in a school which uses computers for learning.

TABLE 18: Commonly Shared Beliefs Held by Teachers, Parents and Students in no particular order of importance

Role of teachers in schools using computers for learning include:-

1	Curriculum developers.
2	Maintain student discipline.
3	Counsellors and study advisers.
4	Computer operators.
5	Developers of student social skills.
6	Managers of individual student learning.
7	Assessors of student performance.
8	Student motivators.
9	Provide advice to parents.
10	Not student minders.

TABLE 19: Additional Beliefs Held by Parents in no particular order of importance

Role of teachers in schools using computers for learning include:

1	Trouble shooters of student problems.
2	Evaluators of computer programs.

TABLE 20: Additional Beliefs Held by Teachers in no particular order of importance

Role of teachers in schools using computers for learning include:

1	Trouble shooters of student problems.
2	Not computer program buyers.
3	Evaluators of computer programs.

From Table 17 it can be seen that the theorising about schools incorporated a commonly held view that schools would remain much as they were but would increasingly use technology in learning. This perspective reinforced the theories on computers in education from Table 13 which suggested that all participants in schooling anticipated a gradual transformation of schools towards much greater dependence upon computer technology.

The role of teacher also reflected this transition (Table 18) with the shared belief that teachers would maintain their traditional functions but would incorporate those roles which would support the use of technology in education.

Both parents and teachers shared the view that they would remain involved in identifying student problems but would also perform evaluations of computer programs. This, by implication, suggests that learning programs would be developed by others for use in schools.

8.5 BELIEFS HELD ABOUT CONTROL OF TECHNOLOGY IN EDUCATION

TABLE 21: Commonly Shared Beliefs by Teachers, Parents and Students in no particular order of importance

1	The development of computer learning is inevitable.
2	Teachers would have to use computers in education.
3	People should choose to involve computers in education.
4	A 'computer society' would not be an exciting possibility.
5	Computers would not make most decisions in society.
6	Computers do not think like humans.
7	Computers do what they are told.

TABLE 22: Additional Beliefs Held by Parents in no particular order of importance

1	Schools would be reshaped by the computer.
2	Teachers would not lose control of the curriculum to computer programmers.
3	Education would not be constrained to fit computers.

TABLE 23: Additional Beliefs Held by Teachers in no particular order of importance

1	Teachers would not lose control of the curriculum to computer programmers.
2	Education would not be constrained to fit computers.

The beliefs commonly held by teachers, parents and students indicated a belief in a measure of inevitability and a lack of control about the involvement of computers in education. However, this belief sits alongside of a belief that people should choose to use the technology. The paradox within these beliefs can be identified from the reluctance of those surveyed to accept that a society which uses computing widely could be exciting.

This may be explained by the recognition that the participants in schools hold different knowledge about the reality of technology from their different perspectives, for example, as workers, as teachers, and as parents seeking to provide guidance for their children. Each sees a different role and hence, some conflict must exist between the theories of each position. Both

teachers and parents are generally optimistic. This can be seen from the parents' and teachers' belief that schools would be reshaped by computers and teachers would maintain control of the curriculum, while parents believed that education would not be constrained in any way by use of the computer.

It is also possible that the conflict within these views could be a measure of the reification of knowledge about computers which caused the participants in schooling to acknowledge the 'obvious' benefits as expressed by the writers, politicians, employers etc, while constructing a reality which maintained all the elements which they believe to be essential to the institution. The beliefs identified within this research are consistent with such an accommodation.

8.6 BELIEFS HELD ABOUT THE PURPOSE OF SCHOOLING WITH RESPECT TO COMPUTERS

TABLE 24: Commonly Shared Beliefs by Teachers, Parents and Students in no particular order of importance

1	All students should learn how to use computers.
2	Students should use computers to enhance their intellectual development.
3	Students should have the skills of computing necessary for employment.
4	Students should be adaptable and be able to cope with changes in a computer society.

The normative statements by Teachers, Parents and Students emphasise again the belief that students should use computers for both learning and preparation for employment.

The beliefs also support the view that computers will have a major role in any perceived future for which students must be prepared.

8.7 BELIEFS HELD ABOUT THE PROMOTERS OF COMPUTERS IN EDUCATION

TABLE 25: Commonly Shared Beliefs by Teachers, Parents and Students in no particular order of importance

The promoters of computers in education were held to be:-

1	The media
2	Government
3	Employers
4	Education Department
5	Computer Suppliers
6	Teachers

In addition to the above the following beliefs were held by parents and teachers.

TABLE 26: Belief Held by Parents and Teachers

The promoters of computers in education were held to be:-

1	Parents
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From the perspective of teachers, parents and students there was no one force promoting computers in education. This supports the view that the pluralistic nature of society causes the promotion of technology to a greater or lesser degree depending on the advantages and disadvantages viewed from each perspective. In general there is a wide perception that many groups are promoting the use of the technology. The potential benefits to all parties have created the shared core of reality which has enabled the technology to be absorbed with relatively little turmoil and hastened the development of the knowledge which has legitimated its use by all sectors.

Conclusions

9. CONCLUSIONS

9.1 THE IMPLICATIONS FOR SCHOOLING

From the limited findings of this research it would suggest that schools will not be in an environment which is dominated by the computer nor will schools have features greatly different from those presently operating. Schools will not cease as suggested by Papert (1980) nor will teachers find themselves unemployed. Schooling will maintain this profile in the future because the reality of such schooling is presently being constructed by those engaged in the 'world of schooling' namely, the teachers, parents and students.

Based on the analysis of all sources used in this study an interpretation is given as to how this reality of schooling is being created and how the social construction of 'knowledge' about computers and education supports that reality.

9.2 THE DEVELOPMENT OF THEORIES & THEIR ROLE IN DEFINING A NEW REALITY

A little over a decade ago, in the mid 1970s, the technology of computers became sufficiently sophisticated to move them from the clumsy scientific models used for research and be purchased by businesses and individuals for personal, commercial and manufacturing environments.

At about the same time writers began publishing a range of books which provided evidence of the theorising taking place about the effects of this technology on society. This points to the rate at which theorising impacts upon society. There are numerous reasons why this may have occurred but several may be cited.

First, research workers began publishing papers about how this technology could be used, often straying far from their field of expertise to speculate how work would be revolutionised (Michie, 1974).

Second, manufacturers and suppliers of computer equipment began promoting the potential benefits of using computers. From these early efforts to create a market and popularise the technology grew the seeds of considerable theorising. In particular, claims by the producers that computers would remove the drudgery and high cost of labour struck a raw nerve within those concerned about the security of employment.

A plethora of books was published dealing with work and employment (Barrett, 1978; Marsh, 1981). Computers were rapidly being used in consumer goods. Computers were also being used in space exploration and military equipment. These high profile uses provided the catalyst for further claims about the power, versatility and necessity of computers. Upon this fertile foundation writers speculated about how society would change as a result of the technology (Burnham, 1980; Evan, 1979; Martin, 1981).

Another contributing factor to the theorising at that time can be found in the disciplines of psychology and neurology which used analogies of computing to explain concepts about human thinking (Boden 1977).

The language used including aspects of 'intelligence' enabled the theorising to cross into areas previously considered sacrosanct. The theorising by Michie (1979) about artificial intelligence and the potential of the computer to become a tutor saw the beginning of a number of authors publishing theories about the place of computers in education. Research had actually taken place on this subject beginning in approximately 1970 but did not become the topic of authors for another five years.

Some authors were clearly presenting rival definitions of the reality of schooling. The challenge thrown up by Papert (1980), Heaford (1985) and others to embrace the technology was generally ignored by the educational bureaucracies at that time. However, writers such as Shallis (1984), Reineke (1982), Weigenbaum (1976) and Turkle (1984) all argued against the head-long rush into the wide use of the technology. Nevertheless, while these debates were underway in the literature, society was adopting computer technology in the business, manufacturing and service sectors at an ever increasing rate.

Many people, as a consequence, were involved in the use of the technology as part of their daily work routines. The language of computers was beginning to be seen as an essential pre-requisite for those entering the work force and much of the social construction of knowledge about computers in education was underway. But why were computers selected for use in schools in preference to other technologies? This can be explained by examining the reification of knowledge about computing.

9.3 REIFICATION OF COMPUTER TECHNOLOGY

Not only were computers viewed as essential to the work place but they were being viewed as essential to life itself. Many of the early claims about computers and their ability to send human beings to the moon, do rapid calculating and issue detailed personal statements were accepted in society but they were also enlarged and took on mythical qualities. Even where this did not occur the computer was given a particular status in society where its inevitability was unquestionable (see Table 11 page 286). This unquestionable nature of the knowledge manifests the reification of that knowledge. The reification of knowledge about computers appears to have had a significant bearing upon its acceptance within education and its legitimization as an essential element of education.

9.4 THE PROCESS OF LEGITIMATION

As computers reached higher levels of reification in society more individuals began to explore the technology. Amongst the individuals were teachers. In a modern society a high level of tolerance exists for individuals to explore new ideas. (Berger and Luckman, 1966). Outside the institution of schooling knowledge about computers, and particularly reified accounts of its necessity, created a demand for schools to provide students with 'knowledge' about computers.

The knowledge held by society was and still remains tentative and rudimentary in nature (see Table 10 and 13).

No fundamental demand grew for schools to change radically the way in which they educated the young as some accounts in the media proposed. As teachers began to respond to the same reified knowledge, the educational bureaucracy set up a small unit to respond to growing social pressure. That unit, the Computing Centre, was not central to the Education Department's purpose but provided evidence of its interest and response to community pressure.

As the Centre trained teachers they returned to their schools and created an internal force in sympathy with some of the external pressure for schools to respond. Computer suppliers also added to the pressure by offering schools assistance to purchase computers. However, although the schools

accommodated this external and in some cases internal pressure, there was no uniform response.

A more unified response followed the legitimation of computing by numerous organisational and political forces, in particular, political parties, and Government.

There are compelling reasons to believe that the legitimation of computing was a necessary element of schooling which required a high degree of reification of the knowledge about computing before this legitimation could occur (see political party policy statement and comments by the then Minister for Education, page 134).

Once again the legitimation of the knowledge of computing could only be described as rudimentary in nature. No attempts were made to describe how this technology was to be used but rather that students somehow had to have the 'knowledge'.

9.5 THE ROLE OF THE SYMBOLIC UNIVERSE

No forms of legitimation take place without being located in some way into a symbolic universe to explain its place in society and in this case, education.

Berger and Luckmann proposed that,

If the institutional order is to be taken for granted in its totality as a meaningful whole, it must be legitimated by 'placement' in a symbolic universe (Berger and Luckmann 1966 : 122).

In this study the inclusion of computer technology into the institution of schooling was legitimated by governments, political parties and unions using an economic symbolic universe which appeared to be taken for granted. However, what this study failed to establish was whether the symbolic universe was used to locate computers into schooling or whether computers were located into schooling because of a problem with the symbolic universe of economics, that is, whether computers were used as a procedure of universe-maintenance.

- It may be that the legitimation process served both functions. For example,
- it must be asked why the government chose to legitimate computers into the institution of schooling at a time when they were clearly concerned with economic theories although at a rudimentary level. After all, computers had been in schools for some time. Furthermore, would this legitimation by the government have made any significant difference to the process given that the computer knowledge was so highly reified and parents did not acknowledge that the Government was a major influence.

A further matter refers to the manner in which the whole institution of schooling was moved towards the symbolic universe of economics. This process brought the institution of schooling more firmly within the Government's own field of influence. This may demonstrate the influence of power which was applied to impose a particular view of reality sponsored by the government. In this case, that education must serve an economic purpose.

However, it is questionable how firmly the institution of schooling is located in the economic symbolic universe as even the then South Australian Minister for Education, Arnold, and the then Federal Minister, Jones, both expressed views which showed that they were attempting to hold onto a long established knowledge that schooling was to educate for the development of the whole person (see pages 121,122, 125 and 138) and to maintain an established reality that is 'held to be knowledge', against emerging competing views.

At this point it is necessary to discuss the nature of the theories created to make this event meaningful.

As previously mentioned, few people when asked could articulate why computing had such a high priority in comparison to other technologies. However, they could describe where computing was used to make life easier. This level of theorising was largely rudimentary.

What appeared to be equally important in this case was that those trying to legitimate the place of computers in education, were no better placed to explain why computers were so important to society and education than the rest of the community. This appeared to present a problem for the legitimators who in the absence of an elaborate symbolic universe, more obvious in previous societies, had to rely upon rudimentary economic arguments to justify and explain the importance of computers to education.

Their argument ran something like this: The well being of the community depends upon its economic development. Its economic developments depends upon the use of technology. Computer technology is most important to the economic development and education is the appropriate place to prepare society for the technology.

In other words educational purposes were being expressed in terms which enhanced the creation of wealth. However, because the 'knowledge' of computers became so reified then there seemed to be little need to justify and explain the technology in any detail. It was self evident.

The next question to answer was how had the institution of schooling responded to the demands of reality definers from outside the school. First, it must be pointed out that 'knowledge' about the institution of schooling was still firmly sedimented within society. However, unlike many such institutions of the past, modern schooling seems to have placed few obstacles and little resistance to the acceptance of new ideas for schooling.

This does not imply that individuals did not speak out against change but at the institutional level no rigorous opposition was found. This can be explained in three ways.

First, the level of reification may have been at such a level that the individual role holders in the institution did not resist what appeared to be inevitable.

Second, the institution appeared to have been responding to another legitimated belief that schooling must respond to the needs of society.

Third, this may also be a factor explained by the levels of pluralism existing in society where the needs of employers, individuals and the institution of schooling are mutually supportive resulting in acceptance of the new reality.

9.6 **WHOSE THEORIES WERE LEGITIMATED?**

It was relatively easy to identify the 'knowledge' which had been legitimated about the use of computers in education in South Australia (see Appendix 5, page 22, 23 and 25), however, it was far more difficult to identify whose 'knowledge' had been legitimated. Although technology suppliers were often assumed to be the driving force behind the implementation of computers in education, there was little evidence to support the view that they have a significant influence in the construction of knowledge about its use in education.

The ownership of specific theories in a modern society seems to be far more difficult to identify and single ownership of theories may no longer be tenable in an integrated, pluralistic society. In this instance the evidence points to a process by which different groups adopted the theories according to how the theories supported their own view of reality.

For example, Governments used the knowledge about the technology to support claims that productivity must be improved and wealth generated and to some degree had the power to enforce their views. Teacher unions used the knowledge to protect jobs and to identify areas of exploitation while schools used the knowledge in many instances to convince their clients, ie parents, that they were progressive and responding to the latest needs of society. However, the knowledge about the technology appeared, once objectivated, to have created the substance of new knowledge which posed the question, 'How can the knowledge now held be used to again redefine the reality of schooling?' The Principals were responding by exploring the application of computers within their schools which tends to demonstrate the dialectic nature of knowledge (refer Appendix 5, page 27).

9.7 THE IMPLICATIONS FOR THE PRACTICE IN SCHOOLS

It is necessary to return to the theories of the educational writers such as O'Shea and Self (1983), Heaford (1983), Coburn and others (1982) and Conabere and Anderson (1985).

O'Shea and Self gave three reasons for introducing computers into education:

1. To enable students to cope with a technological future.
This was widely accepted by parents, students and teachers.
2. They felt that computers would assist with administrative matters.
This too was a view widely shared and finally, computers would improve the learning process.
3. All sectors of the schooling community accepted that computers should be used to assist the intellectual development of students.

I shall take Heaford as a writer expressing views opposed to the reality described above.

Heaford expressed the view that the rate of change would cause alarm to educators. The evidence from the survey would not support this view. In fact many of the educators appeared at ease with the introduction of computers and held beliefs about its extensions into other fields. His second concern was that computers would be confined to mathematics and science departments. This concern was not shared by the school population and efforts were being made to extend computer use into all subjects. Third, he felt that the use of computers would be monopolised by males. No such belief was accepted within the schools even though some instances of it might exist in reality. Fourth, he had concerns for the lack of knowledge held by the teaching profession. Although this concern may be levelled at

individuals within the profession evidence from the survey showed that teachers' knowledge had at least kept pace with the rest of the community and a larger percentage of the teaching profession had computing experience than the community at large.

His final point regarded the lack of studies about the impact of computers on society. This aspect of his beliefs may be sustained but once again it could be argued that this is not the task of educators but may need to be included in some way in the curriculum. Responses to the survey indicated that this topic should be addressed in schools. However, School Principals showed an awareness of this matter and were keen to widen the base of computer use in schools which would address some aspects of this concern.

Coburn and others approached the issue of computers in schools from the perspective of training. First, they raised questions about how teachers would get adequate training. This concern hinged to some degree around what was considered adequate training.

If Coburn and associates assumed that teachers would require extensive programming skills they might have had cause for concern. However, modern software development and the heavy promotion of computers in schools by computer companies have removed many of these problems.

The survey indicated that the major source of knowledge about computing came from direct experience with computers and from talking to others. If the survey results were indicative of the teaching profession then most had been using computers or had worked with a mentor in the school who had been trained either by the Computing Centre or a computer supplier.

Second, Coburn and associates raised the issue of **computer reliability** and ease of use. This problem was not raised as a concern by school teachers in any discussions about computers. Moreover, recent developments are simplifying the means of using computers further. Some students raised as an issue the need to type information into the computer, however, many devices are now available which would reduce this method of interaction.

Third, Coburn and associates believed that some social problems would accompany the introduction of computers into schools. School Principals and some parents expressed concerns about this matter in relation to social interaction. This concern was not given any credibility by those responding to the survey who believed that such problems could be dealt with by restructuring the curriculum to place more emphasis upon human relations and learning more about the knowledge acquisition aspects to computer learning.

Fourth, Coburn raised a question about the appropriate goals for computer literacy. Within the schools surveyed this was no longer regarded as an issue. Computers were regarded as tools and were to be used whenever appropriate.

Finally, Coburn asked how teachers would use the computer's learning potential. This question cannot adequately be addressed at this time. However, teachers were exploring the potential and the beliefs they held supported the view that learning would become a more individual activity as much more learning took place at the computer.

Conabere and Anderson advanced four reasons why the traditional methods used by teachers persisted. The first was that schools had never had any real competition. This argument depended upon what they regarded as competition. If they meant that schools had not had to compete with any organisation which offered a different technology then they might have been correct. However, the more likely reason for this was that 'knowledge' about schooling and the institution of learning using those traditional methods is sedimented into human consciousness and thus other alternatives are not easily accepted by society. The evidence presented within this research (see Table 11 page 286) suggests that teachers, parents and students are reconstructing that reality to include computer technology as a legitimate approach to learning.

Second, Conabere and Anderson claimed that the teaching profession was conservative. This argument could probably be sustained but once again the point can be made that 'knowledge' about teachers was the more important factor in that the roles were institutionally defined and society would not tolerate a role for teachers which was not conservative in nature. This research nevertheless, suggests that new roles were being defined for teachers which would involve the computer as a normal part of schooling.

Third, they pointed out that no commitment was given by the Government to on-the-job training. Such commitments have been given (refer page 135, Arnold 1985) but whether that commitment had any real impact is debatable.

Certainly, within this research Principals of Schools and the Head of the Computing Centre all expressed doubts about the Government's commitment to real change occurring in schools.

Finally, Conabere and Anderson expressed concern about the lack of educational research and development to show how improvements could be made. This claim could still be made but it could also be argued that teachers are experimenting with, in this instance, computers, and are being supported in that development by the school community.

Conabere and Anderson also claimed that computers should be introduced into education on three grounds:-

- (1) Computers could enhance and aid learning through the immediacy of their access to data.
- (2) Students showed increased motivation.
- (3) Students might learn to 'think about thinking'.

The survey results showed a belief by parents, teachers and students that indeed, computers would provide a number of benefits to learning. However, no support was given to the belief that students would be motivated by the use of computers.

One further implication regarding the construction of knowledge about computers in schooling needs addressing. Once a technology, such as computing, is installed in schools and the institution begins to rely upon it then there will be a temptation during times of scarce resources to make decisions about where those resources should be spent; more technology or more people?

If past trends, such as automation in industry, serve to guide us then those decisions will be made in favour of the technology. Moreover, once computers are widely used within schools then the institution of schooling would become a consumer of technology in the same way as other industrial and commercial institutions have become in the past. This process appears to have the potential for acceleration of the rate of change in schools.

9.8 SUMMARY

There is some evidence to support the notion that a new reality is being defined. Teachers and parents, in particular, support the inclusion of computing in schools and Principals were theorising about the next phase of development.

The responses to the survey could be interpreted in such a way as to suggest that students are already taking the new reality for granted and not placing great emphasis on the use of computers. Their general support for many of the belief statements were at a lower level than parents and teachers and many of their comments indicated that although computers were important they were not the most important issue facing them in the future.

No doubt, as computing becomes more sophisticated and is more widely available due to lower costs, then students will spend greater proportions of their time working with and through computers.

The 'taken for granted' nature of the 'knowledge' held by students about education and computers and the theories being constructed by those reality definers most able to influence the future directions of schooling, clearly demonstrate that a new reality has been established in which computers are perceived as the learning technology for schooling and essential knowledge of an educated citizen. The roles of teachers, their methodology and the potential created for interaction between students, teachers and specialists

with new 'knowledge' about computer applications for learning will increasingly become more acceptable as alternative definitions of reality are presented to schools and the dialectic between the old and the new boundaries of reality create the conditions for the new 'social distribution of knowledge (with its consequences for the social objectivation of reality)' (Berger and Luckman 1966 : 193).

Appendices

10. APPENDICES

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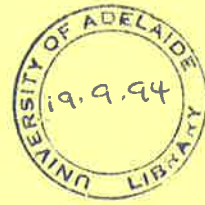
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*The Making of Technological Reality in Schooling:
A Study of the Social Construction of 'Knowledge'
about Computers and Education*



The Making of Technological Reality in Schooling:

***A Study of the Social Construction of 'knowledge' about Computers
and Education.***

***Thesis submitted in fulfilment of the requirements for the degree of Doctor
of Philosophy at the University of Adelaide (Department of Education)***

January, 1994

Errol Cresshull

APPENDICES

10. APPENDICES

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- APPENDIX 2** Interview Questions Put to the Principals of Schools
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Appendix 1

APPENDIX 1

Appendix 1 is the list of questions prepared to guide the interview of the Director of the Angle Park Computing Centre.

APPENDIX 1

Interview Questions for the Director of the Angle Park Computing Centre

1. What role has the Centre played in the development of computer education?
2. What is the Centre's present role?
3. What problems face the Centre and computer education?
4. Why has computing created such an impact?
5. What is the purpose of teaching about computers?
6. Should schools teach with computers or about computers?
7. Do you see a threat to education from external computer groups?
8. What role have parents played in computer studies?
9. Are teachers' fears a problem?
10. How important has the Centre been to computer learning?
11. What problems face the schools?
12. What has been the Government's role in the development of computers for school use?
13. Are schools still relevant?
14. How will learning be affected by the introduction of computers?
15. What is the school's future in a modern society.

Appendix 2

APPENDIX 2

Appendix 2 presents the questions prepared to guide the interview with the Principals of Schools.



APPENDIX 2

Interview Questions Put to the Principals of Schools

1.1 How important to you is it that the School offers computer use in its studies?

Important

Not Important

Explain: _____

1.2 What are the policies of the School regarding the introduction and use of computers?

Explain: _____

1.3 What is the purpose of these policies?

- (a) Better prepare students for technology
- (b) Better prepare students for jobs
- (c) Give them better access to information
- (d) To improve their learning skills
- (e) To improve their motivation

Others specify: _____

1.4 Do you believe that teaching students to use computers improves their employment opportunities?

YES

NO

If Yes

- What sort of employment? _____

- Is it important for their leisure opportunities? YES NO

Explain: _____

2. Are you under any direction or pressure to implement computer use into your curriculum from:-

- (a) Government
- (b) Education Department
- (c) Media
- (d) School Boards, Councils
- (e) Parents
- (f) Teachers
- (g) Peers
- (h) Students

Explain: _____

3. Do you think that parents want their children to be taught to use computers?

YES

NO

Explain: _____

4. In what ways should students in this school be taught about computer use?

Explain: _____

- At what levels should it be taught. (Ring answer)

1 2 3 4 5 6 7 8 9 10 11 12

- What students should be given this education?

- (a) All students
- (b) Those who request it
- (c) Those who are gifted with high ability
- (d) Those who have mathematical ability

Others specify: _____

5. What steps have been taken to develop the knowledge and skills of teachers?

- (a) Teachers sent to courses
- (b) In-service course at the school
- (c) Literature distribution

Others specify: _____

6. What sort of response do teachers generally give to such programs?

- (a) Highly interested
- (b) Attend courses
- (c) Show little interest
- (d) Generally reluctant

Others specify: _____

7. What do you believe will be the long term effect of using computers on students?

- (a) ways of working
- (b) ways of thinking
- (c) ways of relating
- (d) ways of problem solving
- (e) ways of using their leisure
- (f) employment opportunities

Explain: _____

8. What do you believe will be the long term effect of using computers on teachers?

- (a) ways of working
- (b) ways of thinking about teaching
- (c) ways of relating to students
- (d) ways of teaching problem solving
- (e) ways of using their leisure
- (f) career opportunities

Explain: _____

9. Do you use computers for administering the School?

YES

NO

If not

- is this planned for the future?

What knowledge should administration have about computer use?

Explain: _____

10. Do you believe the future use of computers is exciting and optimistic?

YES

NO

Explain:

Appendix 3

APPENDIX 3

Appendix 3 was used to introduce the project to each of the participants in the project.

COMPUTER AND EDUCATION
RESEARCH PROJECT

- Project Description:** Computer Use in Education
- Objective:** To determine the way in which teachers, parents and students think about the use of technology in education.
- Background:** Over the past decade computers have rapidly been accepted as a technology which can impinge on all aspects of society. Having been widely accepted in the industrial and commercial sphere, writers have suggested that computers have a natural and useful role in education. Already computers are being widely used in most schools to provide students with an awareness of their potential. However, some educational writers believe that the computer has a much larger role both in education and society and will create immense change.
- This project seeks to determine the views of those people who would have to accept such arguments if the computer was to become a reality in learning and education.
- The Method:** A questionnaire has been designed to elicit responses to a wide range of questions by teachers, students and parents on this subject.
- The questionnaire would be administered to all teachers willing to participate, who teach Year 10, 11 and 12 students.
- The same questionnaire would be administered to all students in Years 10, 11 and 12 and the questionnaire would then be sent home with students to their parents who would return them to the school.
- Time Commitment:** The questionnaire takes approximately 30 minutes to complete and would be followed by a short interview with a sample of the participating Teachers and Parents to explore their views more fully.
- Confidentiality:** All aspects of this survey will be treated in the strictest confidence and will only be used for the research purpose cited above. All aspects of this research will be in accordance with the Education Department and University of Adelaide's code of conduct for research in schools.
- Outcomes:** The results of the survey would be made available to the school and final details of any research conclusions would also be available if considered of benefit for future decisions.

Appendix 4

APPENDIX 4

Appendix 4 includes the questionnaire used for the survey of Students, Parents and Teachers. All questionnaires are similar except for introductory questions.

STUDENT SURVEY

A Survey About Computers & Education

The following questionnaire seeks to determine what students think about computers and their possible role in education.

All aspects of this survey will be treated in the strictest confidence and will only be used for the research purposes cited above. All aspects of this research will be in accordance with the Education Department and the University of Adelaide's code of conduct for research in schools.

The questionnaire takes approximately 30 minutes to complete.

Example:

	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
Computers are used in many businesses	1	2	3	4	5

Thank you for taking part in this survey.

PARENT SURVEY

A Survey About Computers & Education

The following questionnaire seeks to determine what parents think about computers and their possible role in education.

All aspects of this survey will be treated in the strictest confidence and will only be used for the research purposes cited above. All aspects of this research will be in accordance with the Education Department and the University of Adelaide's code of conduct for research in schools.

The questionnaire takes approximately 30 minutes to complete and may be followed by a short interview.

Example:

Strongly Agree		Not Sure	Strongly Disagree
	Agree		Disagree

Computers are used in many businesses	1	2	3	4	5
---------------------------------------	---	---	---	---	---

If you are willing to be interviewed as a follow up after the questionnaire, please place your telephone number in the space provided.

Name:

Telephone Number:

Please place the completed survey in the accompanying envelope and post to:-

Adelaide
Education
5001

The University of
Department of
GPO Box 498
ADELAIDE SA

Thank you for taking part in this survey.

PARENT SURVEY

SECTION I - BACKGROUND

NAME OF SCHOOL:

SEX: MALE FEMALE (Circle answer)

ETHNIC BACKGROUND

MOTHER BORN IN:

FATHER BORN IN:

SELF BORN IN:

LANGUAGE USED IN THE HOME:

AGE: (Circle appropriate years)

 20-29 30-39 40-49 50-59 60+

OCCUPATION:

Answer each question by circling your answer.

- Have you used a computer? YES NO
- Do you use a computer at school? YES NO
- Do you use a computer at home? YES NO
- Have you undertaken training in computer use? YES NO
- For how long have you used a computer? ___ Yrs ___ Mths

Where did you gain most of your knowledge about computers? Circle the number which most agrees with the source of your knowledge.

	Most	Some	No	
	Knowledge	Knowledge	Knowledge	
Not				
Sure				
Newspapers	1	2	3	4
Television	1	2	3	4
Magazines	1	2	3	4
Radio	1	2	3	4
Books	1	2	3	4
Talking to Other People	1	2	3	4
School	1	2	3	4
Computer Training Course	1	2	3	4
Watching People use Computers	1	2	3	4

TEACHER SURVEY

A Survey About Computers & Education

The following questionnaire seeks to determine what teachers think about computers and their possible role in education.

All aspects of this survey will be treated in the strictest confidence and will only be used for the research purposes cited above. All aspects of this research will be in accordance with the Education Department and the University of Adelaide's code of conduct for research in schools.

The questionnaire takes approximately 30 minutes to complete and may be followed by a short interview.

Example:

	Strongly Agree		Not Sure		Strongly Disagree
Computers are used in many businesses	1	2	3	4	5

Name:

Thank you for taking part in this survey.

TEACHER SURVEY

SECTION I - BACKGROUND

NAME OF SCHOOL:

SEX: MALE FEMALE (Circle answer)

ETHNIC BACKGROUND

MOTHER BORN IN:

FATHER BORN IN:

SELF BORN IN:

LANGUAGE USED IN THE HOME:

AGE: (Circle appropriate years)

20-29 30-39 40-49 50-59 60+

YEARS OF TEACHING:

0-5 6-10 11-15 16-20 21-25 26-30 31-35 36+

SPECIALISATION: (circle most appropriate)

ARTS 1 MATHS 2 SCIENCE 3 VOCATIONAL 4

Answer each question by circling your answer.

- Have you used a computer? YES NO
- Do you use a computer at school? YES NO
- Do you use a computer at home? YES NO
- Have you undertaken training in computer use? YES NO
- For how long have you used a computer? ___ Yrs ___ Mths

Where did you gain most of your knowledge about computers? Circle the number which most agrees with the source of your knowledge.

	Most Knowledge	Some Knowledge	No Knowledge	Not Sure
Newspapers	1	2	3	4
Television	1	2	3	4
Magazines	1	2	3	4
Radio	1	2	3	4
Books	1	2	3	4
Talking to Other People	1	2	3	4
School	1	2	3	4
Computer Training Course	1	2	3	4
Watching People use Computers	1	2	3	4

SECTION II - TECHNOLOGICAL FUTURE

Read each statement below and circle the number which most clearly agrees with your opinion.

	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
Computers are likely to have a great effect on my life.	1	2	3	4	5
All people will need to know about computers in the future.	1	2	3	4	5
Computers are unlikely to change things much in my lifetime.	1	2	3	4	5
The use of computers will mean that most people will be required to work part-time in future.	1	2	3	4	5
Computers will eventually put people out of work.	1	2	3	4	5
Computers will run most factories.	1	2	3	4	5
Computers will store personal information about us.	1	2	3	4	5
Those people who can use computers will get good jobs.	1	2	3	4	5
Governments should have more control over computer use.	1	2	3	4	5
Computer use will greatly change jobs.	1	2	3	4	5
Governments will know much more about us from computers.	1	2	3	4	5
Much of our leisure time will be spent playing computer games.	1	2	3	4	5
Many people will work from home using computers instead of going to a workplace.	1	2	3	4	5
New religions will arise based on super computers.	1	2	3	4	5
Most of our communication will be through computers.	1	2	3	4	5
Most of our information will come from computers.	1	2	3	4	5

SECTION III - COMPUTERS & EDUCATION

Read each statement below and circle the number which most clearly agrees with your opinion.

	Strongly Agree	2	Not Sure	4	Strongly Disagree
		Agree		Disagree	
Relationships					
Computer learning would improve relationships between students.	1	2	3	4	5
Students would prefer to be taught by computers rather than teachers.	1	2	3	4	5
Learning by a computer would cause less friction between students and teachers.	1	2	3	4	5
Students would get better results if their learning was controlled by computers rather than teachers.	1	2	3	4	5
Students would tend to discuss computer related problems with other students.	1	2	3	4	5
Learning Ability					
Students' ability to learn would be improved by using computers.	1	2	3	4	5
Using computers would complicate learning about a subject.	1	2	3	4	5
Students would spend more time researching a subject if it was learnt using computers.	1	2	3	4	5
Computer learning would help students organise their work more successfully.	1	2	3	4	5
Using computers would assist students to learn how to learn.	1	2	3	4	5
Motivational Effects					
Using computers would make students more interested in their studies.	1	2	3	4	5
Learning would be more enjoyable if students could control the subject material through computers.	1	2	3	4	5

Strongly Agree		Not Sure	Strongly Disagree		
	2		4		
	Agree		Disagree		

Gender Effects

Male students would be more able at using computers than female students.

1 2 3 4 5

Female students would be less interested in using computers.

1 2 3 4 5

Male and female students would be equally able to learn using computers.

1 2 3 4 5

Females are more likely than males to need computing skills in their future jobs.

1 2 3 4 5

Mixed classes of males and females would be best when learning by computer.

1 2 3 4 5

Most students would be better able to learn using computers when working with a member of the same sex.

1 2 3 4 5

Females would learn better using computers in groups.

1 2 3 4 5

Career Needs

Most people will need to use computers in their

1 2 3 4 5

Most future work will be less skilled as computers are widely used.

1 2 3 4 5

Many jobs students would like to do will be replaced by computer technology.

1 2 3 4 5

Computers will cause work to change rapidly in the future and people will need to learn for a new job more often.

1 2 3 4 5

Most school leavers will need to know how to use computers to gain employment.

1 2 3 4 5

Need to Study Social Effects of Computers on Society

Computers will not greatly affect society in the future.

1 2 3 4 5

Students should be studying the effects of computers on society.

1 2 3 4 5

Students should be concerned about the way computers are being used in society.

1 2 3 4 5

	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
Computers are unlikely to affect students in their personal lives.	1	2	3	4	5
Creativity					
The use of computers would place limits on the ways students solve problems.	1	2	3	4	5
Computer learning would produce students who all think in a similar way.	1	2	3	4	5
Students would be more creative if they used computers to learn.	1	2	3	4	5
Relevance of Computer Learning to Different Subjects					
Science subjects are more suitable for computer learning than arts subjects.	1	2	3	4	5
Computers should be used for career subjects	1	2	3	4	5
Learning using computers is relevant to all subjects	1	2	3	4	5
Relevance of Computers to Future Needs					
Much of students' present studies would not be needed as the information would be instantly available on computer.	1	2	3	4	5
Learning about computers will be irrelevant to students' future needs.	1	2	3	4	5
Use of computers to learn will change what students need to learn in future.	1	2	3	4	5
Using computers for learning will be useful to future learning needs in TAFE or University.	1	2	3	4	5
Equity Issues					
Students who are able to learn computers would become an elite group (ie, a special group).	1	2	3	4	5
Computer learning will benefit those students who can afford the most expensive, private learning material.	1	2	3	4	5
Students will have a greater say in the materials they wish to learn.	1	2	3	4	5

	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
The slower learners will be at a greater disadvantage when using computer learning.	1	2	3	4	5
Efficiency Issues					
Schools which use computer learning will be more successful than those which do not.	1	2	3	4	5
Students choice of studies will be more related to their personal needs.	1	2	3	4	5
Less teachers will be required in each school.	1	2	3	4	5
Schools will be able to use teachers more usefully.	1	2	3	4	5
Teachers will be able to give students more personal attention where it is needed.	1	2	3	4	5
Students who do not have a strong desire to learn will fall behind.	1	2	3	4	5
Students who are able to use computers would be able to learn at their ownpace.	1	2	3	4	5
Some work could be done from home terminals.	1	2	3	4	5
Students would have instant access to relevant information through the computer.	1	2	3	4	5
Students' records could be updated rapidly and results gained instantly.	1	2	3	4	5
Students would individually be able to spend more time on problems with the teacher.	1	2	3	4	5
Students would work more productively without distractions from other students.	1	2	3	4	5

COMMENTS:

SECTION IV - THE FUTURE OF COMPUTERS & SCHOOLING

What future do you see for schools where computers are widely used? Circle the most likely description of the school of the future (ie 5-10 years)

- | | |
|--|---|
| A place which conducts lessons as at present but which uses increasing amounts of computer technology for learning. | 1 |
| A place from where students' progress is managed, records kept and advice given but with much of the learning occurring out of the school in houses, libraries and other institutions. | 2 |
| A place where students spend time on individual study programs monitored and recorded by computer. | 3 |
| A private company which manages computer learning programs for individuals for a fee in their homes or in small learning centres. | 4 |
| A place where students gather for group and social activities but specific knowledge is gained personally using computer technology. | 5 |
| A place which becomes irrelevant as technology removes the need for separate institutional education and replaces it with centralised data banks of learning material which can be used as required throughout life. | 6 |
| None of the above | 7 |

The role of a teacher includes many tasks. From the list below indicate how important each task will be in a future school in which computers may be widely used for learning.

	Most Important	Important	Not Sure	Unimportant	Least Important
Curriculum developers	1	2	3	4	5
Maintain student discipline	1	2	3	4	5
Counsellors and study advisers	1	2	3	4	5
Computer operators	1	2	3	4	5
Developers of student social skills	1	2	3	4	5
Managers of individual student learning	1	2	3	4	5
Assessors of student performance	1	2	3	4	5
Trouble shooters	1	2	3	4	5
Student motivators	1	2	3	4	5
Provide advice to parents	1	2	3	4	5
Computer program buyers	1	2	3	4	5
Evaluators of computer programs	1	2	3	4	5
Child minders	1	2	3	4	5
Writers of computer programs	1	2	3	4	5

SECTION V - CONTROL OF TECHNOLOGY IN EDUCATION

Indicate the degree to which you agree or disagree with the following statements.

	Strongly Agree	2	Not Sure	Strongly Disagree	5
		Agree		Disagree	
Most people have made a decision about using computers in education.	1	2	3	4	5
The development of the computer for school use is inevitable.	1	2	3	4	5
Teachers will have to use computers in education.	1	2	3	4	5
A 'computer society' is an inhuman prospect.	1	2	3	4	5
People will be given the choice about where computers are used in society.	1	2	3	4	5
Given a choice I would not involve computers in education.	1	2	3	4	5
Schools will be reshaped by the computer.	1	2	3	4	5
Computers will ultimately make most decisions in society.	1	2	3	4	5
A 'computer society' is an exciting possibility.	1	2	3	4	5
Computers are only like any other machine eg TV.	1	2	3	4	5
Computers think much like humans.	1	2	3	4	5
Many computer applications are rather frightening	1	2	3	4	5
Computers are very complicated.	1	2	3	4	5
Computers can only do what they are told.	1	2	3	4	5
A 'computer society' is a frightening future.	1	2	3	4	5
Teachers will lose control of the curriculum to computer programmers.	1	2	3	4	5
Education will be constrained to fit computers.	1	2	3	4	5

From the groups identified below show whether you agree or disagree that they have promoted the use of computers in education.

	Strongly Agree	2	Not Sure	3	Strongly Disagree	4	5
The Media	1	2	3	4	5		
The Government	1	2	3	4	5		
Employers	1	2	3	4	5		
The Education Department	1	2	3	4	5		
Parents	1	2	3	4	5		
Computer Suppliers	1	2	3	4	5		
Teachers	1	2	3	4	5		
Unions	1	2	3	4	5		

COMMENTS:

Appendix 5

APPENDIX 5

This appendix is the analysis of the surveys of schools. The schools surveyed were part of a case study of the knowledge held by students about computers in schooling.

The appendix consists of responses to five sub-sections as follows:-

- Technological Future
- Computers and Education
- The Future of Schooling and Education
- Control of Computer Technology in Education
- Evaluation of Schooling

These sub-sections have been presented as follows:-

- Sources of Knowledge About Computers
- Beliefs about a Technological Future
- Computers and Education
- Role of Teachers and Computer Technology
- Control of Technology in Education
- Purpose of Schooling
- Satisfaction with Schools
- Promoters of Computers in Education
- Selected Questions from Beliefs about a Technological Future by Sex, Teacher Specialisation, School and Age
- Selected Questions from Beliefs about Computers and Education
- Analysis of Selected Questions from Control of Technology in Education by Age, Sex and School

SOURCE OF KNOWLEDGE ABOUT COMPUTERS

			Most Knowledge	Some Knowledge	No Knowledge	Not Sure	TOTAL
NEWSPAPERS	S	n	1	90	177	27	295
		%	0.34	30.51	60.00	9.15	100
	P	n	1	72	102	1	176
		%	0.57	40.91	57.95	0.57	100
	T	n	0	21	16	1	38
		%	0.00	55.26	42.11	2.63	100
	Tot %		0.30	42.22	53.35	4.11	100
TELEVISION	S	n	20	151	102	22	295
		%	6.78	51.19	34.58	7.46	100
	P	n	7	60	108	1	176
		%	3.98	34.09	61.36	0.57	100
	T	n	2	19	15	2	38
		%	5.26	50.00	39.47	5.26	100
	Tot %		5.34	45.09	45.13	4.43	100
MAGAZINES	S	n	14	93	163	24	294
		%	4.76	31.63	55.44	8.16	100
	P	n	7	71	99	2	179
		%	3.91	39.66	55.31	1.12	100
	T	n	1	20	15	0	38
		%	2.78	55.56	41.67	0.00	100
	Tot %		3.81	42.28	50.80	3.09	100
RADIO	S	n	1	33	228	29	291
		%	0.34	11.34	78.35	9.97	100
	P	n	2	21	147	6	176
		%	1.14	11.93	83.52	3.41	100
	T	n	0	5	30	2	37
		%	0.00	13.51	81.08	5.41	100
	Tot %		0.49	12.26	80.48	6.26	100

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

SOURCE OF KNOWLEDGE ABOUT COMPUTERS

			Most Knowledge	Some Knowledge	No Knowledge	Not Sure	TOTAL
BOOKS	S	n	50	157	70	17	294
		%	17.01	53.40	23.81	5.78	100
	P	n	24	90	65	0	179
		%	13.41	50.28	36.31	0.00	100
	T	n	4	21	9	2	36
		%	11.11	58.33	25.00	5.56	100
		Tot %		13.89	54.00	28.37	3.78
TALKING TO OTHERS	S	n	81	164	41	11	297
		%	27.27	55.22	13.80	3.70	100
	P	n	61	109	17	0	187
		%	32.62	58.29	9.09	0.00	100
	T	n	18	18	1	2	39
		%	46.15	46.15	2.56	5.13	100
		Tot %		35.34	53.22	8.48	2.94
WORK/SCHOOL	S	n	230	68	7	2	307
		%	74.92	22.15	2.28	0.65	100
	P	n	89	62	51	2	204
		%	43.63	30.39	25.00	0.98	100
	T	n	22	15	2	0	39
		%	56.41	38.46	5.13	0.00	100
		Tot %		58.32	30.33	10.80	0.54
COMPUTER TRAINING	S	n	78	67	125	19	289
		%	26.99	23.18	43.25	6.57	100
	P	n	52	41	87	5	185
		%	28.11	22.16	47.03	2.70	100
	T	n	16	11	11	1	39
		%	41.03	28.21	28.21	2.56	100
		Tot %		32.04	24.51	39.49	3.94
WATCHING COMPUTERS	S	n	68	176	39	16	299
		%	22.74	58.86	13.04	5.35	100
	P	n	42	117	27	3	189
		%	22.22	61.90	14.29	1.59	100
	T	n	13	23	4	0	40
		%	32.50	57.50	10.00	0.00	100

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

BELIEFS ABOUT A TECHNOLOGICAL FUTURE

		AGREE		NOT SURE		DISAGREE		COMMENT	
		ONE	TWO	THREE	FOUR	FIVE	TOTAL		
Computers will have great effect on my life	S	n	58	123	87	29	9	Commonly shared belief held.	
		%	18.95	40.20	28.43	4.48	2.94		100
	P	n	49	98	20	43	11		221
		%	22.17	44.34	9.05	19.46	4.98		100
	T	n	13	16	5	7	3		44
		%	29.55	36.36	11.36	15.91	6.82		100
All people will need to know about computers	S	n	93	148	42	22	2	Commonly shared belief held.	
		%	30.29	48.21	13.68	7.17	0.65		100
	P	n	66	99	27	24	5		221
		%	29.86	44.80	12.22	10.86	2.26		100
	T	n	16	17	2	9	0		44
		%	36.36	38.64	4.55	20.45	0.00		100
Unlikely to change things in my life time	S	n	11	36	83	128	47	Commonly shared belief held in the negative.	
		%	3.61	11.80	27.21	41.97	15.41		100
	P	n	7	32	14	117	51		221
		%	3.71	14.48	6.33	52.94	23.08		100
	T	n	1	4	2	15	22		44
		%	2.27	9.09	4.55	34.09	50.00		100
Most work will be part-time	S	n	6	50	135	95	21	No commonly held belief by students. Commonly held belief in the negative by parents and teachers.	
		%	1.95	16.29	43.97	30.94	6.84		100
	P	n	7	15	49	100	50		221
		%	3.17	6.79	22.17	45.25	22.62		100
	T	n	0	4	14	16	10		44
		%	0.00	9.09	31.82	36.36	22.73		100
Put people out of work	S	n	17	64	73	118	32	No commonly held belief by students. Commonly held belief in the negative by parents and teachers.	
		%	5.59	21.05	24.01	38.82	10.53		100
	P	n	10	18	22	110	61		221
		%	4.52	8.14	9.95	49.77	27.60		100
	T	n	2	4	9	17	12		44
		%	4.55	9.09	20.45	38.64	27.27		100
Will run most factories	S	n	26	125	97	55	4	No commonly shared belief held.	
		%	8.47	40.72	31.60	17.92	1.30		100
	P	n	6	56	61	83	15		221
		%	2.71	25.34	27.60	37.56	6.79		100
	T	n	3	10	14	13	4		44
		%	6.82	22.73	31.82	29.55	9.09		100

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for number of responses = n
percentage of responses = %

BELIEFS ABOUT A TECHNOLOGICAL FUTURE

		AGREE		NOT SURE		DISAGREE		COMMENT			
		ONE	TWO	THREE	FOUR	FIVE	TOTAL				
Store personal information about people	S	n	70	163	62	9	2	306	Commonly shared belief held.		
		%	22.88	53.27	20.26	2.94	0.65			100	
	P	n	67	144	5	2	3			221	
		%	30.32	65.16	2.26	0.09	1.36				100
	T	n	17	26	0	1	0			44	
		%	38.64	59.09	0.00	2.27	0.00				100
Use of computers will lead to good jobs	S	n	76	138	60	26	7	307	Commonly shared belief held.		
		%	24.76	44.95	19.54	8.47	2.28			100	
	P	n	34	116	30	40	1			221	
		%	15.38	52.49	13.57	18.10	0.45				100
	T	n	7	18	13	6	0			44	
		%	15.91	40.91	29.55	13.64	0.00				100
Government should have more control	S	n	18	53	165	59	12	307	No commonly shared belief held.		
		%	5.86	17.26	53.75	19.22	3.91			100	
	P	n	18	57	50	72	24			221	
		%	8.14	25.79	22.62	32.58	10.86				100
	T	n	2	9	18	12	13			44	
		%	4.55	20.45	40.91	27.27	6.82				100
Will greatly change jobs	S	n	49	175	65	18	0	307	Commonly shared belief held.		
		%	15.96	57.00	21.17	5.86	0.00			100	
	P	n	37	146	23	14	1			221	
		%	16.74	66.06	10.41	6.33	0.45				100
	T	n	11	28	4	1	0			44	
		%	25.00	63.64	9.09	2.27	0.00				100
Governments will know more about us	S	n	25	110	121	40	10	306	No commonly held belief by students.		
		%	8.17	35.95	39.54	13.07	3.27			100	
	P	n	54	137	16	12	2			221	Commonly held belief by parents and teachers.
		%	24.43	61.99	7.24	5.43	0.90				
	T	n	9	27	6	2	0			44	
		%	20.45	61.36	13.64	4.55	0.00				100
Computers will be used for leisure	S	n	12	42	61	140	52	306	Commonly shared belief held in the negative.		
		%	3.91	13.68	19.87	45.60	16.94			100	
	P	n	2	17	24	134	44			221	
		%	0.90	7.69	10.86	60.63	19.91				100
	T	n	0	2	2	25	15			44	
		%	0.00	4.55	4.55	56.82	34.09				100

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

BELIEFS ABOUT A TECHNOLOGICAL FUTURE

		AGREE		NOT SURE		DISAGREE			
		ONE	TWO	THREE	FOUR	FIVE	TOTAL	COMMENT	
Many people will work from home computers	S	n 30	121	99	48	8	306	No commonly shared belief held.	
		% 9.80	39.54	32.35	15.69	2.61	100		
	P	n 3	70	65	69	14	221		
		% 1.36	31.67	29.41	31.22	6.33	100		
	T	n 0	16	17	8	3	44		
		% 0.00	36.36	38.64	18.18	6.82	100		
New religions will arise based on computers	S	n 2	4	56	84	160	306	Commonly shared belief held in the negative.	
		% 0.65	1.31	18.30	27.45	52.29	100		
	P	n 1	8	32	92	87	220		
		% 0.45	3.64	14.55	41.82	39.55	100		
	T	n 0	1	6	16	21	44		
		% 0.00	2.27	13.64	36.36	47.73	100		
Communication will be through computers	S	n 26	95	108	61	17	307	No commonly shared belief held.	
		% 8.47	30.94	35.18	19.87	5.59	100		
	P	n 13	97	37	56	16	219		
		% 5.94	44.29	16.89	25.59	7.31	100		
	T	n 4	11	8	17	4	44		
		% 9.09	25.00	18.18	38.64	9.09	100		
Most information will come from computers	S	n 27	117	88	67	8	307	No commonly held belief by students.	
		% 8.79	38.11	28.66	21.82	2.61	100		
	P	n 14	114	31	50	10	219		Commonly held belief by parents.
		% 6.39	52.05	14.16	22.83	4.57	100		
	T	n 3	19	8	11	3	44	No commonly held belief by teachers.	
		% 6.82	43.18	18.18	25.00	6.82	100		

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

COMPUTERS AND EDUCATION

		AGREE		NOT SURE		DISAGREE		COMMENT
		ONE	TWO	THREE	FOUR	FIVE	TOTAL	
Computer learning would improve student relationships	S	n 1	16	83	145	62	307	Commonly shared belief held in the negative.
		% 0.33	5.21	27.04	47.23	20.20	100	
	P	n 1	25	45	122	27	220	
		% 0.45	11.36	20.45	55.45	12.27	100	
	T	n 0	2	9	25	8	44	
		% 0.00	4.55	20.45	56.82	18.18	100	
Students would prefer to be taught by computers	S	n 14	47	59	112	79	306	Commonly shared belief held in the negative.
		% 4.58	15.36	19.28	36.60	24.18	100	
	P	n 1	13	24	132	50	220	
		% 0.45	5.91	10.91	60.00	28.73	100	
	T	n 0	3	6	20	15	44	
		% 0.00	6.82	13.64	45.45	34.09	100	
Would cause less friction between students and teachers	S	n 16	92	69	88	42	307	No commonly held belief by students. Commonly held belief in the negative by parents and teachers.
		% 5.21	29.97	22.48	28.66	13.68	100	
	P	n 2	31	37	123	27	220	
		% 0.91	14.09	16.82	55.91	12.27	100	
	T	n 0	11	10	15	8	44	
		% 0.00	25.00	22.73	34.09	18.18	100	
Students would achieve better results	S	n 7	31	77	120	72	307	Commonly shared belief held in the negative.
		% 2.28	10.10	25.08	39.09	23.45	100	
	P	n 0	10	25	125	59	219	
		% 0.00	4.57	11.42	57.08	26.94	100	
	T	n 0	2	7	22	13	44	
		% 0.00	4.55	15.91	50.00	29.65	100	
Students would discuss problems with other students	S	n 15	102	103	53	34	307	No commonly held belief by students. Commonly held belief by parents and teachers.
		% 4.89	33.22	33.55	17.26	11.07	100	
	P	n 5	116	47	47	5	220	
		% 2.27	52.73	21.36	21.36	2.27	100	
	T	n 2	25	7	6	2	42	
		% 4.76	59.52	16.67	14.29	4.76	100	
Students ability to learn would improve	S	n 16	61	105	88	37	307	No commonly shared belief held.
		% 5.21	19.87	34.20	28.66	12.05	100	
	P	n 10	89	50	11	11	219	
		% 4.57	40.64	22.83	5.02	5.02	100	
	T	n 1	16	16	2	2	44	
		% 2.27	36.36	36.36	4.55	4.55	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

COMPUTERS AND EDUCATION

		AGREE		NOT SURE			DISAGREE	COMMENT	
		ONE	TWO	THREE	FOUR	FIVE	TOTAL		
Computers would complicate learning	S	n	20	88	112	76	11	307	No commonly held belief by students. Commonly held belief in the negative by parents and teachers.
		%	6.51	28.66	36.48	24.76	3.58	100	
	P	n	4	31	57	120	7	219	
		%	1.83	14.16	26.03	54.79	3.20	100	
	T	n	0	1	13	26	47	44	
		%	0.00	2.27	29.55	59.09	9.09	100	
Students would do more research if using computers	S	n	5	52	122	105	23	307	No commonly shared belief held.
		%	1.63	16.94	39.74	34.20	7.49	100	
	P	n	1	53	72	82	11	219	
		%	0.46	24.20	32.88	37.44	5.02	100	
	T	n	1	3	23	13	3	43	
		%	2.33	6.98	53.49	30.23	6.98	100	
Would help organise work	S	n	27	139	74	54	14	308	Commonly held belief by students. No commonly held belief by parents and teachers.
		%	8.77	45.13	24.03	17.53	4.55	100	
	P	n	4	99	58	52	6	219	
		%	1.83	45.21	26.48	23.74	2.74	100	
	T	n	4	10	16	14	0	44	
		%	9.09	22.73	36.36	31.82	0.00	100	
Learn how to learn	S	n	10	68	131	67	32	308	No commonly shared belief held.
		%	3.25	22.08	42.53	21.75	10.39	100	
	P	n	2	83	55	64	15	219	
		%	0.91	37.90	25.11	29.22	6.85	100	
	T	n	3	12	16	12	0	43	
		%	6.98	27.91	37.21	27.91	0.00	100	
Would be more interested in studies	S	n	19	87	83	84	34	307	No commonly shared belief held.
		%	6.19	28.34	27.04	27.36	11.07	100	
	P	n	5	74	49	80	12	220	
		%	2.27	33.64	22.27	36.36	5.45	100	
	T	n	2	20	7	14	1	44	
		%	4.55	45.45	15.91	31.82	2.27	100	
Learning would be more enjoyable	S	n	21	97	95	56	37	306	No commonly shared belief held.
		%	6.86	31.70	31.05	18.30	12.09	100	
	P	n	3	75	63	68	10	219	
		%	1.37	34.25	28.77	31.05	4.57	100	
	T	n	2	14	15	12	1	44	
		%	4.55	31.82	34.09	27.27	2.27	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

COMPUTERS AND EDUCATION

		AGREE		NOT SURE			DISAGREE	COMMENT
		ONE	TWO	THREE	FOUR	FIVE	TOTAL	
Males more able at using computers	S	n 9	8	7	38	246	308	Commonly shared belief held in the negative.
		% 2.92	2.60	2.27	12.34	79.87	100	
	P	n 1	2	7	110	100	220	
		% 0.45	0.91	3.18	50.00	45.45	100	
	T	n 0	1	4	13	26	44	
		% 0.00	2.27	9.09	29.55	59.09	100	
Females less interested in using computers	S	n 9	11	24	63	201	308	Commonly shared belief held in the negative.
		% 2.92	3.57	7.79	20.45	65.26	100	
	P	n 1	13	9	113	84	220	
		% 0.45	5.91	4.09	51.36	38.18	100	
	T	n 0	6	4	12	22	44	
		% 0.00	13.64	9.09	27.27	50.00	100	
Males and females equally able	S	n 198	81	19	3	7	308	Commonly shared belief held.
		% 64.29	26.30	6.17	0.97	2.27	100	
	P	n 70	141	4	3	1	219	
		% 31.96	64.38	1.83	1.37	0.46	100	
	T	n 23	16	3	1	1	44	
		% 52.27	36.36	6.82	2.27	2.27	100	
Females more likely to need computer skills in future jobs	S	n 5	28	67	115	93	308	Commonly shared belief held in the negative.
		% 1.62	9.09	21.75	37.34	30.19	100	
	P	n 3	26	27	121	43	220	
		% 1.36	11.82	12.27	55.00	19.55	100	
	T	n 1	0	10	15	18	44	
		% 2.27	0.00	22.73	34.09	40.91	100	
Mixed classes best when using computers	S	n 54	71	122	44	16	307	No commonly shared belief held.
		% 17.59	23.13	39.74	14.33	5.21	100	
	P	n 12	65	62	67	14	220	
		% 5.45	29.55	28.18	30.45	6.36	100	
	T	n 2	12	21	7	2	44	
		% 4.55	27.27	47.73	15.91	4.55	100	
Same sex classes best when using computers	S	n 14	45	100	95	53	307	Commonly shared belief held in the negative.
		% 4.56	14.66	32.57	30.94	17.26	100	
	P	n 6	31	53	106	23	219	
		% 2.74	14.16	24.20	48.40	10.50	100	
	T	n 0	5	17	17	5	44	
		% 0.00	11.36	38.64	38.64	11.36	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

COMPUTERS AND EDUCATION

		AGREE		NOT SURE		DISAGREE			
		ONE	TWO	THREE	FOUR	FIVE	TOTAL	COMMENT	
Group learning would be best for females	S	n	9	23	107	95	73	307	Commonly held belief in the negative by students and parents. No commonly held belief by teachers.
		%	2.93	7.49	34.85	30.94	23.78	100	
	P	n	3	33	58	101	25	220	
		%	1.36	15.00	26.36	45.91	11.36	100	
	T	n	1	10	16	10	7	44	
		%	2.27	22.73	36.36	22.73	15.91	100	
Need to use computers in future jobs	S	n	66	105	42	12	3	308	Commonly shared belief held.
		%	21.43	60.06	13.64	3.90	0.97	100	
	P	n	32	140	23	25	0	220	
		%	14.55	63.64	10.45	11.36	0.00	100	
	T	n	5	26	9	4	0	44	
		%	11.36	59.09	20.45	9.09	0.00	100	
Future work will be less skilled because computers used	S	n	20	77	88	102	20	307	No commonly held belief by students. Commonly held belief in the negative by parents and teachers.
		%	6.51	25.08	28.66	33.22	6.51	100	
	P	n	6	30	26	134	24	220	
		%	2.73	13.64	11.82	60.91	10.91	100	
	T	n	3	2	12	21	6	44	
		%	6.82	4.55	27.27	47.73	13.64	100	
Many jobs students aspire to will be replaced by computers	S	n	19	89	96	88	15	307	No commonly held belief by students. Commonly held belief in the negative by parents. No commonly held belief by teachers.
		%	6.19	28.99	31.27	28.66	4.89	100	
	P	n	6	38	52	111	13	220	
		%	2.73	17.27	23.64	50.45	5.91	100	
	T	n	3	11	13	13	4	44	
		%	6.82	25.00	29.55	29.55	9.09	100	
Work will change rapidly, students will need to learn new jobs frequently	S	n	21	109	130	98	8	306	No commonly held belief by students. Commonly held belief by parents and teachers.
		%	6.86	35.62	42.48	12.42	2.61	100	
	P	n	16	108	55	38	3	220	
		%	7.27	49.09	25.00	17.27	1.36	100	
	T	n	10	20	11	2	0	43	
		%	23.26	46.57	25.58	4.65	0.00	100	
Know how to use computers to gain employment	S	n	50	173	50	29	6	308	Commonly shared belief held.
		%	16.23	56.17	16.23	9.42	1.95	100	
	P	n	28	135	29	27	1	220	
		%	12.73	61.36	13.18	12.27	0.45	100	
	T	n	5	23	10	6	0	44	
		%	11.36	52.27	22.73	13.64	0.00	100	

Results shown as follows-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

COMPUTERS AND EDUCATION

		AGREE		NOT SURE		DISAGREE		
		ONE	TWO	THREE	FOUR	FIVE	TOTAL	COMMENT
Will not greatly effect society in future	S	n 4	39	69	136	60	308	Commonly shared belief held in the negative.
		% 1,30	12.66	22.40	44.16	19.48	100	
	P	n 3	26	29	139	25	222	
		% 1,35	11.71	13.06	62.61	11.26	100	
	T	n 1	6	1	25	10	43	
		% 2,33	13.95	2.33	58.14	23.26	100	
Should study effects of computers on society	S	n 12	93	114	67	22	308	No commonly held belief by students. Commonly held belief by parents and teachers.
		% 3,90	30.19	37.01	21.75	7.14	100	
	P	n 10	144	34	32	1	221	
		% 4,52	65.16	15.38	14.48	0.45	100	
	T	n 7	29	4	2	0	42	
		% 16,67	69.05	9.52	4.76	0.00	100	
Students should be concerned about the use of computers	S	n 27	158	70	41	11	307	Commonly shared belief held.
		% 8,79	51.47	22.80	13.36	3.58	100	
	P	n 19	155	22	25	1	222	
		% 8,56	69.82	9.97	11.26	0.45	100	
	T	n 9	30	3	1	0	43	
		% 20,93	69.77	6.98	2.33	0.00	100	
Unlikely to have any personal effect	S	n 35	88	85	72	27	307	No commonly held belief by students. Commonly held belief in the negative by parents and teachers.
		% 11,40	28.66	27.69	23.45	8.79	100	
	P	n 6	51	40	110	15	222	
		% 2,70	22.97	18.02	49.55	6.76	100	
	T	n 0	6	6	23	8	43	
		% 0,00	13.95	13.95	53.49	18.60	100	
Limit problem solving ability	S	n 21	91	113	67	16	308	No commonly held belief by students and parents. Commonly held belief in the negative by teachers.
		% 6,82	29.55	36.69	21.75	5.19	100	
	P	n 10	72	32	95	13	222	
		% 4,50	32.43	14.41	42.79	5.86	100	
	T	n 1	5	12	15	10	43	
		% 2,33	11.63	27.91	34.88	23.26	100	
Cause students to think in a similar way	S	n 25	70	92	89	31	307	No commonly held belief by students. Commonly held belief in the negative by parents & teachers.
		% 8,14	22.80	29.97	28.99	10.10	100	
	P	n 4	56	34	108	20	222	
		% 1,80	25.23	15.32	48.65	9.01	100	
	T	n 1	2	13	15	12	43	
		% 2,33	4.65	30.23	34.88	27.91	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

COMPUTERS AND EDUCATION

		AGREE		NOT SURE		DISAGREE		TOTAL	COMMENT
		ONE	TWO	THREE	FOUR	FIVE			
Students would be more creative	S	n	6	35	71	126	68	306	Commonly shared belief held.
		%	1.96	11.44	23.20	41.18	22.22	100	
	P	n	0	39	64	107	12	222	
		%	0.00	17.57	28.83	48.20	5.41	100	
	T	n	3	7	10	19	3	42	
		%	7.14	16.67	23.81	45.24	7.14	100	
Science subjects more suitable to computer learning	S	n	7	82	70	102	47	308	No commonly held belief by students and parents. Commonly held belief in the negative by teachers.
		%	2.27	26.62	22.73	33.12	15.26	100	
	P	n	5	63	57	86	10	221	
		%	2.26	28.51	25.79	38.91	4.52	100	
	T	n	1	8	6	17	11	43	
		%	2.33	18.60	13.95	39.53	25.58	100	
Should be used for career studies	S	n	15	97	127	48	20	307	No commonly held belief by students and parents. Commonly held belief by teachers.
		%	4.89	31.60	41.37	15.64	6.51	100	
	P	n	5	107	69	38	2	221	
		%	2.26	48.42	31.22	17.19	0.90	100	
	T	n	3	22	12	4	0	41	
		%	7.32	53.66	29.27	4.76	0.00	100	
Relevant to all subjects	S	n	29	103	89	65	22	300	No commonly held belief by students. Commonly held belief by parents and teachers.
		%	9.42	33.44	28.90	21.10	7.14	100	
	P	n	18	113	46	41	4	222	
		%	8.11	50.90	20.72	18.47	1.80	100	
	T	n	8	30	3	1	1	43	
		%	18.60	69.77	6.98	2.33	2.33	100	
Much present studies would not be required	S	n	10	69	116	87	29	306	No commonly held belief by students. Commonly held belief in the negative by parents and teachers.
		%	3.27	23.55	37.91	28.43	7.84	100	
	P	n	0	26	36	127	32	221	
		%	0.00	11.76	16.29	57.47	14.48	100	
	T	n	0	4	9	23	7	43	
		%	0.00	9.30	20.93	53.49	16.28	100	
Learning about computers would be irrelevant to students future needs	S	n	4	26	58	166	53	307	Commonly shared belief held in the negative.
		%	1.30	8.47	18.89	54.07	17.26	100	
	P	n	2	15	16	159	29	221	
		%	0.90	6.79	7.24	71.95	13.12	100	
	T	n	0	0	3	29	11	43	
		%	0.00	0.00	6.98	67.44	25.58	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for, number of responses = n
percentage of responses = %

COMPUTERS AND EDUCATION

		AGREE		NOT SURE		DISAGREE		COMMENT	
		ONE	TWO	THREE	FOUR	FIVE	TOTAL		
Using computers to learn will change what students need to learn	S	n	12	77	153	51	13	No commonly shared belief held.	
		%	3.92	25.16	50.00	16.67	4.25		
	P	n	2	87	58	65	8		220
		%	0.91	39.55	26.36	29.55	3.64		
	T	n	2	19	9	11	2		43
		%	4.65	44.19	20.93	25.58	4.65		
Will be useful to future learning needs	S	n	28	142	112	20	6	Commonly shared belief held.	
		%	9.09	46.10	36.36	6.49	1.95		
	P	n	18	149	36	18	0		221
		%	8.14	67.42	16.29	8.14	0.00		
	T	n	8	27	7	1	0		43
		%	18.60	62.79	16.28	2.33	0.00		
Those who can use computers well will become elite	S	n	9	44	76	129	49	Commonly shared belief in the negative	
		%	2.93	14.33	24.76	42.02	15.96		
	P	n	5	30	30	140	15		220
		%	2.27	13.64	13.64	63.64	6.82		
	T	n	1	8	12	16	7		44
		%	2.27	18.18	27.27	36.36	15.91		
Those who can afford private learning material will be advantaged	S	n	18	64	63	103	57	Commonly held belief in the negative by parents and students.	
		%	5.90	20.98	20.66	33.77	18.69		
	P	n	5	39	27	136	13		220
		%	2.27	17.73	12.27	61.82	5.91		
	T	n	2	12	11	13	6		44
		%	4.55	27.27	25.00	29.55	13.64		
Will have greater say what material they wish to learn	S	n	11	85	130	64	17	No commonly shared belief held.	
		%	3.58	27.69	42.35	20.85	5.54		
	P	n	2	63	76	73	6		220
		%	0.91	28.64	34.55	33.18	2.73		
	T	n	0	13	21	9	1		44
		%	0.00	29.55	47.73	20.45	2.27		
Slower learners will be at a greater disadvantage	S	n	25	58	80	107	37	No commonly held belief by students.	
		%	8.14	18.89	26.06	34.85	12.05		
	P	n	6	45	37	119	13		220
		%	2.73	20.45	16.82	54.09	5.91		
	T	n	0	7	7	20	10		44
		%	0.00	15.91	15.91	45.45	22.73		

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

COMPUTERS AND EDUCATION

		AGREE		NOT SURE		DISAGREE		COMMENT
		ONE	TWO	THREE	FOUR	FIVE	TOTAL	
Schools which use computer learning will be more successful	S	n 12	84	101	78	32	307	No commonly held belief by parents and students. Commonly held belief by teachers.
		% 3.91	27.36	32.90	25.41	10.42	100	
	P	n 11	89	51	61	7	219	
		% 5.02	40.64	23.29	27.85	3.20	100	
	T	n 5	18	12	8	1	44	
		% 11.36	40.91	27.27	18.18	2.27	100	
Choice of studies will be more relevant to personal needs	S	n 16	96	140	42	13	307	No commonly shared belief held.
		% 5.21	31.27	45.60	13.68	4.23	100	
	P	n 3	100	68	43	5	219	
		% 1.37	45.66	31.05	19.63	2.28	100	
	T	n 1	18	15	8	2	44	
		% 2.27	40.91	34.09	18.18	4.55	100	
Less teachers will be required	S	n 19	88	66	104	30	307	No commonly held belief by students. Commonly held belief in the negative by parents. No commonly held belief by teachers.
		% 6.19	28.66	21.50	33.88	9.77	100	
	P	n 3	22	35	135	25	220	
		% 1.36	10.00	15.91	61.36	11.36	100	
	T	n 1	4	13	19	7	44	
		% 2.27	9.09	29.55	43.18	15.91	100	
Teachers will be more effectively used	S	n 8	103	124	51	20	306	No commonly held belief by teachers and students. Commonly held belief by parents.
		% 2.61	33.66	40.52	16.67	6.54	100	
	P	n 7	112	48	49	4	220	
		% 3.18	50.91	21.82	22.27	1.82	100	
	T	n 0	21	15	5	3	44	
		% 0.00	47.73	34.09	11.36	6.82	100	
Teachers will give students more personal attention	S	n 23	149	68	45	22	307	Commonly shared belief held.
		% 7.49	48.53	22.15	14.66	7.17	100	
	P	n 11	123	41	39	6	220	
		% 5.00	55.91	18.64	17.73	2.73	100	
	T	n 3	19	12	6	3	43	
		% 6.98	44.19	27.91	13.95	6.98	100	
Students without strong desire to learn will fall behind	S	n 35	115	89	55	13	307	Commonly shared belief held.
		% 11.40	37.46	28.99	17.92	4.23	100	
	P	n 8	108	38	63	3	220	
		% 3.64	49.09	17.27	28.64	1.36	100	
	T	n 1	24	8	9	2	44	
		% 2.27	54.55	18.18	20.45	4.55	100	

Results shown as follows:-

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percentage of responses = %

COMPUTERS AND EDUCATION

		AGREE		NOT SURE		DISAGREE		COMMENT
		ONE	TWO	THREE	FOUR	FIVE	TOTAL	
Students will be able to learn at their own pace	S	n 39	160	71	27	10	307	Commonly shared belief held.
		% 12.70	52.12	23.13	8.79	3.26	100	
	P	n 11	137	40	30	1	219	
		% 5.02	62.56	18.26	13.70	0.46	100	
	T	n 4	32	5	3	0	44	
		% 9.09	72.72	11.36	6.82	0.00	100	
Some work could be done from home terminals	S	n 46	197	39	17	7	306	Commonly shared belief held.
		% 15.03	64.38	12.75	5.76	2.29	100	
	P	n 8	179	25	8	0	220	
		% 3.64	81.36	11.36	3.64	0.00	100	
	T	n 5	35	4	0	0	44	
		% 11.36	79.55	9.09	0.00	0.00	100	
Students will have instant access to information	S	n 37	174	75	13	8	307	Commonly shared belief held.
		% 12.05	56.68	24.43	4.23	2.61	100	
	P	n 16	161	25	17	1	220	
		% 7.27	73.18	11.36	7.73	0.45	100	
	T	n 11	27	4	2	0	44	
		% 25.00	61.36	9.09	4.55	0.00	100	
Student records could be updated rapidly	S	n 71	178	48	9	6	306	Commonly shared belief held.
		% 23.20	58.17	13.73	2.94	1.96	100	
	P	n 34	167	11	6	2	220	
		% 15.45	75.91	5.00	2.73	0.91	100	
	T	n 15	26	1	1	1	44	
		% 34.09	59.09	2.27	2.27	2.27	100	
Testing could occur as students felt ready	S	n 48	131	79	34	15	307	Commonly shared belief held.
		% 15.64	42.67	25.73	11.07	4.89	100	
	P	n 13	136	39	29	3	220	
		% 5.91	61.82	17.73	13.18	1.36	100	
	T	n 10	28	3	3	0	44	
		% 22.73	63.64	6.82	6.82	0.00	100	
Spend more time on problems with teachers	S	n 35	118	90	57	7	307	No commonly held belief by students. Commonly held belief by parents and teachers.
		% 11.40	38.44	29.32	18.57	2.28	100	
	P	n 9	110	63	33	5	220	
		% 4.09	50.00	28.64	15.00	2.27	100	
	T	n 5	18	14	6	1	44	
		% 11.36	40.91	31.82	13.64	2.27	100	
Students would be more productive	S	n 31	96	70	79	30	306	No commonly shared belief held.
		% 10.13	31.37	22.88	25.82	9.80	100	
	P	n 8	95	59	48	9	219	
		% 3.65	43.38	26.94	21.92	4.11	100	
	T	n 4	18	13	7	2	44	
		% 9.09	40.91	29.55	15.91	4.51	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

ROLE OF TEACHERS AND COMPUTER TECHNOLOGY

		AGREE		NOT SURE		DISAGREE		COMMENT
		ONE	TWO	THREE	FOUR	FIVE	TOTAL	
Curriculum Developers	S	n 38	114	112	20	5	289	Commonly shared belief held.
		% 13.15	39.45	38.75	6.92	1.73	100	
	P	n 72	109	22	7	1	211	
		% 34.12	51.66	10.43	3.32	0.47	100	
	T	n 21	17	3	1	0	42	
		% 50.00	40.48	7.14	2.38	0.00	100	
Maintain discipline	S	n 56	144	48	28	13	289	Commonly shared belief held.
		% 19.38	49.83	16.61	9.69	4.50	100	
	P	n 68	86	13	24	20	211	
		% 32.23	40.76	6.16	11.37	9.48	100	
	T	n 13	20	3	3	4	43	
		% 30.23	46.51	6.98	6.98	9.30	100	
Counsellors and Study Advisers	S	n 83	121	59	19	7	289	Commonly shared belief held.
		% 28.72	41.87	20.42	6.57	2.42	100	
	P	n 72	102	18	10	7	209	
		% 34.45	48.80	8.61	4.78	3.35	100	
	T	n 20	15	6	0	2	43	
		% 46.51	34.88	13.95	0.00	4.65	100	
Computer Operators	S	n 88	123	61	12	6	290	Commonly shared belief held.
		% 30.34	42.41	21.03	4.14	2.07	100	
	P	n 37	104	25	32	9	207	
		% 17.87	50.24	12.08	15.46	4.35	100	
	T	n 7	23	3	5	5	43	
		% 16.28	53.49	6.98	11.63	11.63	100	
Developers of social skills	S	n 55	105	88	29	12	289	Commonly shared belief held.
		% 19.03	36.33	30.45	10.03	4.15	100	
	P	n 52	94	26	23	12	207	
		% 25.12	45.41	12.56	11.11	5.80	100	
	T	n 20	16	1	1	6	44	
		% 45.45	36.36	2.27	2.27	13.64	100	
Learning managers	S	n 48	119	87	33	3	290	Commonly shared belief held.
		% 16.55	41.03	30.00	11.38	1.03	100	
	P	n 61	108	23	11	3	206	
		% 29.61	52.43	11.17	5.34	1.46	100	
	T	n 17	23	1	2	1	44	
		% 38.64	52.27	2.27	4.55	2.27	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

ROLE OF TEACHERS AND COMPUTER TECHNOLOGY

		AGREE		NOT SURE		DISAGREE		COMMENT	
		ONE	TWO	THREE	FOUR	FIVE	TOTAL		
Assessor of performance	S	n	57	105	79	45	4	290	Commonly shared belief held.
		%	19.66	36.21	27.24	15.52	1.38	100	
	P	n	66	111	13	13	3	206	
		%	32.04	53.88	6.31	6.31	1.46	100	
	T	n	156	25	1	1	2	44	
		%	34.09	56.82	2.27	2.22	4.55	100	
Trouble shooters	S	n	25	44	145	47	27	288	No commonly held belief by students. Commonly held belief by parents and teachers.
		%	8.68	15.28	50.35	16.32	9.38	100	
	P	n	29	79	48	35	13	204	
		%	14.22	38.73	23.53	17.16	6.37	100	
	T	n	8	18	13	1	3	43	
		%	18.60	41.86	30.23	2.33	6.98	100	
Motivators	S	n	57	112	71	34	14	288	Commonly shared belief held.
		%	19.79	38.89	24.65	11.81	4.86	100	
	P	n	68	96	19	17	6	206	
		%	33.01	46.60	9.22	8.25	2.91	100	
	T	n	18	18	3	2	2	43	
		%	41.86	41.86	6.98	4.65	4.65	100	
Parental advisors	S	n	44	114	82	38	11	289	Commonly shared belief held.
		%	15.22	39.45	28.37	13.15	3.81	100	
	P	n	47	114	23	17	6	207	
		%	22.71	55.07	11.11	8.21	2.90	100	
	T	n	11	25	7	0	0	43	
		%	25.58	58.14	16.28	0.00	0.00	100	
Computer program	S	n	43	76	96	58	16	289	No commonly held belief by students and parents. Commonly held belief by teachers.
		%	14.88	26.30	33.22	20.07	5.54	100	
	P	n	27	73	51	43	13	207	
		%	13.04	35.27	24.64	20.77	6.28	100	
	T	n	9	19	8	4	2	42	
		%	21.43	45.24	19.05	9.52	4.76	100	
Computer program evaluators	S	n	51	92	97	40	10	290	No commonly held belief by students. Commonly held belief by parents and teachers.
		%	17.59	31.72	33.45	13.79	3.45	100	
	P	n	39	86	50	22	9	206	
		%	18.93	41.75	24.27	10.68	4.37	100	
	T	n	13	18	9	1	2	43	
		%	30.23	41.86	20.93	2.33	4.65	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

ROLE OF TEACHERS AND COMPUTER TECHNOLOGY

		AGREE		NOT SURE		DISAGREE		
		ONE	TWO	THREE	FOUR	FIVE	TOTAL	COMMENT
Student minders	S	n 22	40	105	68	55	290	No commonly held belief by students and teachers.
		% 7.59	13.79	36.21	23.45	18.97	100	
	P	n 5	15	29	73	82	204	Commonly held belief in the negative by parents.
		% 2.45	7.35	14.22	35.78	40.20	100	
	T	n 3	14	8	10	7	42	
		% 7.14	33.33	19.05	23.81	16.67	100	
Computer program writers	S	n 60	86	88	40	14	289	Commonly held belief by students.
		% 20.83	29.86	30.56	13.89	4.86	100	
	P	n 20	56	52	43	37	208	No commonly held belief by parents and teachers.
		% 9.62	26.92	25.00	20.67	17.79	100	
	T	n 6	10	8	11	6	41	
		% 14.63	24.39	19.51	26.83	14.63	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, forⁿ number of responses = n
percentage of responses = %

CONTROL OF TECHNOLOGY IN EDUCATION

		AGREE		NOT SURE		DISAGREE		TOTAL	COMMENT
		ONE	TWO	THREE	FOUR	FIVE			
Most people made decision about using computers in education	S	n	22	128	105	40	4	299	No commonly shared belief held.
		%	7.36	42.81	35.12	13.38	1.34	100	
	P	n	7	81	54	70	3	215	
		%	3.26	37.69	25.12	32.56	1.40	100	
	T	n	1	20	13	8	1	43	
		%	2.33	46.51	30.23	18.60	2.33	100	
The development of the computer for school use is inevitable	S	n	27	137	115	17	3	299	Commonly shared belief held.
		%	9.03	45.82	38.46	5.69	1.00	100	
	P	n	37	162	12	5	1	217	
		%	17.05	74.65	5.53	2.30	0.45	100	
	T	n	11	27	2	4	0	44	
		%	25.00	61.36	4.55	9.09	0.00	100	
Teachers will have to use computers in education	S	n	31	141	66	55	6	299	Commonly shared belief held.
		%	10.37	47.16	22.07	18.39	2.01	100	
	P	n	25	161	17	13	2	218	
		%	11.47	73.85	7.80	5.96	0.92	100	
	T	n	7	25	5	6	1	44	
		%	15.91	56.82	11.36	13.64	2.27	100	
A 'computer society' is an inhuman prospect	S	n	56	66	111	58	10	299	No commonly shared belief held.
		%	18.06	22.07	37.12	19.40	3.34	100	
	P	n	25	56	34	88	15	218	
		%	11.47	25.69	15.60	40.37	6.88	100	
	T	n	6	11	8	13	6	44	
		%	13.64	25.00	18.18	29.55	13.64	100	
People will be given the choice about where computers are used in society	S	n	12	73	107	91	16	299	No commonly held belief by students and teachers. Commonly held belief in the negative by parents.
		%	4.01	24.41	35.79	30.43	5.35	100	
	P	n	4	58	44	92	19	217	
		%	1.84	26.73	20.28	42.40	8.76	100	
	T	n	0	11	15	15	3	44	
		%	0.00	25.00	34.09	34.09	6.82	100	
Given a choice I would not involve computers in education	S	n	42	33	67	117	40	299	Commonly shared belief held in the negative.
		%	14.05	11.04	22.40	39.13	13.38	100	
	P	n	2	11	16	147	42	218	
		%	0.92	5.05	7.34	67.43	19.27	100	
	T	n	1	3	1	27	12	44	
		%	2.27	6.82	2.27	61.36	27.27	100	

Results shown as follows:

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

CONTROL OF TECHNOLOGY IN EDUCATION

		AGREE		NOT SURE		DISAGREE		TOTAL	COMMENT
		ONE	TWO	THREE	FOUR	FIVE			
Schools will be reshaped by the computer	S	n	28	118	94	47	12	299	No commonly held belief by students. Commonly held belief by parents. No commonly held belief by teachers.
		%	9.36	39.46	31.44	15.72	4.01	100	
	P	n	5	109	52	46	6	218	
		%	2.29	50.00	23.85	21.10	2.75	100	
	T	n	8	12	11	12	1	44	
		%	18.18	27.27	25.00	27.27	2.27	100	
A 'computer society' is an exciting possibility	S	n	12	51	77	74	85	299	Commonly shared belief held in the negative.
		%	4.01	17.06	25.75	24.75	28.43	100	
	P	n	2	39	52	89	35	217	
		%	0.92	17.97	23.96	41.01	16.13	100	
	T	n	3	11	7	14	9	44	
		%	6.82	25.00	15.91	31.82	20.45	100	
Computers will ultimately make most decisions in society	S	n	15	40	86	100	56	297	Commonly shared belief held in the negative.
		%	5.05	13.47	28.96	33.67	18.86	100	
	P	n	2	14	23	118	61	218	
		%	0.92	6.42	10.55	54.13	27.98	100	
	T	n	1	2	6	20	15	44	
		%	2.27	4.55	13.64	45.45	34.09	100	
Computers are only like any other machine	S	n	25	67	76	95	36	299	No commonly shared belief held.
		%	8.36	22.41	25.42	31.77	12.04	100	
	P	n	29	74	10	92	12	217	
		%	13.36	34.10	4.61	42.40	5.53	100	
	T	n	5	12	6	15	6	44	
		%	11.36	27.27	13.64	34.09	13.64	100	
A 'computer society' is a frightening future	S	n	66	71	89	54	19	299	No commonly shared belief held by students.
		%	22.07	23.75	29.77	18.06	6.35	100	
	P	n	21	68	39	77	13	218	
		%	9.63	31.19	17.89	35.32	5.96	100	
	T	n	5	10	9	13	7	44	
		%	11.36	22.73	20.45	29.55	15.91	100	
Teachers will lose control of the curriculum to computer programmers	S	n	36	61	121	70	11	299	No commonly held belief by students. Commonly held belief in the negative by parents and teachers.
		%	12.04	20.40	40.47	23.41	3.68	100	
	P	n	5	36	36	114	26	217	
		%	2.30	16.59	16.59	52.53	11.98	100	
	T	n	1	5	7	21	10	44	
		%	2.27	11.36	15.91	47.73	22.73	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

CONTROL OF TECHNOLOGY IN EDUCATION

		AGREE		NOT SURE			DISAGREE	COMMENT	
		ONE	TWO	THREE	FOUR	FIVE	TOTAL		
Education will be constrained to fit computers	S	n	34	72	125	59	9	299	No commonly held belief by students. Commonly held belief in the negative by parents and teachers.
		%	11.37	24.08	41.81	19.73	3.01	100	
	P	n	5	39	40	107	26	217	
		%	2.30	17.97	18.43	49.31	11.98	100	
	T	n	1	5	10	18	10	44	
		%	2.27	11.36	22.73	40.91	22.73	100	
Computers think like humans	S	n	6	22	47	107	117	299	Commonly shared belief in the negative.
		%	2.01	7.36	15.72	35.79	39.13	100	
	P	n	1	10	9	101	96	217	
		%	0.46	4.61	4.15	46.54	44.24	100	
	T	n	0	0	2	18	24	44	
		%	0.00	0.00	4.55	40.91	54.55	100	
Computer applications frightening	S	n	29	60	131	62	16	298	No commonly shared belief held.
		%	9.73	20.13	43.96	20.81	5.37	100	
	P	n	15	71	36	80	16	218	
		%	6.88	32.57	16.51	36.70	7.34	100	
	T	n	4	9	8	15	8	44	
		%	9.09	20.45	18.18	34.09	18.18	100	
Computers are complicated	S	n	36	97	48	90	27	298	No commonly shared belief held.
		%	12.08	32.55	16.11	30.20	9.06	100	
	P	n	13	84	19	96	5	217	
		%	5.99	38.71	8.76	44.24	2.30	100	
	T	n	3	17	4	15	4	43	
		%	6.98	39.53	9.30	34.88	9.30	100	
Computers can do only what they are told	S	n	96	139	37	23	4	299	Commonly shared belief held.
		%	32.11	46.49	12.37	7.69	1.34	100	
	P	n	66	128	8	11	4	217	
		%	30.41	58.99	3.69	5.07	1.84	100	
	T	n	19	18	3	3	1	44	
		%	43.18	40.91	6.82	6.82	2.27	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

PURPOSE OF SCHOOLING

		AGREE		NOT SURE			DISAGREE	TOTAL	COMMENT
		ONE	TWO	THREE	FOUR	FIVE			
Students should learn how to use computers	S	n 81	141	27	37	7	293	Commonly shared belief held.	
		% 27.65	48.12	9.22	12.63	2.39	100		
	P	n 68	127	6	14	0	215		
		% 31.63	59.07	2.79	6.51	0.00	100		
	T	n 21	21	0	1	1	44		
		% 47.73	47.73	0.00	2.27	2.27	100		
Use computers to enhance intellectual development	S	n 21	72	97	82	24	293	No commonly held belief by students.	
		% 7.17	24.57	32.08	27.99	8.19	100		
	P	n 21	114	34	43	5	217	Commonly held belief by parents and teachers	
		% 9.68	52.53	15.67	19.82	2.33	100		
	T	n 6	24	5	7	2	44		
		% 13.64	54.55	11.36	15.91	4.55	100		
Learn implications of computers for society	S	n 25	124	105	31	8	293	No commonly held belief by students.	
		% 8.53	42.32	35.84	10.58	2.73	100		
	P	n 36	159	14	8	0	217	Commonly held belief by parents and teachers.	
		% 16.59	73.27	6.45	3.69	0.00	100		
	T	n 14	28	1	0	1	44		
		% 31.82	63.64	2.27	0.00	2.27	100		
Have computing skills for employment	S	n 51	166	51	18	7	293	Commonly shared belief held.	
		% 17.41	56.66	17.41	6.14	2.39	100		
	P	n 35	158	9	15	0	217		
		% 16.13	72.81	4.15	6.91	0.00	100		
	T	n 11	24	6	3	0	44		
		% 25.00	54.55	13.64	6.82	0.00	100		
Skills to enhance them to live in a 'computer society'	S	n 29	113	82	47	22	293	No commonly held belief by students.	
		% 9.90	38.57	27.99	16.04	7.51	100		
	P	n 26	159	14	17	0	216	Commonly held belief by parents and teachers.	
		% 12.04	73.61	6.48	7.87	0.00	100		
	T	n 12	30	2	0	0	44		
		% 27.27	68.18	4.55	0.00	0.00	100		
Be adaptable to change in a computer society	S	n 27	129	83	41	13	293	Commonly shared belief held.	
		% 9.22	44.03	28.33	13.99	4.44	100		
	P	n 38	150	15	11	1	215		
		% 17.67	69.77	6.98	5.12	0.47	100		
	T	n 18	25	1	0	0	44		
		% 40.91	56.82	2.27	0.00	0.00	100		

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

SATISFACTION WITH SCHOOLS

		S C H O O L S ARE SATISFAC. AS THEY ARE	SCHOOLS IN NEED OF CHANGE	SCHOOLS ARE BECOMING IRRELEVANT	SCHOOLS WILL NOT CHANGE	NOT SURE	TOTAL	COMMENT	
Satisfaction with schools	S	n	153	46	17	19	59	294	Commonly held belief by students.
		%	52.04	15.65	5.78	6.46	20.07	100	
	P	n	65	98	5	6	41	215	No commonly held belief by teachers and students.
		%	30.23	45.58	2.33	2.79	19.07	100	
	T	n	10	19	3	3	8	43	
		%	23.26	44.19	6.98	6.98	18.60	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

PROMOTERS OF COMPUTERS IN EDUCATION

		AGREE		NOT SURE		DISAGREE	
		ONE	TWO	THREE	FOUR	FIVE	
Media	S	n	34	151	72	33	7
		%	11.45	50.84	24.24	11.11	2.36
	P	n	11	117	48	35	2
		%	5.16	54.93	22.54	16.43	0.94
	T	n	8	26	5	4	1
		%	18.18	59.09	11.36	9.09	2.27
Government	S	n	37	115	96	38	10
		%	12.50	38.85	32.43	12.84	3.38
	P	n	10	121	48	34	3
		%	4.63	56.02	22.22	15.74	1.39
	T	n	5	22	10	7	0
		%	11.36	50.00	22.73	15.91	0.00
Employers	S	n	47	141	87	18	3
		%	15.88	47.64	29.39	6.08	1.01
	P	n	17	114	51	31	1
		%	7.94	53.27	23.83	14.49	0.47
	T	n	7	18	9	10	0
		%	15.91	40.91	20.45	22.73	0.00
Education Department	S	n	49	152	77	14	5
		%	16.50	51.18	25.93	4.71	1.68
	P	n	16	135	52	13	0
		%	7.41	62.50	24.07	6.03	0.00
	T	n	8	25	6	5	0
		%	18.18	56.82	13.64	11.36	0.00
Parents	S	n	19	88	99	69	22
		%	6.40	29.63	33.33	23.23	7.41
	P	n	7	108	63	34	2
		%	3.27	50.47	29.44	15.89	0.93
	T	n	6	21	12	5	0
		%	13.64	47.73	27.27	11.36	0.00
Computer Suppliers	S	n	139	100	43	9	6
		%	46.80	33.67	14.48	3.03	2.02
	P	n	73	109	19	13	2
		%	33.80	50.46	8.80	6.02	0.93
	T	n	21	17	4	2	0
		%	47.73	38.64	9.09	4.55	0.00

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

PROMOTERS OF COMPUTERS IN EDUCATION

		AGREE		NOT SURE		DISAGREE	
		ONE	TWO	THREE	FOUR	FIVE	
Teachers	S	n	22	136	91	37	11
		%	7.41	45.79	30.64	12.46	3.70
	P	n	10	107	69	27	1
		%	4.67	50.00	32.24	12.62	0.47
	T	n	3	28	8	5	0
		%	6.82	63.64	18.18	11.36	0.00
Unions	S	n	11	26	201	42	17
		%	3.70	8.75	67.68	14.14	5.72
	P	n	3	22	112	62	14
		%	1.41	10.33	52.58	29.11	6.57
	T	n	1	7	24	12	0
		%	2.27	15.91	54.55	27.27	0.00

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

**SELECTED QUESTIONS FROM BELIEFS ABOUT A TECHNOLOGICAL FUTURE
BY SEX, TEACHER SPECIALISATION, SCHOOL & AGE**

		AGREE		NOT SURE		DISAGREE	
		ONE	TWO	THREE	FOUR	FIVE	
Computers will have great effect on my life	S	n	51	101	75	24	7
		%	19.77	39.15	29.07	9.30	2.71
	P	n	20	43	13	28	7
		%	18.02	38.74	11.71	25.23	6.31
	T	n	6	7	1	3	1
		%	33.37	38.89	5.56	16.67	5.56
SEX = Male	S	n	6	22	11	5	2
		%	13.04	47.83	23.91	10.87	4.35
	P	n	26	50	6	14	4
		%	26.00	50.00	6.00	14.00	4.00
	T	n	6	9	4	3	2
		%	25.00	37.50	16.67	12.50	8.33
Arts Teachers	n	5	5	2	2	1	
	%	33.33	33.33	13.33	13.33	6.67	
Science Teachers	n	3	2	1	1		
	%	42.86	28.57	14.29	14.29		
Vocational Teachers	n	1	4	2	2	1	
	%	10.00	40.00	20.00	20.00	10.00	
School = Y	S	n	11	38	23	11	4
		%	12.64	43.68	26.44	12.64	4.60
	P	n	21	39	8	19	6
		%	22.58	41.94	8.60	20.43	6.45
	T	n	6	7	4	2	3
		%	27.27	31.82	18.18	9.09	13.64

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

**SELECTED QUESTIONS FROM BELIEFS ABOUT A TECHNOLOGICAL FUTURE
BY SEX, TEACHER SPECIALISATION, SCHOOL & AGE**

		AGREE		NOT SURE		DISAGREE	
		ONE	TWO	THREE	FOUR	FIVE	
Computers will have great effect on my life	S	n	47	85	64	18	5
		%	21.46	38.81	29.22	8.22	2.28
	P	n	28	58	12	24	5
		%	22.05	45.67	9.45	18.90	3.94
	T	n	7	9	1	5	0
		%	31.82	40.91	4.55	22.73	0.00
SCHOOL = X							
AGE = 50-59	P	n	5	7	0	3	2
		%	29.41	41.18	0.00	17.65	11.76
	T	n	0	2	1	2	1
		%	0.00	33.33	16.67	33.33	16.67
AGE = 40-49	P	n	37	72	16	32	6
		%	22.70	44.17	9.82	19.63	3.68
	T	n	7	4	3	4	2
		%	35.00	20.00	15.00	20.00	10.00
AGE = 30-39	P	n	6	13	3	8	2
		%	18.75	40.63	9.38	25.00	6.25
	T	n	5	8	0	0	0
		%	38.46	61.54	0.00	0.00	0.00

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

SELECTED QUESTIONS FROM BELIEFS ABOUT COMPUTERS & EDUCATION

		AGREE		NOT SURE		DISAGREE	
		ONE	TWO	THREE	FOUR	FIVE	
Students would prefer to be taught by computers	S	n	7	35	39	91	50
		%	3.15	15.77	17.57	40.99	22.52
	P	n	0	5	8	82	31
		%	0.00	3.97	6.35	65.08	24.60
	T	n	0	0	2	14	6
		%	0.00	0.00	9.09	63.64	27.27
SCHOOL = X	S	n	7	12	20	21	24
		%	8.33	14.29	25.00	25.00	28.59
	P	n	1	8	49	49	19
		%	1.08	8.60	52.69	52.69	20.43
	T	n	0	3	6	6	9
		%	0.00	13.64	27.27	27.27	40.91
SEX = Male	S	n	3	11	9	11	10
		%	6.82	25.00	20.45	25.00	22.73
	P	n	0	8	11	58	23
		%	0.00	8.00	11.00	58.00	23.00
	T	n	0	3	4	8	9
		%	0.00	12.50	16.67	33.33	37.50
SEX = Female	S	n	11	36	48	101	64
		%	4.23	13.85	18.46	38.85	24.62
	P	n	0	5	9	69	27
		%	0.00	4.55	8.18	62.73	24.55
	T	n	0	0	2	12	4
		%	0.00	0.00	11.11	66.67	22.22
Schools which use computer learning will be more successful	S	n	2	14	13	12	4
		%	4.44	31.11	28.89	26.67	8.89
	P	n	6	40	23	28	3
		%	6.00	40.00	23.00	28.00	3.00
	T	n	3	10	6	4	1
		%	12.50	41.67	25.00	16.67	4.17
SEX = Male	S	n	9	70	88	65	28
		%	3.46	26.92	33.85	25.00	10.77
	P	n	4	45	25	31	4
		%	3.67	41.28	22.94	28.44	3.67
	T	n	2	6	6	4	0
		%	11.11	33.33	33.33	22.22	0.00

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

SELECTED QUESTIONS FROM BELIEFS ABOUT COMPUTERS & EDUCATION

		AGREE		NOT SURE		DISAGREE				
		ONE	TWO	THREE	FOUR	FIVE				
Schools which use computer learning will be more successful School = Y	S	n	4	26	20	25	10			
		%	4.71	30.59	23.53	29.41	11.76			
	P	n	3	29	24	33	4			
		%	3.23	31.18	25.81	35.48	4.30			
	T	n	3	10	5	3	1			
		%	13.64	45.45	22.73	13.64	4.55			
SCHOOL=X	S	n	8	58	81	53	22			
		%	3.60	26.13	36.49	23.89	9.91			
	P	n	8	59	27	28	3			
		%	6.40	47.20	21.60	22.40	2.40			
	T	n	2	8	7	5	0			
		%	9.09	36.36	31.82	22.73	0.00			
Students ability to learn would improve SCHOOL=X	S	n	12	42	77	68	23			
		%	5.41	18.92	34.68	30.63	10.36			
	P	n	7	59	27	27	5			
		%	5.60	47.20	21.60	21.60	4.00			
	T	n	0	8	8	5	1			
		%	0.00	36.36	36.36	22.73	4.55			
SCHOOL=Y	S	n	4	19	28	20	14			
		%	4.71	22.35	32.94	23.53	16.47			
	P	n	3	29	23	32	6			
		%	3.23	31.18	24.73	34.41	6.45			
	T	n	1	8	8	4	1			
		%	4.55	36.36	36.36	18.18	4.55			
SEX = Male	S	n	3	10	19	8	4			
		%	6.82	22.73	43.18	18.18	9.09			
	P	n	4	44	17	30	5			
		%	4.00	44.00	17.50	30.00	5.00			
	T	n	1	9	9	4	1			
		%	4.17	37.50	37.50	16.67	4.17			
SEX = Female	S	n	13	50	86	79	33			
		%	4.98	19.16	32.95	30.27	12.64			
	P	n	5	41	31	26	6			
		%	4.59	37.61	28.94	23.85	5.50			
	T	n	0	6	6	5	1			
		%	0.00	33.33	33.33	27.78	5.56			

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

SELECTED QUESTIONS FROM BELIEFS ABOUT COMPUTERS & EDUCATION

		AGREE		NOT SURE		DISAGREE	
		ONE	TWO	THREE	FOUR	FIVE	
Need to know how to use computers to gain employment SCHOOL=Y	S	n	10	40	22	10	4
		%	11.63	46.51	25.58	11.63	4.65
	P	n	15	47	15	15	0
		%	16.30	51.09	16.30	16.30	0.00
	T	n	3	11	4	4	0
		%	13.64	50.00	18.18	18.18	0.00
SCHOOL= X	S	n	40	132	28	19	2
		%	18.02	59.91	12.61	8.56	0.90
	P	n	13	87	14	12	1
		%	10.24	68.50	11.02	9.45	0.79
	T	n	2	12	6	2	0
		%	9.09	54.55	27.27	9.09	0.00
SEX = Female	S	n	45	150	39	22	5
		%	17.24	57.47	14.94	8.43	1.92
	P	n	15	70	8.93	16	1
		%	13.39	62.50	4	14.29	0.89
	T	n	3	10	22.22	1	0
		%	16.67	55.56	5.56	5.56	0.00
SEX = Male	S	n	4	23	10	7	1
		%	8.89	51.11	22.22	15.56	2.22
	P	n	13	58	17.35	10	0
		%	13.27	59.18	6	10.20	0.00
	T	n	1	12	25.00	5	0
		%	4.17	50.00	20.83	20.83	0.00
Much of present studies would not be required SCHOOL=Y	S	n	4	17	39	16	10
		%	4.65	19.77	45.35	18.60	11.63
	P	n	0	10	18	54	11
		%	0.00	10.75	19.35	58.06	11.83
	T	n	0	2	6	12	1
		%	0.00	9.52	28.57	57.14	4.76
SCHOOL=X	S	n	6	52	77	71	14
		%	2.73	23.64	35.00	32.27	6.36
	P	n	0	15	18	73	21
		%	0.00	11.81	14.17	57.48	16.54
	T	n	0	2	3	11	6
		%	0.00	4.09	13.64	50.00	27.27

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

SELECTED QUESTIONS FROM BELIEFS ABOUT COMPUTERS & EDUCATION

		AGREE		NOT SURE		DISAGREE			
		ONE	TWO	THREE	FOUR	FIVE			
Much of present studies would not be required	S	n 8	57	94	78	22			
		% 3.09	22.01	36.94	18 30.12	8.49			
	P	n 0	13	16.22	66	14			
		% 0.00	11.71	4	59.46	12.61			
	T	n 0	0	23.53	10	3			
SEX = Female		% 0.00	0.00		58.82	17.65			
				21					
				46.67					
SEX = Male	S	n 2	11	16	9	2			
		% 4.44	24.44	16.00	20.00	4.44			
	P	n 0	9	5	57	18			
		% 0.00	9.00	20.83	57.00	18.00			
	T	n 0	3		13	3			
	% 0.00	12.50		54.17	12.50				
				4					
				8.89					
Males are more able at using computers	S	n 2	4	6	19	16			
		% 4.44	8.89	6.12	42.22	35.56			
	P	n 0	1	2	62	29			
		% 0.00	1.02	8.33	63.27	29.59			
	T	n 0	0		7	15			
SEX = Male		% 0.00	0.00		29.17	62.50			
				3					
				1.15					
SEX = Female	S	n 7	4	1	19	228			
		% 2.68	1.53	0.89	7.28	87.36			
	P	n 1	0	2	41	69			
		% 0.89	0.00	11.11	36.61	61.61			
	T	n 0	0		5	11			
	% 0.00	0.00		27.78	61.11				
				5					
				5.81					
SCHOOL=Y	S	n 4	7	4	22	48			
		% 4.65	8.14	4.35	25.58	55.81			
	P	n 1	1	2	41	45			
		% 1.09	1.09	9.09	44.57	48.91			
	T	n 0	0		7	13			
	% 0.00	0.00		31.82	59.09				
				2					
				0.90					
SCHOOL=X	S	n 5	1	3	16	198			
		% 2.25	0.45	2.36	7.21	89.19			
	P	n 0	1	2	69	54			
		% 0.00	0.79	9.09	54.33	42.52			
	T	n 0	1		6	13			
	% 0.00	4.55		27.27	59.09				

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for number of responses = n
percentage of responses = %

**ANALYSIS OF SELECTED QUESTIONS FROM CONTROL OF TECHNOLOGY
IN EDUCATION BY AGE, SEX AND SCHOOL**

		AGREE		NOT SURE		DISAGREE		COMMENTS
		ONE	TWO	THREE	FOUR	FIVE	TOTAL	
Teachers will have to use computers in education	S	n 21	103	45	41	3	213	Commonly shared belief held.
		% 9.86	48.36	21.13	19.25	1.14	100	
	P	n 16	91	10	7	0	124	
SCHOOL=X		% 12.90	73.39	8.06	5.65	0.00	100	
	T	n 2	14	3	2	1	22	
		% 9.09	63.64	13.64	9.09	4.55	100	
SCHOOL=Y	S	n 10	35	21	14	3	83	Commonly shared belief held.
		% 12.05	42.17	25.30	16.87	3.61	100	
	P	n 8	68	7	6	2	91	
		% 8.79	74.73	7.69	6.59	2.20	100	
	T	n 5	11	2	4	0	22	
		% 22.73	50.00	9.09	18.18	0.00	100	
SEX = Female	S	n 23	117	53	50	6	249	Commonly shared belief held.
		% 9.24	46.99	21.29	20.08	2.41	100	
	P	n 9	82	7	9	0	107	
		% 8.41	76.64	6.54	8.41	0.00	100	
	T	n 3	12	8	1	0	18	
		% 16.67	66.67	11.11	5.56	0.00	100	
SEX = Male	S	n 7	20	13	5	0	45	Commonly shared belief held.
		% 15.56	44.44	28.89	11.11	0.00	100	
	P	n 14	69	9	4	2	98	
		% 14.29	70.41	9.18	4.08	2.04	100	
	T	n 4	13	2	5	0	24	
		% 16.67	54.17	8.33	20.83	0.00	100	
AGE = 20-29	P	n 0	2	0	0	0	2	Shared belief inferred.
		% 0.00	100.00	0.00	0.00	0.00	100	
	T	n 1	1	1	0	0	3	
		% 33.33	33.33	33.33	0.00	0.00	100	
AGE = 30-39	P	n 2	23	1	4	0	30	Shared belief inferred.
		% 6.67	76.67	3.33	13.33	0.00	100	
	T	n 2	10	1	0	0	13	
		% 15.38	76.92	7.69	0.00	0.00	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

**ANALYSIS OF SELECTED QUESTIONS FROM CONTROL OF TECHNOLOGY
IN EDUCATION BY AGE, SEX AND SCHOOL**

		AGREE		NOT SURE			DISAGREE	COMMENTS
		ONE	TWO	THREE	FOUR	FIVE	TOTAL	
Teachers will have to use computers in education AGE = 40-49	P	n 22	119	12	7	2	162	Shared belief inferred.
		% 13.58	73.46	7.41	4.32	1.23	100	
	T	n 3	11	1	5	0	20	
		% 15.00	55.00	5.00	23.00	0.00	100	
AGE = 50-59	P	n 1	10	2	2	0	15	Shared belief inferred.
		% 6.67	66.67	13.33	13.33	0.00	100	
	T	n 1	3	1	1	0	6	
		% 16.67	50.00	16.67	16.67	0.00	100	
AGE = 60>	P	n 0	3	1	0	0	4	Shared belief inferred.
		% 0.00	75.00	25.00	0.00	0.00	100	
A 'computer society' is an inhuman prospect SCHOOL=X	S	n 38	50	79	40	6	213	No commonly belief held by students and teachers.
		% 17.84	23.47	37.09	18.78	2.82	100	
	P	n 11	25	17	60	11	124	Commonly held belief in the negative by parents.
		% 8.87	20.16	13.71	48.39	8.87	100	
	T	n 3	4	5	6	4	22	
		% 13.64	18.18	22.73	27.27	18.18	100	
SCHOOL=Y	S	n 15	16	30	18	4	83	No commonly shared belief.
		% 18.07	19.28	36.14	21.69	4.82	100	
	P	n 12	31	16	28	4	91	
		% 13.19	34.07	17.58	30.77	4.40	100	
	T	n 3	7	3	7	2	22	
		% 13.64	31.82	13.64	31.82	9.09	100	
SEX = Female	S	n 46	56	94	46	7	249	No commonly shared belief.
		% 18.47	22.49	37.75	18.47	2.81	100	
	P	n 13	28	15	45	6	107	
		% 12.15	26.17	14.02	42.06	5.61	100	
	T	n 1	4	5	4	4	18	
		% 5.56	22.22	27.78	22.22	22.22	100	
SEX = Male	S	n 7	10	15	11	2	45	No commonly shared belief held by students and teachers.
		% 15.56	22.22	33.33	24.44	4.44	100	
	P	n 10	23	14	43	8	98	Commonly held belief in the negative by parents.
		% 10.20	23.47	14.29	43.88	8.16	100	
	T	n 4	7	2	9	2	24	
		% 16.67	29.17	8.33	37.50	8.33	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

**ANALYSIS OF SELECTED QUESTIONS FROM CONTROL OF TECHNOLOGY
IN EDUCATION BY AGE, SEX AND SCHOOL**

		AGREE		NOT SURE		DISAGREE		TOTAL	COMMENTS
		ONE	TWO	THREE	FOUR	FIVE			
A 'computer society' is an inhuman prospect Age = 20-29	P	n	0	1	1	0	2	Negative shared belief inferred.	
		%	0.00	50.00	50.00	0.00	100		
	T	n	0	0	1	2	3		
		%	0.00	0.00	33.33	66.67	100		
AGE = 30-39	P	n	6	5	7	2	30	Shared belief inferred.	
		%	20.00	16.67	23.33	6.67	100		
	T	n	3	3	6	1	13	Negative shared belief inferred.	
		%	23.08	23.08	46.15	7.69	100		
AGE = 40-49	P	n	15	24	75	13	162	Negative shared belief inferred.	
		%	9.26	14.81	46.30	8.02	100		
	T	n	3	2	6	3	20	No commonly held belief.	
		%	15.00	10.00	30.00	15.00	100		
AGE = 50-59	P	n	3	1	2	0	15	Shared belief inferred.	
		%	20.00	6.67	13.33	0.00	100		
	T	n	2	2	0	0	6		
		%	33.33	33.33	0.00	0.00	100		
AGE = 60>	P	n	0	1	3	0	4	Negative shared belief inferred.	
	%	0.00	25.00	75.00	0.00	100			
People will be given the choice about where computers are used in society SCHOOL=X SCHOOL=Y	S	n	6	73	68	12	213	No commonly shared belief.	
		%	2.82	34.27	31.92	5.63	100		
	P	n	2	28	50	8	124		
		%	1.61	22.58	40.32	6.45	100		
	T	n	0	8	7	2	22		
		%	0.00	36.36	31.82	9.09	100		
S	n	5	34	23	3	83	No commonly held belief by students.		
	%	6.02	40.96	27.71	3.61	100			
P	n	1	16	41	10	90	Negative belief held by parents.		
	%	1.11	17.78	45.56	11.11	100			
T	n	0	7	8	1	22	No commonly held belief by teachers.		
	%	0.00	31.82	36.36	4.55	100			
SEX = Female	S	n	9	89	77	15	249	No commonly shared belief.	
		%	3.61	35.74	30.92	6.02	100		
	P	n	2	26	42	5	107		
		%	1.87	24.30	39.25	4.67	100		
	T	n	0	8	5	1	18		
		%	0.00	44.44	27.78	5.56	100		

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for number of responses = n
percentage of responses = %

**ANALYSIS OF SELECTED QUESTIONS FROM CONTROL OF TECHNOLOGY
IN EDUCATION BY AGE, SEX AND SCHOOL**

		AGREE		NOT SURE		DISAGREE		TOTAL	COMMENTS
		ONE	TWO	THREE	FOUR	FIVE			
People will be given the choice about where computers are used in society	S	n 2	11	18	14	0	45	No commonly held belief by students. Commonly held belief in the negative by parents and teachers.	
		% 4.44	24.44	40.00	31.11	0.00	100		
	P	n 1	24	16	43	13	97		
		% 1.03	24.74	16.49	44.33	13.40	100		
	T	n 0	6	6	10	2	24		
		% 0.00	25.00	25.00	41.67	8.33	100		
SEX = Male									
AGE = 20-29	P	n 0	1	0	0	1	2		
		% 0.00	50.00	0.00	0.00	50.00	100		
	T	n 0	3	0	0	0	3		
		% 0.00	100.0	0.00	0.00	0.00	100		
AGE = 30-39									
AGE = 30-39	P	n 1	8	5	11	5	30	Shared belief in the negative inferred.	
		% 3.33	26.67	16.67	36.67	16.67	100		
	T	n 0	1	5	6	1	13		
		% 0.00	7.69	38.46	46.15	7.69	100		
AGE = 40-49									
AGE = 40-49	P	n 2	42	34	70	13	161	Shared belief in the negative inferred.	
		% 1.24	26.09	21.12	43.48	8.07	100		
	T	n 0	5	5	9	1	20		
		% 0.00	25.00	25.00	45.00	5.00	100		
AGE = 50-59									
AGE = 50-59	P	n 0	6	4	5	0	15	No commonly held belief.	
		% 0.00	40.00	26.67	33.33	0.00	100		
	T	n 0	1	4	0	1	6		
		% 0.00	16.67	66.67	0.00	16.67	100		
AGE = 60>									
AGE = 60>	P	n 0	1	0	3	0	4		
		% 0.00	25.00	0.00	75.00	0.00	100		
Given a choice I would not involve computers in education									
SCHOOL=X	S	n 27	19	44	92	31	213	Commonly held belief in the negative.	
		% 12.68	8.92	20.66	43.19	14.55	100		
	P	n 0	4	5	88	27	124		
		% 0.00	3.23	4.03	70.97	21.77	100		
	T	n 1	1	1	12	7	22		
		% 4.55	4.55	4.55	54.55	31.82	100		
SCHOOL=Y									
SCHOOL=Y	S	n 14	13	23	24	9	83	No commonly held belief by students. Commonly held belief in the negative by parents and teachers.	
		% 16.87	15.66	27.71	28.92	10.84	100		
	P	n 2	7	11	56	15	91		
		% 2.20	7.69	12.09	61.54	16.48	100		
	T	n 0	2	0	15	5	22		
		% 0.00	9.09	0.00	68.18	22.73	100		

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for number of responses = n
percentage of responses = %

**ANALYSIS OF SELECTED QUESTIONS FROM CONTROL OF TECHNOLOGY
IN EDUCATION BY AGE, SEX AND SCHOOL**

		AGREE		NOT SURE		DISAGREE		TOTAL	COMMENTS
		ONE	TWO	THREE	FOUR	FIVE			
Given a choice I would not involve computers in education SEX= Female	S	n	37	26	53	102	32	249	Commonly held belief in the negative.
		%	14.86	10.44	20.88	40.96	12.85	100	
	P	n	1	7	4	77	18	107	
		%	0.93	6.54	3.74	71.96	16.82	100	
	T	n	0	1	0	12	5	18	
		%	0.00	5.56	0.00	66.67	27.78	100	
SEX = Male	S	n	3	6	15	14	7	45	Commonly held belief in the negative.
		%	6.67	13.33	33.33	31.11	15.56	100	
	P	n	1	4	11	60	22	98	
		%	1.02	4.08	11.22	61.22	22.45	100	
	T	n	0	2	0	15	7	24	
		%	0.00	8.33	0.00	62.50	29.17	100	
AGE = 20-29	P	n	1	0	1	0	0	2	
		%	50.00	0.00	50.00	0.00	0.00	100	
	T	n	0	0	0	1	2	3	
		%	0.00	0.00	0.00	33.33	66.67	100	
AGE = 30-39	P	n	1	3	3	20	3	30	Negative shared belief inferred.
		%	3.33	10.00	10.00	66.67	10.00	100	
	T	n	0	1	0	9	3	13	
		%	0.00	7.69	0.00	69.23	23.08	100	
AGE = 40-49	P	n	0	7	11	108	36	162	Negative shared belief inferred.
		%	0.00	4.32	6.79	66.67	22.22	100	
	T	n	0	1	0	13	6	20	
		%	0.00	5.00	0.00	65.00	30.00	100	
AGE = 50-59		n	0	0	1	12	2	15	Negative shared belief inferred.
		%	0.00	0.00	6.67	80.00	13.33	100	
		n	0	1	0	4	1	6	
		%	0.00	16.67	0.00	66.67	16.67	100	
AGE = 60>		n	0	0	0	3	1	4	Negative shared belief inferred.
		%	0.00	0.00	0.00	75.00	25.00	100	
		n	13	89	63	41	8	213	
		%	6.10	41.78	29.11	19.25	3.76	100	
Schools will be reshaped by the computer SCHOOL=X		n	2	54	32	34	2	124	No commonly shared belief.
		%	1.61	43.55	25.81	27.42	1.61	100	
		n	3	8	7	4	1	22	
		%	9.09	36.36	31.82	18.18	4.55	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

**ANALYSIS OF SELECTED QUESTIONS FROM CONTROL OF TECHNOLOGY
IN EDUCATION BY AGE, SEX AND SCHOOL**

		AGREE		NOT SURE		DISAGREE		COMMENTS	
		ONE	TWO	THREE	FOUR	FIVE	TOTAL		
Schools will be reshaped by the computer	S	n 13	29	32	5	4	83	Commonly shared belief held by students and parents.	
		% 15.66	34.94	38.55	6.02	4.82	100		
	P	n 3	52	20	12	4	91		
SCHOOL=Y	P	% 3.30	57.14	21.98	13.19	4.40	100	No commonly held belief by teachers.	
	T	n 6	4	4	8	0	22		
		% 27.27	18.18	18.18	36.36	0.00	100		
SEX= Female	S	n 18	99	79	42	11	249	No commonly held belief by students and teachers. Commonly held belief by parents.	
		% 7.23	39.76	31.73	16.87	4.42	100		
	P	n 2	60	19	24	2	107		
		% 1.87	56.07	17.76	22.43	1.87	100		
	T	n 1	7	6	4	0	18		
		% 5.56	38.89	33.33	22.22	0.00	100		
SEX = Male	S	n 6	19	15	4	1	45	Commonly held belief by students. No commonly shared belief by parents and teachers.	
		% 13.33	42.22	33.33	8.89	2.22	100		
	P	n 6	42	29	20	4	98		
		% 3.06	42.86	29.59	20.41	4.08	100		
	T	n 6	5	4	8	1	24		
		% 25.00	20.83	16.67	33.33	4.17	100		
AGE = 20-29	P	n 0	2	0	0	0	2		
		% 0.00	100.0	0.00	0.00	0.00	100		
	T	n 0	2	0	1	0	3		
	% 0.00	66.67	0.00	33.33	0.00	100			
AGE = 30-39	P	n 0	18	6	5	1	30	Shared belief inferred by parents. No commonly held belief inferred.	
		% 0.00	60.00	20.00	16.67	3.33	100		
	T	n 2	2	4	4	1	13		
		% 15.38	15.38	30.77	30.77	7.69	100		
	P	n 4	76	41	36	5	162		No commonly held belief inferred.
		% 2.47	46.91	25.31	22.22	3.09	100		
T	n 4	5	5	6	0	20			
	% 20.00	25.00	25.00	30.00	0.00	100			
AGE = 50-59	P	n 1	8	3	3	0	15	Commonly shared belief inferred.	
		% 6.67	53.33	20.00	20.00	0.00	100		
	T	n 1	3	1	1	0	6		
		% 16.67	50.00	16.67	16.67	0.00	100		
	P	n 0	3	1	0	0	4		Shared belief inferred.
		% 0.00	75.00	25.00	0.00	0.00	100		

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

ANALYSIS OF SELECTED QUESTIONS FROM CONTROL OF TECHNOLOGY IN EDUCATION BY AGE, SEX AND SCHOOL

		AGREE		NOT SURE			DISAGREE	COMMENTS
		ONE	TWO	THREE	FOUR	FIVE	TOTAL	
A 'computer society' is an exciting possibility	S	n 9	36	54	56	58	213	Commonly shared belief in the negative.
		% 4.23	16.90	25.35	26.29	27.23	100	
	P	n 1	26	29	48	20	124	
		% 0.81	20.97	23.39	38.71	16.13	100	
SCHOOL=X	T	n 2	6	3	5	6	22	
		% 9.09	27.27	13.64	22.73	27.27	100	
SCHOOL= Y	S	n 3	15	22	18	25	83	Negative shared belief held.
		% 3.61	18.07	26.51	21.69	30.12	100	
	P	n 1	13	23	39	14	90	
		% 1.11	14.44	25.56	43.33	15.56	100	
	T	n 1	5	4	9	3	22	
		% 4.55	22.73	18.18	40.91	13.64	100	
SEX= Female	S	n 9	40	63	62	75	249	Commonly held belief in the negative by students and parents.
		% 3.61	16.06	25.30	24.90	30.12	100	
	P	n 2	20	24	45	16	107	
		% 1.87	18.69	22.43	42.06	14.95	100	
	T	n 2	5	3	6	2	18	
		% 11.11	27.78	16.67	33.33	11.11	100	
SEX = Male	S	n 3	10	13	12	7	45	No commonly held belief by students. Commonly held belief by parents and teachers.
		% 6.67	22.22	28.89	26.67	15.56	100	
	P	n 0	18	26	35	18	97	
		% 0.00	18.56	26.80	36.08	18.56	100	
	T	n 1	6	4	8	5	24	
		% 4.17	25.00	16.67	33.33	20.83	100	
AGE = 20-29	P	n 0	1	0	1	0	2	
		% 0.00	50.00	0.00	50.00	0.00	100	
	T	n 1	1	0	1	0	3	
		% 33.33	33.33	0.00	33.33	0.00	100	
AGE = 30-39	P	n 0	4	3	17	6	30	Commonly held belief in the negative inferred by parents. No commonly held belief inferred by teachers.
		% 0.00	13.33	10.00	56.67	20.00	100	
	T	n 1	4	2	5	1	13	
		% 7.69	30.77	15.38	38.46	7.69	100	
AGE = 40-49	P	n 1	33	41	60	26	161	Negative shared belief inferred.
		% 0.62	20.50	25.47	37.27	16.15	100	
	T	n 1	4	4	6	5	20	
		% 5.00	20.00	20.00	30.00	25.00	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for number of responses = n
percentage of responses = %

**ANALYSIS OF SELECTED QUESTIONS FROM CONTROL OF TECHNOLOGY
IN EDUCATION BY AGE, SEX AND SCHOOL**

		AGREE		NOT SURE		DISAGREE		COMMENTS
		ONE	TWO	THREE	FOUR	FIVE	TOTAL	
A 'computer society' is an exciting possibility	P	n 1	0	4	7	3	15	Negative shared belief inferred.
		% 6.67	0.00	26.67	46.67	20.00	100	
AGE = 50-59	T	n 0	2	1	2	1	6	
		% 0.00	33.33	16.67	33.33	16.67	100	
AGE = 60>	P	n 0	1	2	1	0	4	
		% 0.00	25.00	50.00	25.00	0.00	100	
Computers will ultimately make most decisions in society	S	n 7	28	63	74	41	213	Commonly held belief in the negative.
		% 3.29	13.15	29.58	34.74	19.25	100	
SCHOOL= X	P	n 0	3	10	69	42	124	
		% 0.00	2.42	8.06	55.65	33.87	100	
SCHOOL= Y	T	n 0	1	2	8	11	22	
		% 0.00	4.55	9.09	36.36	50.00	100	
SEX= Female	S	n 7	11	23	25	15	81	No commonly held belief by students.
		% 8.64	13.58	28.40	30.86	18.52	100	
SEX = Male	P	n 2	11	12	47	19	91	Commonly held belief in the negative by parents and teachers.
		% 2.20	12.09	13.19	51.65	20.88	100	
SEX= Female	T	n 1	1	4	12	4	22	
		% 4.55	4.55	18.18	54.55	18.18	100	
SEX= Female	S	n 12	31	75	83	48	249	Commonly held belief in the negative.
		% 4.82	12.45	30.12	33.33	19.28	100	
SEX = Male	P	n 1	9	9	60	27	107	
		% 1.87	8.41	8.41	56.07	25.23	100	
SEX = Male	T	n 1	0	2	7	8	18	
		% 5.56	0.00	11.11	38.89	44.44	100	
SEX = Male	S	n 2	7	11	16	7	43	Commonly held belief in the negative.
		% 4.65	16.28	25.58	37.21	16.28	100	
SEX = Male	P	n 0	5	10	50	33	98	
		% 0.00	5.10	10.20	51.02	33.67	100	
SEX = Male	T	n 0	1	3	13	7	24	
		% 0.00	4.17	12.50	54.17	29.17	100	
AGE = 20-29	P	n 0	0	0	1	1	2	
		% 0.00	0.00	0.00	50.00	50.00	100	
AGE = 20-29	T	n 0	0	0	0	3	3	
		% 0.00	0.00	0.00	0.00	100.0	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

**ANALYSIS OF SELECTED QUESTIONS FROM CONTROL OF TECHNOLOGY
IN EDUCATION BY AGE, SEX AND SCHOOL**

		AGREE		NOT SURE		DISAGREE		TOTAL	COMMENTS
		ONE	TWO	THREE	FOUR	FIVE			
Computers will ultimately make most decisions in society	P	n	0	2	3	17	8	30	Commonly held belief in the negative.
		%	0.00	6.67	10.00	56.67	26.67	100	
	T	n	0	0	2	8	3	13	
		%	0.00	0.00	15.38	61.54	23.08	100	
AGE = 30-39									
AGE = 40-49	P	n	2	12	15	85	48	162	Commonly held belief in the negative.
		%	1.23	7.41	9.26	52.47	29.63	100	
	T	n	0	1	2	9	8	20	
		%	0.00	5.00	10.00	45.00	40.00	100	
AGE = 50-59									
AGE = 50-59	P	n	0	0	3	8	4	15	Commonly held belief in the negative.
		%	0.00	0.00	20.00	53.33	26.67	100	
	T	n	1	0	1	3	1	6	
		%	16.67	0.00	16.67	50.00	16.67	100	
AGE = 60>									
AGE = 60>	P	n	0	0	0	4	0	4	
		%	0.00	0.00	0.00	100.0	0.00	100	
Computers are only like any other machine									
SCHOOL=X	S	n	13	46	50	75	29	213	No commonly shared belief.
		%	6.10	21.60	23.47	35.21	13.62	100	
	P	n	17	40	7	52	7	123	
		%	13.82	32.52	5.69	42.28	5.69	100	
T	n	2	5	4	7	4	22		
	%	9.09	22.73	18.18	31.82	18.18	100		
SCHOOL=Y									
SCHOOL=Y	S	n	11	21	25	19	7	83	No commonly shared belief.
		%	13.25	25.30	30.12	22.89	8.43	100	
	P	n	11	33	3	39	5	91	
		%	12.09	36.26	3.30	42.86	5.49	100	
	T	n	3	7	2	8	2	22	
		%	13.64	31.82	9.09	36.36	9.09	100	
SEX=Female									
SEX=Female	S	n	19	53	65	83	29	249	No commonly shared belief.
		%	7.63	21.29	26.10	33.33	11.65	100	
	P	n	12	38	7	44	6	107	
		%	11.21	35.51	6.54	41.12	5.61	100	
	T	n	3	4	4	5	2	18	
		%	16.67	22.22	22.22	27.78	11.11	100	
SEX = Male									
SEX = Male	S	n	4	13	10	11	7	45	No commonly shared belief by students and parents.
		%	8.89	28.89	22.22	24.44	15.56	100	
	P	n	16	32	3	40	6	97	
		%	16.49	32.99	3.09	41.24	6.19	100	
	T	n	2	7	2	10	3	24	
		%	8.33	29.17	8.33	41.67	12.50	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

**ANALYSIS OF SELECTED QUESTIONS FROM CONTROL OF TECHNOLOGY
IN EDUCATION BY AGE, SEX AND SCHOOL**

		AGREE		NOT SURE		DISAGREE		COMMENTS
		ONE	TWO	THREE	FOUR	FIVE	TOTAL	
Computers are only like any other machine	P	n 4	8	2	15	1	30	Negative shared belief inferred.
		% 13.33	26.67	6.67	50.00	3.33	100	
AGE = 30-39	T	n 0	5	1	5	2	13	
		% 0.00	38.46	7.69	38.46	15.38	100	
AGE = 40-49	P	n 25	58	7	62	9	161	Shared belief inferred.
		% 15.53	36.02	4.35	38.51	5.59	100	
	T	n 2	6	2	8	2	20	Negative shared belief inferred.
		% 10.00	30.00	10.00	40.00	10.00	100	
AGE = 50-59	P	n 0	6	1	7	1	15	Negative shared belief inferred.
		% 0.00	40.00	6.67	46.67	6.67	100	
	T	n 2	0	2	1	1	6	No commonly shared belief.
		% 33.33	0.00	33.33	16.67	16.67	100	
AGE = 60>	P	n 0	0	0	3	1	4	
		% 0.00	0.00	0.00	75.00	25.00	100	
A 'computer society' is a frightening future	S	n 44	47	67	43	12	213	No commonly shared belief.
		% 20.66	22.07	31.46	20.19	5.63	100	
SCHOOL=X	P	n 14	32	23	46	9	124	
		% 11.29	25.81	18.55	37.10	7.26	100	
	T	n 3	4	5	5	5	22	
		% 13.64	18.18	22.73	22.73	22.73	100	
SCHOOL=Y	S	n 20	24	21	11	7	83	Shared belief inferred.
		% 24.10	28.92	25.30	13.25	8.43	100	
	P	n 7	34	16	30	4	91	No commonly held belief by parents and teachers.
		% 7.69	37.36	17.58	32.97	4.40	100	
	T	n 2	6	4	8	2	22	
		% 9.09	27.27	18.18	36.36	9.09	100	
SEX=Female	S	n 56	58	76	44	15	249	No commonly shared belief.
		% 22.49	23.29	30.52	17.67	6.02	100	
	P	n 9	29	23	40	6	107	
		% 8.41	27.10	21.50	37.38	5.61	100	
	T	n 1	3	6	4	4	18	
		% 5.56	16.67	33.33	22.22	22.22	100	
SEX = Male	S	n 7	13	12	10	3	45	No commonly held belief by students and parents.
		% 15.56	28.89	26.67	22.22	6.67	100	
	P	n 12	32	14	34	6	98	
		% 12.24	32.65	14.29	34.69	6.12	100	
	T	n 3	6	3	9	3	24	Negative shared belief inferred by teachers.
		% 12.50	25.00	12.50	37.50	12.50	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

ANALYSIS OF SELECTED QUESTIONS FROM CONTROL OF TECHNOLOGY IN EDUCATION BY AGE, SEX AND SCHOOL

		AGREE		NOT SURE		DISAGREE		TOTAL	COMMENTS
		ONE	TWO	THREE	FOUR	FIVE			
A 'computer society' is a frightening future	P	n 0	1	1	0	0	2		
		% 0.00	50.00	50.00	0.00	0.00	100		
	T	n 0	1	0	1	1	3		
		% 0.00	33.33	0.00	33.33	33.33	100		
AGE = 20-29									
AGE = 30-39	P	n 3	14	4	7	2	30		Shared belief inferred.
		% 10.00	46.67	13.33	23.33	6.67	100		
	T	n 1	2	3	4	3	13		Negative shared belief inferred.
		% 7.69	15.38	23.08	30.77	23.08	100		
AGE = 40-49									
AGE = 40-49	P	n 15	45	30	62	10	162		No commonly shared belief.
		% 9.26	27.78	18.52	38.27	6.17	100		
	T	n 2	4	5	6	3	20		
		% 10.00	20.00	25.00	30.00	15.00	100		
AGE = 50-59									
AGE = 50-59	P	n 2	6	1	5	1	15		Shared belief inferred.
		% 13.33	40.00	6.67	33.33	6.67	100		
	T	n 1	2	1	2	0	6		
		% 16.67	33.33	16.67	33.33	0.00	100		
AGE = 60>									
AGE = 60>	P	n 1	0	1	2	0	4		
		% 25.00	0.00	25.00	50.00	0.00	100		
Teachers will lose control of the curriculum to computer programmers									
Teachers will lose control of the curriculum to computer programmers	S	n 25	48	77	57	6	213		No commonly held belief by students.
		% 11.74	22.54	36.15	26.76	2.82	100		
	P	n 2	12	17	75	18	124		Commonly held belief in the negative by parents and teachers.
		% 1.61	9.68	13.71	60.48	14.52	100		
	T	n 0	2	4	8	8	22		
		% 0.00	9.09	18.18	36.36	36.36	100		
SCHOOL= X									
SCHOOL= Y									
SCHOOL= Y	S	n 10	12	43	13	5	83		No commonly shared belief by students and parents.
		% 12.05	14.46	51.81	15.66	6.02	100		
	P	n 3	22	18	39	8	90		
		% 3.33	24.44	20.00	43.33	8.89	100		
	T	n 1	3	3	13	2	22		Negative held belief inferred by teachers.
		% 4.55	13.64	13.64	59.09	9.09	100		
SEX= Female									
SEX= Female	S	n 33	50	97	61	8	249		No commonly held belief by students.
		% 13.25	20.08	38.96	24.50	3.21	100		
	P	n 3	15	18	58	13	107		Negative held belief inferred by parents and teachers.
		% 2.80	14.02	16.82	54.21	12.15	100		
	T	n 1	2	2	7	6	18		
		% 5.56	11.11	11.11	38.89	33.33	100		

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

**ANALYSIS OF SELECTED QUESTIONS FROM CONTROL OF TECHNOLOGY
IN EDUCATION BY AGE, SEX AND SCHOOL**

		AGREE		NOT SURE		DISAGREE		TOTAL	COMMENTS
		ONE	TWO	THREE	FOUR	FIVE			
Teachers will lose control of the curriculum to computer programmers SEX = Male	S	n 1	10	23	9	2	45	No commonly held belief inferred. Negative shared belief inferred by parents and teachers.	
		% 2.22	22.22	51.11	20.00	4.44	100		
	P	n 2	17	12	53	13	97		
		% 2.06	17.53	12.37	54.64	13.40	100		
	T	n 0	3	3	14	4	24		
		% 0.00	12.50	12.50	58.33	16.67	100		
AGE = 20-29	P	n 0	0	0	2	0	2		
		% 0.00	0.00	0.00	100.0	0.00	100		
	T	n 0	1	0	0	2	3		
		% 0.00	33.33	0.00	0.00	66.67	100		
AGE = 30-39	P	n 1	6	9	12	2	30	No commonly held belief. Negative held belief inferred.	
		% 3.33	20.00	30.00	40.00	6.67	100		
	T	n 0	1	1	8	3	13		
		% 0.00	7.69	7.69	61.54	23.08	100		
AGE = 40-49	P	n 3	25	24	86	23	161	Negative held belief inferred.	
		% 1.86	15.53	14.91	53.42	14.29	100		
	T	n 0	3	3	9	5	20		
		% 0.00	15.00	15.00	45.00	25.00	100		
AGE = 50-59	P	n 1	2	2	9	1	15	Negative held belief inferred.	
		% 6.67	13.33	13.33	60.00	6.67	100		
	T	n 1	0	1	4	0	6		
		% 16.67	0.00	16.67	66.67	0.00	100		
AGE = 60>	P	n 0	1	0	3	0	4		
		% 0.00	25.00	0.00	75.00	0.00	100		
Education will be constrained to fit computers SCHOOL=X	S	n 22	52	88	47	4	213	No commonly held belief. Negative held belief inferred by parents and teachers.	
		% 10.33	24.41	41.31	22.07	1.88	100		
	P	n 2	14	20	71	17	124		
		% 1.61	11.29	16.13	57.26	13.71	100		
	T	n 0	2	6	6	8	22		
		% 0.00	9.09	27.27	27.27	36.36	100		
SCHOOL= Y	S	n 11	20	35	12	5	83	No commonly held belief by students and parents. Negative held belief inferred by teachers.	
		% 13.25	24.10	42.17	14.46	6.02	100		
	P	n 3	23	20	35	9	90		
		% 3.33	25.56	22.22	38.89	10.00	100		
	T	n 1	3	4	12	2	22		
		% 4.55	13.64	18.18	54.55	9.09	100		

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

**ANALYSIS OF SELECTED QUESTIONS FROM CONTROL OF TECHNOLOGY
IN EDUCATION BY AGE, SEX AND SCHOOL**

		AGREE		NOT SURE		DISAGREE		COMMENTS	
		ONE	TWO	THREE	FOUR	FIVE	TOTAL		
Education will be constrained to fit computers SEX=Female	S	n 28	59	105	51	6	249	No commonly held belief.	
		% 11.24	23.69	42.17	20.48	2.41	100		
	P	n 4	16	23	52	12	107		Commonly held belief in the negative.
		% 3.74	14.95	21.50	48.60	11.21	100		
	T	n 1	1	4	5	7	18	Negative held belief inferred.	
		% 5.56	5.56	22.22	27.78	38.89	100		
SEX = Male	S	n 4	12	18	8	3	45	No commonly held belief.	
		% 8.89	26.67	40.00	17.78	6.67	100		
	P	n 1	19	14	50	13	97		Negative held belief inferred by parents and teachers.
		% 1.03	19.59	14.43	51.55	13.40	100		
	T	n 0	4	4	13	3	24		
		% 0.00	16.67	16.67	54.17	12.50	100		
AGE = 20-29	P	n 0	1	0	1	0	2		
		% 0.00	50.00	0.00	50.00	0.00	100		
	T	n 0	0	0	0	3	3		
		% 0.00	0.00	0.00	0.00	100.0	100		
AGE = 30-39	P	n 1	6	10	10	3	30	No commonly held belief.	
		% 3.33	20.00	33.33	33.33	10.00	100		
	T	n 0	1	3	6	3	13	Commonly held belief in the negative inferred.	
		% 0.00	7.69	23.08	46.15	23.08	100		
AGE = 40-49	P	n 3	27	24	85	22	161	Commonly held belief in the negative.	
		% 1.86	16.77	14.91	52.80	13.66	100		
	T	n 0	4	3	9	4	20	Commonly held belief in the negative inferred.	
		% 0.00	20.00	15.00	45.00	20.00	100		
AGE = 50-59	P	n 1	1	4	8	1	15	Commonly held belief in the negative inferred.	
		% 6.67	6.67	26.67	53.33	6.67	100		
	T	n 1	0	2	3	0	6		
		% 16.67	0.00	33.33	50.00	0.00	100		
AGE = 60>	P	n 0	1	0	3	0	4		
		% 0.00	25.00	0.00	75.00	0.00	100		
Computers can do only what they are told AGE = 30-39	P	n 8	21	1	0	0	30	Shared belief inferred.	
		% 26.67	70.00	3.33	0.00	0.00	100		
	T	n 4	4	2	2	1	13		
		% 30.77	30.77	15.38	15.38	7.69	100		

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

**ANALYSIS OF SELECTED QUESTIONS FROM CONTROL OF TECHNOLOGY
IN EDUCATION BY AGE, SEX AND SCHOOL**

		AGREE		NOT SURE			DISAGREE	COMMENTS
		ONE	TWO	THREE	FOUR	FIVE	TOTAL	
Computers can do only what they are told	P	n 8	21	1	0	0	30	Shared belief inferred.
		% 26.67	70.00	3.33	0.00	0.00	100	
AGE = 30-39	T	n 4	4	2	2	1	13	
		% 30.77	30.77	15.38	15.38	7.69	100	
AGE = 40-49	P	n 49	91	7	11	3	161	Shared belief held.
		% 30.43	56.52	4.35	6.83	1.86	100	
AGE = 50-59	T	n 11	9	0	0	0	20	Shared belief inferred.
		% 55.00	45.00	0.00	0.00	0.00	100	
AGE = 60>	P	n 5	9	0	0	1	15	Shared belief inferred.
		% 33.33	60.00	0.00	0.00	6.67	100	
AGE = 60>	T	n 2	2	1	1	0	6	
		% 33.33	33.33	16.67	16.67	0.00	100	
AGE = 60>	P	n 1	3	0	0	0	4	
		% 25.00	75.00	0.00	0.00	0.00	100	

Results shown as follows:-

S = Student, P = Parent, T = Teacher, for: number of responses = n
percentage of responses = %

Appendix 6

APPENDIX 6

Appendix 6 provides the interview outline which was used to provide guidance for the conduct of the interviews of Employers, Educational Administrators and Computer Suppliers.

The responses to the questions in this outline were left to the individual to answer or in some cases not answer according to their understanding.

INTERVIEW OUTLINE

- Explanation of Research:** Research into the ways in which knowledge commonly held by people influences the creation of reality.
- Purpose of Interview:** To explore the boundaries and types of knowledge held by people in different roles in society.
- In particular, explore the type of knowledge held about technology in education.
- Procedure:** A series of questions will be asked under the following headings:
1. Technological Future
 2. Computers and Education
 3. The Future of Schooling and Computers
 4. Control of Technology in Education
 5. Evaluation of Schooling
- Introduction:** Given that children entering schools now will leave schools a decade into the future - say 2001-2005.
- What image do you hold about society and technology in which schools will operate?*
- Technological Future:**
- Greatly change our lives
 - Effect on work
 - Leisure
 - Privacy
 - Control
 - New cults of technology
- Computers and Education:**
- Relationships
 - Learning ability
 - Motivation
 - Creativity
 - Gender effects
 - Career needs
 - Relevance to subjects
 - Redundancy of current learning
 - Equity
 - Efficiency/Effectiveness

Future of Computers and Schooling:

- As now but more technology
- Management of learning only
- Individualised study
- Private company providing programs for a fee
- Gathering for social development but individual learning using computers
- Becomes irrelevant due to centralised data banks
- None of the above

How do you see the role of teachers changing?

Control of Technology in Education:

- Most people decided
- Inevitable
- "In-human" society
- Choice where used
- I would not use computers in education
- Schooling reshaped
- Computer society "exciting"
- Frightening future
- Teachers will lose control
- Education constrained

Who do you believe has most promoted use of computers in education?

- Media
- Employers
- Education Department
- Parents
- Computer companies
- Teachers
- Unions

Evaluation of Schooling:

- Schools satisfactory
- Need radical change
- Irrelevant
- Always be same
- Not sure

Conclusion:

- Any other matters not covered but considered relevant
- How the questions will be used
- Thanks for participation

Appendix 7

APPENDIX 7

This table was developed by analysing the content of the interviews and identifying statements which were supportive of computers in education for Employers, Computer Suppliers and Educational Administrators for each of the key areas in the survey.

APPENDIX 7

CONSTRUCTION OF KNOWLEDGE

Constructions Supporting Computers in Education

	EMPLOYERS	COMPUTER SUPPLIERS	EDUCATIONAL ADMIN.
Relationships	<ul style="list-style-type: none"> • Improve 	<ul style="list-style-type: none"> • Improve 	<ul style="list-style-type: none"> • Increase inter-dependence and independence
Learning Ability	<ul style="list-style-type: none"> • Speed up learning 	<ul style="list-style-type: none"> • Learning will be enhanced 	<ul style="list-style-type: none"> • Will learn how to access information • Learn how to problem solve
Equity	<ul style="list-style-type: none"> • Government schools should provide access 		<ul style="list-style-type: none"> • Public schools will provide access
Motivation	<ul style="list-style-type: none"> • Will motivate 	<ul style="list-style-type: none"> • Will motivate • Motivate those taught well 	<ul style="list-style-type: none"> • Writing improves • Removes drudgery
Creativity		<ul style="list-style-type: none"> • Can enhance (if well managed) • Require latest technology 	<ul style="list-style-type: none"> • More creative
Gender Effect	<ul style="list-style-type: none"> • Does not differentiate between sexes 	<ul style="list-style-type: none"> • Provides common platform • Girls must have more time 	<ul style="list-style-type: none"> • Boys more attracted
Career Needs	<ul style="list-style-type: none"> • Careers database useful • Jobs will require computers 	<ul style="list-style-type: none"> • The way school system going makes it harder to move students to menial jobs • Technology enhances peoples careers 	
Relevance	<ul style="list-style-type: none"> • More relevant to science subjects • Relevant to all disciplines 	<ul style="list-style-type: none"> • Relevant to all subjects 	<ul style="list-style-type: none"> • Relevant to all disciplines into basis of all subjects

CONSTRUCTION OF KNOWLEDGE

Constructions Supporting Computers in Education

	EMPLOYERS	COMPUTER SUPPLIERS	EDUCATIONAL ADMIN.
Relevance	<ul style="list-style-type: none"> • More relevant to science subjects • Relevant to all disciplines 	<ul style="list-style-type: none"> • Relevant to all subjects 	<ul style="list-style-type: none"> • Relevant to all disciplines into basis of all subjects
Redundancy of Knowledge	<ul style="list-style-type: none"> • Problem solving will be more important than getting answer 	<ul style="list-style-type: none"> • With access to information problem solving important • Need to introduce computers to child at young age 	<ul style="list-style-type: none"> • Curriculum must be reviewed to maintain relevance • Education should provide common experience
Efficiency and Effectiveness	<ul style="list-style-type: none"> • Will enhance efficiency and effectiveness of schools • If teachers had computer skills schools would be more efficient and effective • Efficiency should improve 	<ul style="list-style-type: none"> • Will free up teachers • New delivery systems will remove levels of infrastructure 	<ul style="list-style-type: none"> • If teachers focus on monitoring learning they may get better performance

Appendix 8

APPENDIX 8

This table was developed by analysing the content of the interviews and identifying statements which were not supportive of computers in Education for Employers, Computer Suppliers and Educational Administrators for each of the key areas in the survey.

CONSTRUCTION OF KNOWLEDGE

Constructions Not Supporting Computers in Education

	EMPLOYERS	COMPUTER SUPPLIERS	EDUCATIONAL ADMIN.
Relationships	<ul style="list-style-type: none"> • Risk to listening skills 		<ul style="list-style-type: none"> • Reduced socialisation • Less flexible • Teachers not comfortable
Learning Ability	<ul style="list-style-type: none"> • Some students will not be able to learn by computers 		
Motivation	<ul style="list-style-type: none"> • Will not motivate • Motivate only while new 		<ul style="list-style-type: none"> • Some people will be demotivated
Creativity	<ul style="list-style-type: none"> • Will not enhance 		<ul style="list-style-type: none"> • Limiting by lack of freedom in technology

Appendix 9

APPENDIX 9

This table was developed by analysing the content of the interviews and identifying statements which were neither supportive or non-supportive of computers in education for Employers, Computer Suppliers and Educational Administrators for each of the key areas in the survey.

CONSTRUCTION OF KNOWLEDGE

Constructions Which Neither Support Nor Confirm Computers in Education

	EMPLOYERS	COMPUTER SUPPLIERS	EDUCATIONAL ADMIN.
Relationships	<ul style="list-style-type: none"> Inequity will always exist 	<ul style="list-style-type: none"> Will not have any impact 	
Creativity			<ul style="list-style-type: none"> Education system is restrictive to technology
Gender Effect		<ul style="list-style-type: none"> Society is saying science is for boys 	<ul style="list-style-type: none"> Bias reflected in society
Career Needs	<ul style="list-style-type: none"> Career information needs to come from outside of schools 		<ul style="list-style-type: none"> Technology cannot be stopped People cannot win against technology All people will be affected Many skills are throw away skills Need to move skill levels up from manual level
Relevance	<ul style="list-style-type: none"> Need to replace old with new 		
Efficiency and Effectiveness	<ul style="list-style-type: none"> Not students who cannot cope but teachers 		<ul style="list-style-type: none"> Schooling is about relationships

Appendix 10

APPENDIX 10

This appendix presents a summary of the content of the newspaper articles in South Australia in the period 1986 to 1992 to establish the type of 'knowledge' which they presented to the reader during this period.

**SUMMARY OF ARTICLES IN NEWSPAPERS
PUBLISHED IN SOUTH AUSTRALIA**

PAPER	DATE	ARTICLE
The Advertiser	4 March 1986	Networking information base between schools
The Advertiser	22 April 1986	Networking subject and curriculum development
The Advertiser	21 June 1986	Funding from State Government for computers - parents and friends committee to provide funds
The Advertiser	13 December 1986	Computer awareness comes for parents in country schools
The Advertiser	28 February 1987	Funding for computers
The Advertiser	7 March 1987	Links with schools in other countries
The Advertiser	28 March 1987	Theorising about swapping pens for computers and benefits, better work, spell checks and technology
The Advertiser	1 May 1987	Funding for computers by government jointly with parents Computers as tools to gain access to curriculum 'Legitimate' role of teachers
The Advertiser	9 June 1987	Theorising about 'independent study habits' - better prepared
The Advertiser	18 June 1987	Technological solutions to small number of students, in distance locations to access subjects
The Advertiser	26 June 1987	Education Department's new policy to use computers across all subjects Minister (Crafter) supports computers for learning
The Advertiser	5 September 1987	Parents learning about computers
The Advertiser	26 September 1987	Announcing the electronic database of newspaper material NewsScan Theorising about teachers keeping up to date with technology
The Advertiser	17 October 1987	(Advertising) Presents computer games for teaching arithmetic and computers

PAPER	DATE	ARTICLE
The Advertiser	11 December 1987	Purchase of computers by school council
The Advertiser	5 March 1988	Computer links to school in other countries
The Advertiser	22 July 1988	Theorising about new elite group by those who cannot get computer access - Leader of Opposition Olsen theorising that computer awareness increases link between school and work
The Advertiser	2 November 1988	Technology - low number of students in some country schools can be assisted by using computer linkups
The Advertiser	6 November 1988	Promotion of Computers in Schools
Sunday Mail	5 February 1989	Theorising that computers develop skills (especially for employers) in analysing, questioning, researching, hypothesising, adapting. Tech will help students be more productive in workforce
The News	23 February 1989	Promotion of computers in education
Sunday Mail	19 March 1989	Application of computers for teaching history
The News	10 April 1989	Claim that the benefits to education of computers far outstrips the reality - parents still ask - are computers good for education - Yes if carefully selected
The News	25 May 1989	Promotion of computers in education
The Advertiser	23 June 1989	Computers for admin purposes networking
The Advertiser	31 July 1989	Minister for Education - theorising about the needs for computing skills for the future
The News	29 August 1989	Theorising about student skills at industry standard levels. Concern expressed that government not providing funding to replace computer technology
The News	30 August 1989	Political statement that some schools are being discriminated against by not being provided with computer technology

PAPER	DATE	ARTICLE
The Advertiser	3 October 1989	Administration of Catholic education by computers
The Advertiser	29 September 1990	Theorising about teacher numbers being cut and money being spent on computers for students to teach themselves Applied to education as well as industry, manufacturing
The News	15 February 1991	Application of computers across curriculum, 8 year olds English comment
The News	27 May 1991	Promotion of computers by Apple - by PM Hawke
The News	29 May 1991	Promotion of computers in supermarkets
The News	14 June 1991	Promotion of computers for education - 70% of SA and NT enrolled in Coles - Apples for computers
The Advertiser	1 July 1991	Promotion of computers first SA school to win computer
The Advertiser	4 July 1991	Minister of Education - proposes code of ethics for promotion of computers
The News	8 July 1991	USA study - theorising about the use of computers for learning from homes. Theorising about need for students to use computers and develop team work - not in individual learning
The News	29 August 1991	Theorising about the development of teachers to assist implementation in schools
The News	20 September 1991	Theorising about students writing more effectively than those using pen and paper
The Advertiser	3 December 1991	Theorising about the skills of young children who use computers from 6 - preparing for life
The News	25 March 1992	Promotion of computer company
The Advertiser	6 May 1992	Theorising about computers and learning - skills required for 21st Century Ways children will learn Theorising that parents can no longer leave learning and future to teachers but must take responsibility in the home

Appendix 11

APPENDIX 11

Appendix 11 presents the unabridged interviews of Employers representing a retail industry, a service organisation and a manufacturing industry.

This is followed by a comparative analysis of the key issues of concern for the three (3) core studies.

Finally a summary of the theorising of all Employers is presented.

INTERVIEW FIVE

COMPANY: JOHN MARTIN RETAILERS LTD
POSITION: PERSONNEL MANAGER
DESCRIPTION: Employs and manages the training and development of staff in a large retail company

TECHNOLOGICAL FUTURE

"What images do you hold about the future society and technology in which schools will operate?"

In looking at the structure of work, one of the trends you see is the fact that with the advent of computers back in the mid 1970s' what we found was that we created a started using computers which reduced labour basically. Part of the unemployment today is because those people cannot be employed because of the fact that there is no work for them. We used to have 200 people working in Accounts Receivable we now have 50 because of computers.

One of the other reasons we cost justify computers back in those days was because we got equal pay for women and within 2 years we got an 83% increase in the wages of women and that caused us to look seriously at our costs which meant that we could afford computers. So what you are seeing then is that there is a row of middle management which actually managed all of that labour force and what you've seen is that middle management has been eroded away. So if you continue those trends through what you're seeing is you're bringing people into an organisation especially into an office environment rather than a shop floor environment so you have cut out a layer of middle management on the way through, so that everybody now has to produce the same end results but they now do it using a series of tools. Now computers, big computers, were the tools; personal computers are now becoming more prevalent

although very expensive. Still, I've got 2 laptops, one here and one home. One that is portable. The trends that I see happening are that those PCs' will become more of a diary and a workstation and these portables can be carried around.

Because of the high cost of labour ongoing, what we are seeing is that where a secretary used to service a manager, now we have a secretary servicing 2 or 3 managers or a secretary/typing pool managing 10. In the future what I see is that there will be no secretarial pools at all. What will happen there may be some personnel assistants around on different levels or teams of people but that one on one relationship is going. So what you will see is people will manage their own environment, they will create their own paperwork, their own letters, their own memos, they will use electronic mail as it comes around and so what you will see you will get rid of whole layers of the structure in society. Now that means that for each manager or each person of a technical nature they will have to be fully conversant with the ability to use computers in order to communicate, and not only just use it to produce a letter but know how to use it to transmit data from their PC to another PC and be fully conversant with how the software actually works, not understanding all of it but understanding some basic things like how to call up another person on their PC, send them some data or a report and then close or open and close files on remote devices, things like that. That's a trend coming on the way through from a management point of view.

So the general trend that I would see is that we have been educating the children on computer literacy and computer skills.

Education as such is a process that comes from about 3 areas I think. It's the education you get in the home from the parents. It's the education that you get from the school and the teachers and then there's the ability of the cultural values that you have around you. A person who comes from the eastern suburbs of South Australia culturally, you've got support systems. You understand english, you understand other things. If in fact you don't understand the system or your parents don't or they have come in from a foreign country as a migrant that is a part of the process of education which tends to suffer. I am not explaining myself very well. What I am saying is that the 3 factors affect the child's education or anybody's ability to get on and then in the workplace later on. So what you find is that computer literacy skills have been developed on all 3 fronts. They are picking them up not only from home and school but more so the other areas, then you are going to have people that are going to be successful because they are going to be picking those up.

If you don't have it at home and nobody is interested, they will pick it up at school. And I think it's going to depend on the quality of the schooling that they go to, the quality of the teachers and the facilities and a lot of that comes back to resources.

The third area is going to mean, other areas or in their total environment where they come into contact with computers. Those 3 factors will have a lot of influence in what we finish up in the end.

If you look how you see it in 5-10 years time, I suppose, everything will become slowly more automated and you will have more functions to do. An example is a cash register. 15-20 years ago a cash register was a till which you rang some money up - it was an adding machine with a security with the cash in the drawer. It progressed to being the

first optical format which was the first thing that they used which had an imprint which could be read and you could collect data and then it's going through so it's now you can put SKU information through etc. The next level of scanning so you have bar coding and you integrate that with electronic funds transfer and impost with pin numbers and there is probably another stage after that when you have got more into the EPI fields. So, although you are doing that it has already been built into the equipment. The person who is serving the customer is no more clever etc, their skills are in the selling skills, right, and therefore the equipment is becoming using the skills of the programmer having to be built to the lowest common denominator.

What you will find is that things like expert systems, artificial intelligence, things like that will make much more complex processes still transparent to the user. The equipment that we will be dealing with will be much more complex and the software will be much more complex but it will be much more user friendly on the way through.

So, if you take the process of going from old computers of years ago, the old Cobal System, and today you are looking at fourth generation languages with data based information systems, there you then get into information engineering, artificial intelligence and things like that you are going to find that will help the person who is using the equipment to do something much better and much more complex which will eliminate labour on the way through but it is still going to be transparent to the user because the intelligence of people is not increasing overall. You will still have a clerk doing a clerk's job but, for example, where you used to take an invoice in you used to write an order and the order would be sent off to the supplier and the supplier would then send it in and there would be paperwork going back and forth. What you do is pick the data up from your scanning, you feed that into your computer, your computer automatically generates an order, dials the supplier's computer, they accept the order

you've done, they create pick orders or picking lists, send the stock in. They send you an invoice electronically, the clerk in Accounts Payable that we have is sitting at a screen and pulls that up and then matches that we have received, the stock the invoice is for, clears that and then we get an automatic electronic funds transfer and all of a sudden you have a paperless society. Now you won't get totally away from paper but you are reducing it but you are also cutting the handling times down. Because the paper handling times are an enormous part compared with the thinking time of what the person is actually achieving with the moving of that transaction through.

So, in education it is important that the children that are coming through in 5-10 years time are very comfortable with where the data is and where it's moving and things like that so that abstract thinking about the data sitting here and how I am moving it here so that they understand the process, they understand the process without understanding all of the software, is important.

The problem is you need to understand the technology so you know when it is not working or there's a bug or something. You have to understand the process to understand if there is a problem, in the process not just blindly accept what's happening on the way through.

"What About People's Personal Life?"

I don't think in the short term it will. I think that you may have individual boxes that you buy. Like you will have a smarter television set which is more programmable. You will have smarter CDs, you will have more personal computers in the home. I don't think people can really afford, as a generality, to be all wiring up their home's air conditioning system to be turning itself on and off. I think that people will - the integration of these networks is a terribly complex process in my mind, and although people will buy

individual things the interlinking of, saying that you have a home computer that will drive everything. It means if that does not work nothing works in the whole house and the risk levels are high and the integration is high and when you have different companies developing these things we have problems getting this box to talk to this box and where are computer experts, so in the home it's going to be very difficult for that to happen.

I think you will improve what we have got in each of the areas but I do not think we will actually integrate them at all. I think the integration is not in the next 10 years.

"What about Privacy?"

I think the data is already there on data bases. The problem you have got is accessing it and the cost of accessing it. We have a lot of data here but we don't bother to access it because the cost of accessing it and using it for marketing far exceeds the benefit that we get from it.

So, if you are going to be very sophisticated in accessing, you are going to have like building up profiles of people's eating habits and other things, the cost of doing it far exceeds the benefit we get from it so I don't think people will do it. I think also, that people will be so concentrating on keeping their business in a survival mode that they won't be accessing that sort of data except for general marketing.

If you want to find all the people who buy lawn mowers from you for the last 12 months to sell and the type of oils for lawn mowers or something like that then you might put that data out. We do use, we have some data bases with customers who were on mail order operation so we can selectively mail to them again in certain things but I think people are more concerned about tax information, health information and things like that being disclosed and financial information to some degree is important too but I think

health information and tax information are probably the two greatest ones and they are fairly well guarded by law and privacy laws which are already there, so I think there are sufficient watch dogs for those. in fact, the law has gone a little bit over-the-top.

The problem you have got with some laws now is that they have been built for a particular reason - privacy bills, but the implications they have on increasing cost on our society are quite large so you have got that balance to have. If you want total privacy it is very very expensive, you have to have a balance between what you need to keep private and what you can afford to keep private. And the second matter, I suppose, is that it is not good for a company's reputation for them to allow any of that data to be seen to be given out so I think we generally protect a lot of our files, we would not like to be seen in industry or by the public as being a company which gives any data away.

"What about the notion of control?"

You mean do we have any control over the environment in which we live, changing?

No, I don't think we would have any more or less, I think, if you are talking about environmental factors, weather and things like this, no, I don't think you have much control. If you are talking about our ability to allow new technology to come in and take over jobs etc, no, we don't have. Because you are talking about competitive advantages and what happens is if there are a number of companies in one industry and one of them comes up with some use for computers which gives them a competitive advantage then they will usually take that, then, if in fact the other companies in the industry do not take a lot of effort to catch up and go past or catch up then they fall further behind as the company with competitive advantage can then afford to make more profit, they can afford more computing and more marketing or more something else which will push them further ahead, then everybody else has to take up that technology regardless of

the cost because it's a matter of survival and in big companies, if you do not do that you are going to be left further and further behind and eventually everybody in that company will be in a situation of losing their jobs because either the company folds or gets taken over as you get in that situation of trying to get market leadership, market dominance. So, the role of competitive advantage will eventually force people to use the technology whether they want to or not. The danger is if they cannot afford to use it they will go under. It is a sort of self fulfilling prophecy.

"Cults of technology?"

Yes! but it has still got to be economically sustainable. I think a solution to the Three Mile Island thing is the fact that you have to use expert systems to do the data engineering. You have to take the whole data and engineer it into a format that cuts all of the hack work out so that the people who are making the decisions have the data presented to them in such a way that they are only looking at the data that they need to look at most of the time and then can select into the other data when they feel the need for any further investigation.

So, an expert system should stop you data gathering but give you the data in such a way that you can use it for decision making. So that's the way around that, if you get overridden by the data, so you have to make decisions. If you never make any decisions you never go anywhere. Eventually, if you never make any decisions on a regular basis you just slide.

There have always been people who have pushed the technology to more than what it is on the basis that it gives them some special place in society and as such, you will always have people who are specialists and who get a buzz out of the whole thing and yet they will exist. You will always get the total spectrum of people in anything if you

look at any subject you will get people who are to the right or to the left of whatever point of view you take. You will always have some people like that. It gets back to the economics. If it's economically feasible then it will make progress in society, if it's not economically feasible it may be a great idea for a while but eventually it will not survive.

COMPUTERS AND EDUCATION

"How will relationships change?"

There are a couple of schools of thought that I have seen in primary schools associated with the of computers in the classrooms. One is that you have the computers in a separate room and you go for a computer lesson and it's there and it means that all of the children get equal access, equal quality of access which is good.

Another school of thought puts a number of them in every classroom and only the bright ones who have finished their work then get to go and work on the computers. I don't like that particular aspect because it's not an equitable solution. Theoretically, the best thing would be, I think it has been done in one of the little girls' schools in Melbourne, Melbourne Grammar, I don't know, but what they have done is given every child in the class a laptop, Panasonic 32K Laptop that is, where they put all their work. They can then go to the printer and print it and run it out. I've seen it in other places, I think one or two Catholic Schools, Seaman I think, in the high school has got 40 or 50 Panasonic Laptops in the library you can go and borrow, do your assignment and put the laptop back.

To my way of thinking what has to happen, it has to be part of the tools of every student on the way through but if you cannot get that and it is not economically feasible to do it at this point in time because it has to be funded by parents and if you're in a rich school you can have it and if you're in a poor school you cannot, you are better off to

concentrate on giving them the skills by putting them all in one room and the class goes there and they all use them than putting a small number in each class.

"If all students had a computer, do you think it could impair the relationship?"

No, I don't think so, provided that the software you are using is centrally controlled by the teacher even though the learning skills of the students may be of different paces and they pace themselves using it, you get the same thing, a series of basics in reading, right, so that they will go and select books, they will read from those books and when they finish that standard they will go and read to the teacher and they will then go and put the book back. Now if the teacher is not happy with that book they may try to get them to select a book a little higher or lower standard. Now provided you've got access to those tools through the central computer or the teacher's desk which can monitor which programs or which levels of programs children are going through then you know you won't have that problem and what you will be able to do is, in fact, use the data and the feedback from the computers to the teacher to be able to more closely monitor the actual progress of different students and their strengths and weaknesses, right. So, I think they could actually improve it because it's teaching by exception rather than teaching generally and they can get down and get closer to it.

The other thing it would allow you to do would be to specify your LAP programs better, where you are using your learning assistance programs. If you've got those then you can try to pick those areas and then have people like parents or other people who come in to assist, more specifically, work on LAP programs as well. I think you can improve it but it will take some clever people on the software side because initially if you don't do that you are going to have the opposite reaction.

If it's not well managed information and the teachers are not taught how to use the new technology, they will not be able to do it and therefore they will mess it up. So, it has better potential but it has a down side risk to it.

"Learning ability?"

I think so, because, I think, certainly there is a lot of gifted students who are not pushed anywhere near the level that they could be because they can't go any faster. LAP programs are not always for the dummies in the class but also for extension learning for the smarties in the class and certainly if there is access to the software then the students can benefit from it as well. What you have got to be worried about though is that education is not about technology purely and simply, education is about appropriately rounded students coming out with specifically set minimum centre skills where if they have had extension they have to take from that through. Computers, I am sure, can help in many of these areas of accessing data but they don't necessarily help in areas of expression and things like that. I am not an educationalist but I think there is a balance there and you can use computers in some parts of the educational curriculum quite easily and others I don't think you will ever use them at all.

"Will computers motivate kids?"

Yes.

"Creativity?"

I am not sure on that one. I think that one of the things you get with television is it's a passive process. You sit there, you change a few channels and it's all fed at you. You accept what you want but you don't have to think about the process very often.

In computing, where you are using your keyboard etc, you are going to be further along the track. The fact that you have to do something, you have got to interact, you have to use your mind quite often and figure out what you're going to do. So, it's more creative than what you're doing. I am not sure if it's going to be creative in another sense though. I think Australians are a reasonably creative society. I think there are a lot of things we create but, in fact, we don't develop in Australia but we own patterns which are developed in United States or in Japan where there is capital. I am not sure of that one. My general feeling is, no, they're not going to, but they will not be any worse unless they are taking time away from other creative activities.

"Gender affects?" "Will computers be beneficial or detrimental?"

The quality of access to the facilities is always a problem, so, provided the facility access is equitable then I think girls have got the ability to do it. One of the things I find then is boys are more boisterous and they are more aggressive and therefore they tend to elbow the girls out to get to the machines to play the games and things like that. I personally believe that if you can segregate the sexes in the education process then they only have to worry about the education process whilst they are at school then the girls can, in fact, do as well, if not better.

I'm on the Board of SABS, and I have just been reading some reports about the way questions are written for year 12 exams. It works a bit both ways, some of the girls do better, some of the boys do better, some subjects they are just about equal. So I don't think computing is a subject where I would say that girls couldn't do as well as boys. It has really got to do with accessibility and the fact that they don't feel threatened in the learning process is important.

"Will computers help career development?"

I don't think so. I think that career understanding etc, comes from areas outside of curriculum and schools. I think schools can play a part in that but a lot of that comes from the attitudes in the home. Helping them setting goals, showing them the different pathways. SABSA are doing this with an "Unlock your future" to show people a lot more pathways. They do talk about, have charts, where they say, if you are good at these subjects you can do this sort of career but in relating career to money, to lifestyle, and that balance, a lot of that I'm sure comes from the home more than anywhere else, so if you are going to educate anyone you have to educate parents as well as the students. I'll give you an example - when I was Assistant to the EDP Manager here I had 4 geologist, geophysicists or mineralogists working for me as systems analyst because they had all gone to Uni when geology and mineralogy was big, by the time they had finished Uni there was no jobs in that area. In some cases, they had found that they did not want to spend 9 months of a year driving around in a four wheel drive at the back of Bourke either, it was a completely different lifestyle but they had got the basic education and they had gone on and done other computing courses so it wasn't wasted, it was an education but they did not use those skills in that particular discipline directly, but the skills they learnt by going through the discipline of University and the logic skills etc, the presentation skills that they did use so there are a lot of skills that you can acquire by going to education and Uni that do not directly relate to the career you get in the end. It is helpful if they all match together in the end.

"Are computers more relevant to some subjects more than others?"

Obviously, the ones that have more facts and logic are the easiest to put together. I mean subjects like languages, French, Italian - no. You can have language learning laboratories etc, but that's got to do with understanding the thing. You may be able to,

but some of that is marginal. I mean you could do some interaction between the student and the stream in a learning process where you talk or type back in what you think it should be, it tells you back what it should be then corrects you and so that interaction is a learning process. Certainly, you could pick some of that up but it's marginal compared to some of the other subjects, the sciences, and biology and the chemistries and some of these and the learning abilities through those, I think, are much greater.

"Redundancy of knowledge?"

As you go through your education process the further you go through the less exams to sit for and the more papers you write, in fact, I have been to some exams where I have sat for 4 or 5 hours and I can take all my text books in. What I had to know is how to access those text books and tables and so I learnt the process not the facts, I learnt the process not the tables etc.

I am sure that education has to be about learning about thinking processes and how to put things together and because, really, education is not about how to live in our society and how to make a living in our society but fitting in.

I think that may be it's a bit like I did lectures in 1st year Uni, now they do it in year 3, in 1st year Uni Maths. The process has been more integrated and therefore in year 12 they do more school assessment, moderation etc than they used to but they still do an exam. 20 years ago they did not do that. I think you will go even further on the way through, which means that things like moderation can be done by doing your exam on a computer and somebody else will check it and the moderation will be done by the computer. That's eventually where the technology's going to go, so I don't see that what we are learning today will be - we shouldn't be learning it necessarily, it's maybe the way we are learning it that must change.

"Does this mean that a lot of time in teacher training in developing facts is not required?"

Yes, but you still have to explain why it's right and why it's wrong. When I sit down with my year 9 daughter who is doing maths and she's doing an algebra problem and she says "I don't understand it, why does it happen that way?". I can see what they have done and I can do it by rote but why? And therefore, the teacher must be able to explain why it happens and not just do it because on a screen you would be able to explain it, give some examples etc, but you may need with some students, to tackle that explanation from a different angle. And, maybe a computer can give you 2 or 3 different ways to think about it which may, to some students, be confusing. It will, in fact, give them more information.

"Are we likely to create an equity problem?"

Yes, those who have the resources will get a better education. Then that has always been the case in the whole of history. The people who have had the resources and made the money have always been able to afford better quality education etc. And education is not always going to school, it's education. A child is educated having a trip to the snow or seeing snow and watching it or seeing different things or going on outings or having access to materials or all sorts of things like that. In the case of country students, computers may give access to things which they did not have before, a lot better, because they can tap into the same data in the city as everyone in the city taps into. It cuts the distance out so it will give more equity to those particular students.

"Male and female equity?"

I think it's coming anyway in society. You know it's a bit like a pendulum, it swings a bit far out at times, but then it swings back again. It's sort of swinging to try to find a nice medium.

I think there is a lot of prejudice against women in society and it won't actually change, it will take generations to change it and get it out. Therefore, you are getting an over reaction to the laws against it and draconian penalties against people at times for doing little things just to prove a point.

In the educational sphere, I think the attitude to girls getting access to good education has changed. You had it in the 1920s' and 1930s'. You had females that want to and became Dame Roma Mitchell's, but they did not have access to follow that through quite often. It wasn't still acceptable in society. There used to be a rule in South Australia, I think, that once a teacher married she had to quit her job. I mean, all those things in society changed and once those things changed gradually the other things came through but access to the technology is becoming more equitable but you are getting social justice issues coming through now, or should, I think.

I went to Mansfield Park Primary School to look at some air-conditioning systems because I was Chairman of the School Council of West Beach Primary and they had the same sort of buildings and I think that 80% of the children were from Laos, Vietnam, Cambodia, those areas and so they had a whole set of special needs in that school to try to get them access to the stuff.

"Will computers create improvements?"

I think that everybody who has qualifications should have to do refresher courses compulsorily every 10 years or whatever because people like accountants in order to keep their CPA each year have to do so many hours of training. Teachers do in-service 2 or 3 days a year but I doubt the quality is there. They do a first aid course. They learn about how to discipline children differently and how to set up new policies and discipline in schools. They do things like that.

I get the feeling that in order to make computing work better in the schools it's not the children who can't cope it's the teachers who can't cope and having been Chairman of the School Council for a year and then on the Council for a while, you get 2 groups of teachers in the schools, those who embraced new technology and new ideas going through and others who really do not want to change because it's comfortable.

I think that in order to get the computing to work it's got to work from the top down not from the bottom up, and what you are getting is that school councils are pushing it, the parents are saying we need the children to have more computer literacy, you've got some head masters saying we need more computer literacy, you've got some teachers saying we need some more computer literacy. But the class teacher has to interact with the teachers who have to, they are key teachers who get the extra money to do the computing etc, and I think start at the top. Dr Wilmott says, "right, I want a number of laptops in every school and I want everyone to be part of the curriculum for maths or whatever and its all got to be done in 3 years", and push it down and make every single teacher actually to sit through 2 or 3 days in a year of in-service training so that they are comfortable with it because once they have done it because they had to do it, right, they say this is not so bad after all. They're scared. So I think you have to tackle these groups.

See, one of the areas they are putting computers into is the library systems. The Linex and other systems they are using in schools. The kids can go in there and look things up and they can reference etc., librarians use it all right but none of the other teachers do. The kids know how to use it, maybe headmaster knows how to use it, depending on the headmaster, the teachers aids know how to use it and the librarians know how to use it but the teachers don't. But maybe it's because the in-service training that they are having is not towards new technology but towards things that are simple to organise.

"If they had it would it lead to greater efficiencies or greater effectiveness?"

Yes, I think it would.

FUTURE OF SCHOOLING

I think the school structure as it is and the learning by going to school will stay very similar to the way it is. My reason for that is, I don't think the majority of people in our society are forward thinking enough to allow the change to occur.

A lot of people use school as a child minding centre and really either they are both working or one's working or they don't want the kids during the day anyway and so it is unfortunate for those children who have that attitude but it is a fact in our society. So if we try to change it to home base learning and all sorts of big data bases, they won't be able to cope with the concept. They won't want it and they don't really care about it so they will raise enough ruckus so they won't have it so you end up with having more technology in the schools, hopefully, more experience with the teachers and maybe more individualised learning programs within the structure with more technology but I don't think you will go much further than that in the next 10-20 years.

"Given that work will take on a different shape in the future do you think that will have any influences?"

I don't think so, I think that is fairly marginal. The areas that can do that are very few the examples, like programmers working from home can do it but they lose the interaction.

One of the things that happens about work is that when you go into flexitime and shorter weeks and things like that, the cohesion of the team effort in the office starts to fall away because they don't have that where they all have to be together, therefore, they don't spend that interaction time and you lose some cohesion in the team effort.

I think what you get is change that happens slowly with technology being introduced. You can change the number of hours that a department store operates but you can't change the locations or say to people we have to be there when the public wants us to be and the law allows us to be and what's economical and that balance has to fit in and everyone has to fit their lives around that. If you don't want to, that's all right, but go and work somewhere else. But you have to fit within that environment and I think what will happen to schools is the same, the parents will say "Hey, from 9.00am to 3.30pm or from 8.30am to 3.30pm, I want my child in school." It may be that it goes from 8.00am until 2.30pm or 3.00pm or whatever and you put after school care services in and all those sorts of things, but that basic concept of 5 day per week will probably stay the same but what you will do is introduce more technology, better learning procedures in schools, you will pick up your LAP students better, you will do that sort of thing so that the quality of education and maybe the productivity of education can improve but the basic framework will probably remain the same because I don't think society can cope with enormous changes in that framework. They can cope with change inside the framework but not of the framework. It disrupts their lives outside too much, as you can imagine, if you have 2 people working trying to same for a house and things like that.

"Do you think that with the technology available the education department will be able to move to having less teachers?"

I think they are gradually doing that now. I am not sure. See what is happening with teachers is they are having more time off from classroom contact, one on one contact or classroom contact as D.O.T. time or various things like that so that's increased the number of children but I think they are reducing them gradually because of the number of school children because of the population movement is reducing. I think the education department will gradually whittle them down anyway, because, if you look at the comparisons across the states you are still looking at private schools versus government schools. Private schools still run less teachers per head than the government schools do and I think that the government schools will gradually reduce down a bit as they try to eliminate the extra teachers and aids, but that's independent of technology.

"How do you see the role of teachers changing?"

I think they have got to change and they have to be able to understand the technology and be able to use it as an integrated part of their lessons structure, and that's going to be difficult for them.

So, if they were teaching maths in a particular way or science in a particular way now, eventually there will be computers everywhere and they will use the computers as one of their tools just as you do your calculator, you will have a computer and they will plug in a lesson pack to work on or plug in the system and turn it on and they can go to their own lesson packs.



"Will material be generated elsewhere?"

Yes, but it will be integrated into their lesson plans so that they will have a lesson plan for the period or whatever. What they will do as part of that is they will have access to those materials as part of it. So the actual teaching itself may be taken over by the computer packs but all of the work associated around them, the checking, the marking, the management of the students and all of the explanations, that is all still there. It might affect 30% of their class time that is all.

"Do we have any control of technology?"

I think parents believe that the stuff ought to be there. I believe that parents really believe that they have done it themselves, at home.

"Is there a sense that it is all inevitable? "

No I don't, because I think it is seen as a bit of a competitive advantage. Independent schools who are pushing their children who have paid a lot of money to provide a better quality of education are pushing it as a competitive advantage to give, that's one thing you get if you go to this school that you don't get if you go to a state school or a Catholic school or whatever, so I think it's pushed as a competitive advantage so that the student that comes out the end has skills that you don't get if you go to another school.

"Schooling become inhuman?"

I don't think it has to become, because I think it is only going to be 30% of the classroom time of some subjects and because of the amount of teaching time, of particular time, that a child spends at school, then it will probably not do what you are saying.

They used to go and watch television programs on science and things like that, instead of doing that they will be doing interactive work which is more active rather than a passive environment, therefore, they should get more out of it.

No, I don't see that it should because of the total, I don't know how many lessons of maths you do in a week in a primary school, 3 hours a week out of all the time spent in school.

I think it will be dictated to some degree by the companies that are prepared to put money into the software development that you buy with the hardware. So that people will buy a MacIntosh because the software you can buy with the MacIntosh is the best you can buy. We, interestingly, had a debate at home last night when my 14 year old daughter decided she wanted a MacIntosh because of the software and my wife is a school teacher also believes that the MacIntosh is great. I am saying why don't we get an IBM compatible and you know what the answer will be - we will probably end up with both.

The MacIntosh will be favoured because it has better educational hardware. Things like the BBC and things like that will go, they are not good enough it's just too hard for them, it's too big a commitment to software development.

"Schools reshaped?"

Yes, but not for the reasons of technology, I don't think. I think the reasons it will be reshaped is because of the economy. There is a need to get economies of scale in teaching, and to do that, some of the schools in the western districts area, I know of some examples of where schools are down to 68 students in a primary school and they

close them down, or down to 150, and they are getting marginal. The problem is the geographic spread of students and the demographics of the student population from 20 years ago.

There is a program to put second language into early primary school within 3 or 4 years and they are working their way through that, and it's hard for some schools because you pick Spanish and everyone says why pick Spanish in this school, but it has to feed into perhaps the secondary school which teaches Spanish. So you have a feeder system working. I think they need to do that with computing and I think that will only come if it's driven from the top down. If an education department policy said there will be a second language taught in every school, there should be computing but the problem with computing is it is only a tool; it should be part of the curriculum of a number of subjects not a subject in its own right. That's where the difficulty will come because you can say we are going to have a second language and everyone says the 3 languages are going to be Japanese, Chinese and Spanish and now you work out which one it's going to be, it's easy, it's simple, it's little boxes but computing is not little boxes, you can make its keyboard and information systems into little boxes, but when it should be integrated into the interactive learning processes you can't put it into little boxes, and that's why it's difficult but that is why it needs to come from the top down.

I don't think we have spoken about whether industry expects computer literacy when they start. A large number of our positions these days expect Word Perfect or a basic word processing system understanding. A large number of our clerical positions are becoming almost mandatory to have some sort of spread sheet, understanding or something like that. I do not see it happening in the schools that, that actually being taught unless you do some specific subject and get the use of a calculator, the use of a spread sheet is not much different. So, I see that maybe they are the trends that will

appear and with the SACS program in looking at business pathways. When we start looking at people we may be looking more at people who have done those things so that we don't have to do them here. Not that training is that expensive in those things. You have self learning programs or we can send them off to training programs.

But there are some fundamentals that people are starting to say, that "everyone uses word processing packages, don't they", - "everyone uses a spread sheet, don't they". So we are finding that those are the things which should be taught in the high schools.

I have a philosophy at the moment, when people say we have big unemployment etc, I believe that a lot of people in year 12 in retention which has gone from 45% to 75%-80% are there because there is no work.

People believe, at the moment, that by having more skilling, right, and putting people through TAFE and all these sorts of things, this will solve the problem. It will not at all because all this will do is keep people in education for another 2 or 3 years, at the end of that they will come up with even greater expectations than before and there still won't be any work for them.

The government is not tackling the problem of creating jobs. What it is doing is educating; what it is saying is we need a more skilled society. That is actually being pushed to a large degree by people like Carmichael with the Carmichael report. Now why are they doing that? The unions are using the question of training in order to get changes to the award in order to get more money on the way through. So, I think there are an enormous number of very skilled people out there at the moment who we would love to have working in this business and in many other businesses. We have people who are working with degrees as shop assistants, the education level is there. The

problem is more the fact that we are not creating the basic first level work for these people.

Retail is a sun rise industry. It is where you first go. People say to me, "I am working in retail until I can get a real job". They don't regard retailing as a real job. It is where you work when you go to Uni, you get work part time at MacDonaldis or Hungry Jacks until you get a real job. An you work in retail until you get a real job. Retailing itself is very well paid in a lot of the positions. We have hundreds of positions which are well paid, but you get this problem that the extra skilling, and what you are talking about is important, but really it is not that important. If we find the right person we will put the money in to train them.

When people finish their apprenticeships and start a business as a sales rep, or whatever, that's where all the new business comes from.

That's the whole debate when you get into the Meyer report and the Carmichael Report, and all of this they are concentrating on competency and national standards, but to me it's all a large smoke screen. I have been deeply involved in it through SAAS and Industry Training Committees and I wonder whether it is a political smoke screen to get Keating elected and then after that what happens because it isn't job creating?

If you can get out at the end of TAFE and you can go and start up your own business that you created, that's what we are after.

"Will teachers lose control of the curriculum if computing is widely used?"

Never thought that teachers would lose control because they never had any.

"Who do you believe most promoted computers in education?"

Media? Irrelevant

Government? Did not really have any push

Employers? Did not have any push

Educational departments? Did not have great degree of say

Parents? Did

Computer companies? Very little

Teachers? Yes

Unions? No

INTERVIEW SIX

POSITION: DIRECTOR OF PLANNING (Corporate Planning Manager)
COMPANY: SAGASCO
DESCRIPTION: Planning Manager to a large service organisation

TECHNOLOGICAL FUTURE

"What images do you hold about the future of society and technology in which schools must operate?"

I can see, I think, we will have to have a new social charter - before anything can really happen. The reason why I say that is because we haven't got a very good charter.

Technology will be a very damaging thing. We are already starting to see that, I believe, now with award restructuring, with work practice changes, micro economic reforms. The only fall back to where we are starting is to get to the stage where we are employing technologies, changing the way people work. Our own company is a good example in that we are employing new technology now and in corporate planning we have got computing being used in our training, even in our development of people, we have got computing being used in our offices, computing being used in our vehicles - we have got fax machines now in our vehicles which are almost being superseded by computers which will link directly with the company for dispatch and ordering of parts and that sort of thing.

Now what is happening accompanying that, in 1992, is the downsizing of the organisation which is the thing people have been talking about, that you have tighter, leaner organisations. You have organisations which rely heavily upon technology with some operators who do things to bring it all together. You have some operators who are very well trained that can make decisions on the shop floor. They are supported by

a group of managers who are making sure that the road blocks are out of the way so they can keep going on their jobs, so the whole role of management is changing now. Instead of management doing a lot of things management are just trained to develop people and clear the roads and let people through. That's all happening now with the result that the organisation has gone from about a 1,000 to about 850 in 6 months.

That's all part of it, now what people were saying 5, 6, 10 years ago, is that people will have less work time and more leisure time. Now that's great if you have a job you can have a bit more leisure as long as you can afford to have the leisure. Great, if you can afford to have a semi retirement from work and have a bit more play, that's great. If you have money to do it.

What's generally happening and you read it in the papers the other day, people are still clamouring for a 40 hour week. Those people who still have got jobs are hanging on to them like hell and they are watching and demanding more money and even before work practice changes occurred people are saying, "I want 5% before I start, 2% for the next 6 months, 2% the following 6 months" and so on, as the changes occur we'll evaluate and if there is anything outstanding then we will get a bonus on top of it, kind of thing. So people who have jobs are asking for more money and the management are saying that we cannot deal with part time employment very successfully because we have not got contra built in and those kinds of things. So you have your leisure class; they are called the unemployed, they go to the CES and pick up their money. So we haven't got the social contract in place at the moment which will deal with technology and the new features we are trying to develop at the moment. We have to become globally competitive. We're talking about that and we're doing that through our micro economics reform, and I do believe that within 10 years we will be extremely competitive nationally. I do believe that unless we have a social contract we are going to have a hell of a lot

unemployed people and we are going to have a hell of a lot of unrest, so I guess, we had better sit down and talk it out - how we have everybody in Australia happy in a sense of having a standard of living which is acceptable to all.

Instead of having a high standard for those working and the rest just hang on, and we use them as we need to when the economics are good and put them away when the economics are bad. So we are going from a time where we have had high human involvement in industry to a time when we have high tech involvement in industry with such pretty clever people - but if we don't be careful, we are going to have such a whole group of people with nothing to do. We are starting to see the results of that now with high crime rate, social problems, depression, drug taking and that sort of thing. Now, the society I would not like is the sort of society that we could see in 10 years if we are not careful.

"And for those people who have jobs?"

Fantastic jobs, very fulfilling, very challenging jobs within the global competition.

"And the timeframes for work, are you saying that we need to reconsider how much time we spend in work?"

I think we need to have a balance, where we've got all people making a contribution to society, but that's a basic philosophy that I have got, and to do that we have to look at the way in which people work, the way in which people contribute, for instance, women have traditionally stayed home and men have gone to work. Women stayed home up until 25 years ago, now we have got quite a few families where 2 people work, mother and father and a lot of people are only going to work because they get paid for that sort of work and they do not get paid for staying home. Now we have to start thinking about those sorts of contributions to society and how we can reward people for them.

With technology, there are a lot of things people can do at home and feed into work.

"How will the level of technology affect those sort of things?"

There are a lot of things in the Gas Company that we thought of 10 years ago, we couldn't do, we just did not have the technology and now that we have got your satellite links, your microwave links and that sort of thing - so accountants could operate from home and be the accountant for 10-15 small businesses, and at the moment they live in an office - my accountant, for instance, has an office at Port Adelaide and a home at McLaren Vale, now there is no reason why he could not operate from his home and still work his grapes and have a balanced life. So, and that example could spread right across where people work at home, for instance, organising and accounting things for the school and they spend 2 or 3 days down at the school.

I think we have to get the balance between working at home and working with your clients. A lot of people have left me with the impression that they would hide themselves behind the computer screen and you would never ever see them again, all you would get is messages, a bit like Jumping Jack Flash. I think you will find that it will happen initially, then people will start to say, "lets do what we're doing now, face to face and having a talk". Because, either he types something up on your screen and it comes through on my screen and I answer your message and send it back. To meet, work and live are social things primarily.

"So even if you have technology, people want more than that?"

Yes, because I believe the key to the whole thing of work and life is a social interaction - it is virtually, work is designed to keep us alive, to keep us all going and enable us to have a life style which we like, there is no other reason to work and people who tend to look at work with a sense of business and getting things done, and social interaction as

something separate, they have forgotten what the plot is all about - so you have to really get that balance.

I think, even in here - we have got in our organisation some people who think that business and social interaction are two separate things and we have found that people put together and talking together and having lots of time together are more productive than people sitting behind a machine sending messages to each other. So, screen heights and partitions between people of no more than 1.2m high so that people can see each other and things of that nature and talk to each other. Within the work groups the screens are kept very low.

"What about the question of leisure. Will people be using more and more technology?"

Yes and No. I must admit that I am a fairly simple person when it comes to life and leisure and all those sorts of things, I like bush walking and that sort of thing. Technology will come about as I have found out just in the last week or so, just finding out where the novelties and the unique things are. I have done that by looking at television on trips to have and looked through data banks and things to find out places to go, and I think, that gives you lots of opportunities if you have got the money. If you're one of those unemployed people I was talking about, you can't have it anyway.

"You're saying that technology can give you access to the sort of information of things you can do?"

Providing, one; that you have got the means and the sort of technology to link it up on, and two; if you're lucky enough to get access to the money to do what you want to do and if you haven't got a job then you will not have that sort of money. We come back to that balance of a work life and a leisure life and not just having a lot of people working with little leisure life and having people with leisure life and no work.

"What about concerns about privacy?"

Yes, I have problems with this. I have a mail box and I will go there and I will find 10 letters there, 6 of them from people I have never known before in my life. Where they have got my address from I have no idea and I would like to find out. I would suspect that they have got them from a computer mailing list.

Personally, I believe the selling of mailing lists should be made illegal. The same thing happens with credit arrangements I believe, I think far too many people have got too much information on people.

You must be given the chance to check information too because I happened to find out some information about myself when I went to get a Visa credit extension for the latest overseas trip I made. Whilst the information was given to me wasn't all that bad, but somebody said, "I noticed that you have got so and so" and I said, "I have never had anything like that before" and they said, "it is on your credit reference". So I had a look at it and checked back on it from the company who gave it to them, they said it came from somewhere else. I checked it back to the source and found that it was somebody else.

It wasn't all that bad but it could have been monstrous.

I think that we have to be very careful about those sorts of things.

"How much control do we have over the technology?"

Or how much control we have over it ourselves? I think it is just going to happen, I don't think we have any control.

I think the Pay television on 57 channels are going to come to Australia because somebody out there thinks that quantity is great and I think that what we should be thinking about is quality.

Personally, it would not matter to me if we had only 2 channels in Australia as long as we've got some dam good stuff. I, personally, very rarely watch commercial channels. I think that the quality of the productions on Channel 2 for instance, are far in excess of that offered by the commercial channels, so I am a firm believer in quality productions and I do fear that we have lost control as individuals over what is being done in the community.

"Do you believe that cults will emerge based on computer technology?"

I think that is a bit - oh, I think it would be - we have got people here who we have to say "turn that bloody thing off and go home". I don't know that they are coming straight out and saying "I worship this computer" but their behaviour starts to look that way and some people do simple things with a calculator for instance and think that you or I could do it in our heads. Take columns of figures or layers of figures in a column and come up with an answer. I have seen people come up with an answer for how much 6 lots of paper on a bench because they cannot add up. There are little things like that which is inefficient to use a machine when it's likely you will put your fingers on the wrong button.

COMPUTERS AND EDUCATION

"What about relationships?"

Yep! This is an interesting area because I have said about social contract, that education is a mixture of content and methodology. Content is the hard factual stuff which comes through and it's either learnt or not learnt and people at the senior

secondary assessment board spent a lot of time looking at the content of what they put into education and frameworks and all this kind of stuff and I said to them for years when I was on the Board that we have to also look at the teaching methodology as students learn as much from the methodology and the behaviour patterning of the teacher and the interaction with the teacher is as important if not more important than the actual content of the course.

Contents could be anything, there are 101 ways to teach a principle of mathematics but the way the actual teacher puts it across is the important thing even with computers going into schools, I think it is great - er because it allows students to work at their own pace. I think it helps students come to grips with the computer itself so that they become computer literate - and they then work computers and when they come to work we can teach them specific things that we want them to be taught - I would like to have every child at school to be able to type and type to the Australian standards. I would like every child at school handle a spread sheet. I would like every child to be able to use a graphics package of some sort so that they can write words, they can do numbers and they can draw pictures with computers, and I think, if they can learn that, that almost sets the path. You don't need a lot of packages to do that. I don't think, you need to get more specialised at this stage because I think that's where TAFE comes in and business such as ourselves take those basics and you might toss in a bit of 'D' base as well.

I don't think you need any whiz bang computers to teach people that sort of stuff so you can virtually get any of the cheapest technology to do that sort of thing. The problem I see for schools is they're buying up at schools and colleges and universities. They are buying up their computers at this stage. I hope they are coming to grips with the asset they have got, the fact that it will have to be turned over fairly regularly - as I would hate

to see a situation where they are trying to teach kids to be the people, perhaps 10 or 15 years out, they are using a product which is less than what is being used in business at the time. They ideally need to have equipment 10 or 15 years out in time but they cannot have that, but at least they must have something relatively modern; it's no use trying to teach computing on an old typewriter - you cannot do it, so, I personally, believe that students should have access to it. I also believe that in SA we should also have 1, 2 or 3 very very good TAFE Colleges who concentrate on real high level computing, a polytechnic type group who are churning out the people who can go straight into industry and do the high level thinking that is required and, thirdly, in a business like ours which teaches specifically to a job description or to a package of jobs, and so you would have that hierarchy. A very basic broad education type secondary and primary school doing things like words, numbers and pictures and even play some games on them, educational games.

Then, go to your post secondary education where you start to home in on generic - but have in things which are a higher level and then you get to the specifics when you're out to the universities etc, and latch on to those there and there is no reason why there can't be kids going to the different levels of the school situation and going out and seeing something of industry and so, you get your linkages with industry and your linkages with the colleges even while they are still in secondary or primary school.

"Do you think if schools have all this technology it is going to enhance their learning ability?"

I think it will speed up their processing of the learning process and I think it will allow them to apply more information and knowledge, and it will allow them, hopefully, to have better relationships with their teachers - which brings in that social thing again.

The first will happen without the second happening and there should be times when they get away from their computers and relate to their teachers, talk to them. I think it will give the teachers more time to come back to their students and say, "look, you've got a blockage, let's sit down and talk about it", and relationships will develop that way.

"What makes you think teachers will have the time?"

Computers are faster - it's the self paced learning concept. For instance in our place here we've got people going through customer service type systems, how you actually work your computer to answer telephone calls for a consumer or face to face things. Used to take us weeks and weeks to train people, now it takes us a day. They go through their modules and they will go screaming through their modules to a point where they will need someone, they'll say, "hey, I need you over here" and they will talk to their supervisor or trainer and the relationship will develop on a one-to-one basis talking through things and then they will go on and go racing ahead and they might have 5 or 6 contacts during their 10 modules. Where as before, it was heavily into classroom teaching and all that sort of thing and you would have to go back through things and then you would be dragging your feet because you have to pitch the class at the slowest person in the class and all that sort of stuff. So, we've seen that we can get people to go through 10 modules without any reference to a supervisor, other than, "how are you going" and "everything is going OK". They have answered all the questions which have been set into that module, have been passed and they can go onto the next module as a result of that. So that's working quite well. People that do get into strife and keep coming up to a gate because the competency is not there, or it's forcing the relationships, the supervisors then has got time to talk to that person and let the person who is going well to keep going.

"What about the notion that computers are highly motivational?"

I do not think that computers are highly motivational themselves but the person on them might be motivated by using them and getting answers out. I've had computers and engineers working for me for the last 5 to 6 years and they get the answers quicker and I know people are getting the answers to things, so the computers and the higher level of technology we are getting are providing them with the sorts of results quickly that reinforce the desire to go and get more information. So what the problem I am having is that one of them in particular is getting information almost for the sake of getting information and my role as a manager is to say to him, "you know get away from your machine and let's go and use a white board or some butcher paper and work out where in the hell we're going". And quite often, we use technology to do that - with our top 10 people we take them away on 4 occasions over the last 4 years and we've used technology to get out of their heads into the computer all the ideas they have got and then we have shunted them around in the computer and we've come out with priorities, we've come out with directions about which way we should go - we've come out with lists of things which normally talking to people or putting on butcher paper get lost somewhere, but when you can actually put them into a screen and get them to rate each of them in importance, then you can start getting cross-pair analysis to get your priorities, to get your ratings, if you want. There's some magic stuff coming out about that.

"Do you think computing will increase people's creativity?"

Sh.. - I don't think it does actually - I think it is just a tool to I think I have answered that actually - It gives them the chance to get results back quickly and be rewarded for the work they have put in and that brings forth the desire to get more gain. But I think those sorts of people would be the sort of people who are creative anyway, all the computer does is allow this.

As I said earlier to you, I think, before, a computer is only a tool, it is the same as a shovel or a scythe or a motor car, it just allows you to do things a little bit quicker than it would be possible without them.

Looking at the arts and reflecting on that, I don't know whether computers would help an artist to become more creative in their painting. Graphic designers - my daughter is a graphic designer and does some wonderful work by hand, does wonderful work by computers now and it is allowing her to churn stuff a lot quicker and she is using graphic packages now to play with, and it is giving her a medium and she can actually get things on the screen that would have been difficult to get on to paper - I am thinking of things like holograms and those sort of things, so these things that were in her mind and actually created - the computer has only allowed her to put the creation out - but the creativity was already there.

"What about the gender affects?"

The computer is sexless, ha, ha, when you think about it. When I first came to the Gas Company about 30 years ago, all the secretaries were males using typewriters and the females took over the secretarial role and we took all the males out. There's not one male secretary now although we have two male receptionists come in and that's a job change because gender use and pay rates are the sane. I've found computing no different between the sexes.

"Do you think computers will help with people's career needs?"

There was a report for Greg Crafter back in 1989. One of the recommendations which was put forward and picked up was that the Education Department create a data base of opportunities for kids showing the linkages between schools and school and industry links and tying the whole data base down. So that kids could key in, kids could even

get on the phone at night time and using their own computer at home and get the information and plan out career paths. Greg Crafter, I applaud him for the fact that he went ahead with that and kids are getting a dam good deal out of that. That does not mean it cannot go a lot further. I think we need to spend a lot more money on making sure that it is available and I think at the same time we've got the social contract again and we have to back that up. When I was in Germany they had vocational counsellors for every 400 kids. We've got to start thinking pretty seriously about that sort of thing and they actually get contracts for the kids in work.

"It is interesting to have you say that because TAFE in its restructuring was trying to get rid of its vocational counsellors"

I think they are more important than some of the lecturers. Ha, ha. If the shareholding breaks up and the Gas Company goes I'll be looking for a job Ha, ha!

"Do you think computing lends itself more to some subjects than to other?"

Yeh! Well at the moment it does but I think in the future it will be just an extension of the typewriter and the calculator and now it extends to your graphic design. You have got your CADD/CAM drawing stuff and all that sort of stuff.

"Do you think we will get to a redundancy of current knowledge?"

I don't think that is going to change very much. Certainly, when I was on the SABSA Board they kept on adding subjects to the subject list. When I went there there was about 60 and when I left there was about 180 - but I kept on saying, "Surely there are some redundant subjects now that we should be taking off. We should be looking clearer". I looked on SABSA as a bit like a filing cabinet you have stuff coming in asking for a new filing cabinet, you say, "we'll go back and check your own resources and clean up and see what happens", and they come back and only use 2 drawers in a

3 drawer filing cabinet. So, I think we have to clean out the old and bring in the new. I don't think we should toss out the old simply because it's old and toss the baby out with the bath water. I don't know that computing is going to have that much influence on that sort of principle. Where computing will come in is where I think we can do a lot of cataloguing and stuff where you can very quickly go through it and analyse what is throw-out-able. For example, we have my secretary each month giving me a list of files which I have actually got a note on the bottom, which says 'which do you want to delete' and I go through them and say "Those letters there can go, those reports have a result, now they go".

"What about equity issues. Will some kids have access to the latest technology?"

No, it's going to happen. It happens when people leave school, for instance, my daughter is struggling to get a computer at the moment and she has friends who have parents who are fairly well off and give their children everything that they want. They have the latest Apple MacIntosh and the latest software and it is very difficult for parents. It is a philosophical point of view. First of all, if you have the capacity to give them all they want but you have the philosophical point of view you won't give it to them but if you have a philosophical point of view but you don't have the money to give to them, I think this is just a reality of life that some people are better off than others. What the government's role is, is to try to redistribute wealth so that they get an opportunity.

I spent 10 years living in a commune and we got a lot of things in our life simply by pooling resources so that you might have 10 or 15 pieces of technology, whether it was a lawn mower or a car or whatever, but by pooling all your resources and coming to some agreement you have some chance of getting at least one or two, and if you can centrally locate them and that's very important to kids - access to them, for instance, it's

not too good, for instance, if you live at Morphett Vale or Noarlunga. You've got to make sure they have physical access to them as well as the financial access.

"Will the technology enhance the efficiency and effectiveness of schools?"

Yes to both questions. Yes, it will affect them, they can't get away from it. Yes, it has the opportunity to make them more effective. There is a third point to this. I believe that the principals will be more efficient.

My view, looking out 20 or 30 years ahead, is that schools will still have the same organisation.

I said to you before that buildings are becoming less relevant. The sort of developments that are occurring now where you utilise any resources you can to advance the learning process is good. We are starting to get that way with school/industry links, the closer we can lock in education to life the more motivated kids will be to learn.

One of the criticisms is that teachers have things to teach and the systematics have lost touch with the relationships with what people are doing, or will be doing, and they kind of get bored stiff and are not motivated towards the future aspirations that they had, and if you can lock that future aspiration into the learning process they have a reason for doing things, the motivation just churns its way and the creativity does as well. Having got that sort of learning model in mind, buildings don't make very much sense necessarily as long as you have got somewhere to keep the rain off your head, or even out in a paddock with rain falling on your head, in certain circumstances. So you then come to the question of whether there will be a need for a social interaction as part of the learning education process or whether it can all be done on computers, but I do believe that the social interaction in the learning process will augment learning.

Computers will play a very important role in that the process will involve a lot more than the teacher/pupils that we've got now and the process could involve people from industry and commerce, and could involve people from leisure pursuits working out with PE. You might get some football teams helping kids, and things of that nature, and there would be a whole lot more socialisation of the education system using computing as a medium to make things work, and allowing for flexibility you will probably find that the hours that we are locked in to at the moment with secondary education and primary education, for instance, could be blown out of the window. We could have kids doing things at 6.00am, and/or at 9pm, if it's appropriate - and I think you will find that the barefoot teacher and the boundary rider type concept will be in where a teacher will have a group of people and act as a mentor for that group. The beauty of that is that I reckon that we have a pretty good primary education system in the sense that one person is the mentor for a group of people and takes them for all subjects. It's OK when they get up to Grade 7 after that things get a bit specific and perhaps beyond the generalised ability, but you still could have the concept of the primary class contained if specialist information came through on a medium such as the computer is, and you could call in experts to answer questions where the person failed competency based type tests, or a module could be unlocked because they were not ready yet to go ahead in some sort of assessment process, may not be a competency based test, that will allow them to unlock the door to the next module.

Now, the group's mentor might be the person that unlocks that door for them by discussion or talk. The group's mentor could bring the whole group together to discuss little Joey's problem - have your social interaction, and have your social development start, so you could have a team helping another member of the team to unlock the door. You could have specialists come in who actually designed the module or knows about the module enough, has been trained by the designer, might come in and talk to the

individual or the groups about unlocking the door. So, I see this in human terms being an explosion of potential, and I am not too worried about Greg Crafter's problem with the school buildings, quite frankly. I think that they will all last long enough to see out the old way, and by the time he comes to finish his repairs on all of them, I think you might find they are not what we wanted anyhow. So, I would not worry about repairing too much. There is quite a possibility that we might bulldoze and put houses in there and utilise some other form.

"You mean like houses linked together?"

Yes, or a shopping centre or things, so that when the kids move out of the area they can be used for other sorts of things. So those sort of things I can see it happening and I think computing is going to be a very important part of that linkage, but it doesn't take away from the fact that we have to get the social, and social not in the sense of having a party, but the social interaction going as well. There has to be some modelling of how we deliver the education process because the one to a group that we have at the moment, and in the case of secondary education one to a single group or to a changing one, it's most unsettling. In our company we are in the process of bringing in mentors for graduates and apprentices. We are trying to tie graduates to mentors now, and have that mentor follow that young person through. The young person can change their mentor, it's a voluntary sort of a set up we are putting in to link in with mentors at different stages of development. For instance, people come through us in the corporate planning area here, I have a certain style and I have a certain message to give about the way the Gas Company is going and they might want to be exposed to a different style of mentor, different style of manager and take in some other areas of knowledge, for instance, in an accounting area, an engineering area, or a human resource area, or a computing area - that way we not only run into the detail and the content, but they get different delivery as well.

"How will the teacher's role change - What will they be doing differently?"

The teachers role is changing! There are far too many teachers these days out there who tend to teach the same stuff, year in year out, and they are still out there, I know; my wife is a teacher. She virtually has an oriented approach to her teaching, she has a basic core of information, stuff that she wants to get across and pathways which she wants kids to experience and learn from them, to develop their thinking, and what have you. But a lot of the stuff that she does is in reaction to the stimulus that she gets each year, so she personalises it, and a lot of teachers don't do that still, and I think that content versus methodology coming out again. I was horrified the other evening to hear of a teacher, this particular male said, "I have not changed my lesson plans in the last 10 years". I said, "that's interesting, the needs of children have changed in the last 10 years". He said, "No they haven't", and that horrified me a bit, even things like the economic situations are different now, so I was horrified to hear that.

"If a lot of content is now stored on computers what happens to those people who are so content focussed?"

I guess they will be the ones which fall by the wayside.

I think you will find a lot of things, like discipline problems, are related to those teachers who are content oriented. Teachers who are open to the student and create that environment where the students can learn and have control over their education, probably more in their latter years than their former years, I think there is some control over their former years but as they get later on in life, and I'm talking now about adult education and that ongoing life, I think we should be teaching people how to learn. I think we should be encouraging them to do it themselves with the teacher acting as a mentor and I keep hammering that word, but I think it is very important and I think that it is very important that Australia looks very seriously at the German Mister System which

is pretty well for apprentices but there is no reason why that cannot be based on any level of entrant, or organisation, or whatever, so that I think teachers are going to have to come to grips with the fact that they are not the king pin in the classroom; the student is. I'm happy to say that a lot of teachers are doing that and unhappy to say that the education systems, all of them, are not helping teachers enough, in servicing teachers enough, to actually take time out to sit down and study those areas of methodology and how one changes from being content person to being a methodology person and assisting a self learning group. There's not enough money being poured into that. I think the money will come from the use of technology and things of that nature, because as you speed up processes and you get people learning through mediums like the computer you'll have perhaps greater class sizes than you have now and as I have already said, that you will link it with some sort of motivational force, like where the people are heading. You will be able to have greater class sizes so you will be able to have some of your teachers spare to actually go through the relearning process and recycle them, and put them back in and take the one in there back out, and if you work that with your intake of teachers and your natural attrition, and that sort of stuff, I think that over the next 25 years you will get the quality you are after. So, I can see that process happening and I think that one of the major problems we are having now with things like I read in the paper the other day about bosses slam education and that sort of thing is that the people, people in general in the community, have not got the sort of wide picture of the process that is happening and I think our politicians, some of them have and some of them haven't, and I think if they have got it, I think they should start talking about; this bigger picture to give people a framework to work with. One of the things which has been said quite often is that we have no leadership in Australia, worldwide, and what people are losing the fact of is this vision of the future. If we can start explaining to people what is the vision we can get them involved in building the vision, then we can start getting people to be owners of that vision and participate in the

process. I think we will have a lot less sniping and griping and people will say, "OK I can see things will get better but it's a step backwards from where we want to be, and this and this and we will have to put up with pain for the next 5 years to get something in place so that we can go on". Then they have got control over their destiny.

I think that's what we are doing in our organisation. We get that process up in the Gas Company here and in 3 years we doubled the size of the Company and in the next 5 years we hope to double it again in the sense of market value and everything else.

We have done that simply by getting away from the old methodology of just saying, over the last 10 years we have had this sort of trend in the graph and we will accept it, a nice geometric curve there, of say, 5% increase per year and a couple of points over CPI. We have been quite happy with this sort of approach up until 3 or 4 years ago when we said to ourselves, "what we have to do is stop at this point of time and be happy with what we have been in the past because it's been good but let's set ourselves a target which is considerably above the normal sort of graph and then we look back from that target and develop strategies to get us to that target". We are now doing that, and hence we have doubled the size of the Company in 3 years and the Company has been going for 130 years, and we are going to double it again in the next 5 or so, and it's simply because we've had vision, and we've had a target, and we've had a strategy, those 3 things. So, education I don't think is any different, they are not orphans and if we can set the whole thing up in that context - I think it is great that the Education Department has a 3 year plan. What I would like to see them come out with is a 25 year vision.

CONTROL OF TECHNOLOGY IN EDUCATION

"Do you think that most people have made a conscience decision about where we are heading and about using computers in education?"

I think it is just happening at the moment. I think, because of the cost of the thing involved, it's going to have to make people plan ahead and given that there are limited resources, I think that that will be an economic forcing of control.

The other thing is that looking at the social side of things the social scientist's view of education using those type of things is proceeding, and as the studies and things are done and the scientific papers are written, I think we will probably find that will have an affect on them as well as use of them in certain areas, and kill them off completely in other areas. For instance, we have in the Gas Company an example of that which was that the cost of training was too high and that was one of the reasons why we went to computers and the other thing was that we read some papers on computer base training and competency based training and self paced learning, and those 3 things tied up with the economic argument works out a pretty good cost benefit result and we have tried out and we are going ahead leaps and bounds.

The other thing which is important too is that with our information processing people, our computing people, and this is an economical thing as well, we bring every situation in which there is going to be some work done and it should be examined from a point of view, should we do it ourselves and develop it ourselves or should we be buying packages because there are so many packages these days, our training people, like TAFE, tried to do it themselves and we were getting ourselves into a hell of a pickle with dollars, they were low quality high cost products and we have now found that there are packages from all over the world suitable.

"Is it all inevitable?"

There is in society a certain inevitableness about it, because there is loss of control of the way things are happening, and let's face it, governments are very close together whether they're government or opposition there is very little difference between them in these sorts of things.

"Will computers constrain the way teachers teach?"

Teachers in the system have a fair degree of flexibility about the way they teach and the good ones are developing good stuff. For instance, I'll give you an example, Terry Stair of Morphett Vale Primary School, when my kids were there, now you are talking about team teaching and a classroom teacher, and he used to take the kids out and study aerodynamics and things like that out on the oval and he was teaching them stuff which was about 4th year high school and they were using gliders and kites and things of that nature and he would take them to the airport for a visit, come back and translate it all into mathematics and english and various other things; various other core subject material which the kids took up and ran with and thought that it was very exciting. Some good stuff came out of that school.

"What about Unions, do you think that they have any influence?"

Yes, they have to some extent - there are some positive pockets in the Union, just as there are in companies. But just as there are in companies there are a hell of a lot of reactionaries around the place and those reactionaries, especially some of the Teachers Unions, I believe, are wanting to stay and what they consider to be rights and they are stopping a lot of the work place reforms and things. I think it is probably out of fear. It is also this mentality that we are representing the people and let's face it if people are scared and want to keep what they have got and not looking towards the future and

there are a few creative people who get outvoted every time it goes to a meeting, I do not think we are doing ourselves any favours.

That's why I go back to this painting a vision. We have to get a few more painters around the place to promote it otherwise the reactionary side of things is going to slow things up all the time.

FUTURE OF SCHOOLING AND COMPUTING

"How do you believe that computing will effect the future of schooling?"

Do any of the following descriptions meet your image?

A place which conducts lessons as at present but which uses increasing amounts of computer technology for learning.

A place from where students' progress is managed, records kept and advice given but with much of the learning occurring out of the school in houses, libraries and other public institutions.

A place where students spend time on individual study programs monitored and recorded by computer.

A private company which manages computer learning programs for individuals for a fee in their homes or in small learning centres.

A place where students gather for group and social activities but specific knowledge is gained personally using computer technology.

A place which becomes irrelevant as technology removes the need for separate institutional education and replaces it with centralised data banks of learning material which can be used as required throughout life.

None of those described.

I don't think that any of them are right. I think that schools need radical change but I don't think that closing it all down and starting again is the way to go. I think we have to go from A to B with an educative process and I think we have to take people with us and when I say we I mean those people who have the picture of the future where we are heading; we have to take people who have it with us. We have to encourage them to have that same vision or a vision, and let's face it, they can change our vision once they get talking, so those sorts of mediums have to be set up for discussions and we have to take the people from where they are now, we have to take them in the new directions of where we are going and where we are going is not in concrete, it's a hazy thing, but there are some walls up but we got a fair idea of the parameters we are walking within, but we are heading towards something we are not sure what it will be but we got this hazy picture of where we are heading.

We have a fair indication that it is the right way to go at this stage and we have to get to move as a group through that process and we have to go to it for a couple of reasons, I think. Number one; is if we don't we will have to drag people through screaming and it's going to be a hell of a problem. You are going to get through to the end and they are going to say, "We did not want this anyway". So you can have your argument where ever you want, I prefer to have it up front, and argue my steps on the way through. The beauty of doing it that way, and this is the second point, having gone through and gained consensus on the way through, there is this great addition, you have ownership on the way through so I don't think revolutions work, I think evolutionary processes will work. I think evolutionary process can be speeded up if we have a very clear vision of what we want and we may have to have some mechanism for people to have, to actually put in place that vision.

I think things like the 20/20 Vision document and the Arthur D Little stuff we have got out is good, the sort of stuff we are doing in the Gas Company about where we want to be in 20 years time is good stuff. All of our people, you ask them where we are going and they can tell you, and they have all had a chance to have input into that. Now, that is all pretty powerful sort of stuff and that is starting to spread all across Australia and the world now and I personally think that is the way to go and I think you will find that the people in the Eastern Bloc that at the moment are turning one over for the other, they are good at doing that, will come to the conclusion, there was some good stuff in the old and there is some good stuff in the new and perhaps we can forge a new one. But they need a few visionary people to help and pull it all together. Visionary people do not necessarily have the visions they have the powers to actually pull people together to see a vision. So I won't say that when people say that is a visionary person I say, I have not heard them say a vision or speak of a vision, I say you listen to them talk, they do ask people to think about the future, and they do ask people to form opinions about the future and they do bring people together and start saying that you have the same sort of picture as these people and before you know it, you can write it down. So those sorts of visionary facilitators are the sort that need to be developed. I think that part of the educational process is that we should build that sort of thing into the methodologies and content of our schools. We should teach people the process of facilitation, that's another hard process to learn and I encourage people to do that sort of thing all the time and bring things together, so I think things will evolve, and I think technology helps to evolve quicker, I am only worried that the social skills of the facilitation of this thing will not travel as fast. I think we may get different targets if we do not do it properly and get people to talk about it, if we do not do that, we will muddle along and end up in some back water.

INTERVIEW SEVEN

COMPANY: ROH PTY LTD

POSITION: PERSONNEL MANAGER, Employer Rep, Manufacturing

DESCRIPTION: ROH is a medium size manufacturing company specialising in mass produced automotive components for the Australian and overseas markets.

TECHNOLOGICAL FUTURE

"What images to you hold about the future society and technology in which schools will operate?"

I imagine that there will be a lot greater play on audio visual type equipment, in fact, I think that is already happening whether it's just through entertainment and so on, but a lot of the types of computer packages seem to be much more interactive and therefore I think that will flow through into both training and work, but further than that, I do not think I have thought about it very much.

"Do you see us dealing with a lot more technology?"

Yes, absolutely. The question is whether it will be a simplified version rather than what I see as fairly difficult to get into, perhaps it reflects on my own lack of training but when I look at young kids today and the way in which they match up into computers and so on I imagine that it will become the norm rather than the exception which it still is to some extent.

"Do you think people need reasonable levels of skills in this area to work the technology or do you think it is a bit over-rated?"

I think the skills that are needed and are a lot more likely to be needed, are a lot more basic than are generally given credit for, and that is, good keyboard skills and so on,

which is very basic I suppose, but which are not generally trained or taught to people today and most schools are going to have to be first achieved.

At the moment, as I see it, young children, in particular, that go on to computers are self taught, so therefore, they are probably learning many bad habits in the use of effective keyboarding and I think that keyboard skills have to be taught at much the same time as children are first taught to write. Maybe even sooner so they are being efficient rather than the sink or swim approach which I use.

"What if the technology is simpler to use?"

I guess it depends what you are trying to do. I am only marginally computer literate anyway, so perhaps I am not aware enough of the options that are available, but the basic keyboard skills are going to be required, you are still going to have to put in words. Now voice actuation may overcome that, I am not sure.

"What about working from home?"

Personally, I have problems with that, I believe that if organisations are going to develop and maintain an esprit-de-corp if you like, people feel that they are part of the same process, that they understand what other parts of the organisation do. I do not know that it's going to work adequately sitting at home using the keyboard or something, it removes them and isolates them from the work process and one of the things we have found in our company, even now, is from a practical point of view, is that our offices for best effect are physically adjacent to the manufacturing area so that people have an understanding and an ownership of what goes on. As soon as you put them in ivory towers they forget the real reason for why they were employed.

"Do you think that the integration will become even greater?"

Depends on the company I suppose. Certainly, within our organisation that is the objective but lots of organisations are going in different ways and perhaps where you are a service provider or something of that nature maybe it will not be as necessary for all the component parts to be in one site. As manufacturers, I believe it will because people across the workforce are going to become more and more skilled and are going to be using the same technology anyway, so I think that they will be much closer.

"Do you think that technology will greatly change our lives?"

Well, I guess if you reverse it and say what has happened over the last 10 years then I would say in the next 10 years, yes.

I see nothing to suggest that it is going to slow down the growth, the speed of growth or the speed of change.

"Will it happen in the leisure area as well as in work?"

Do you mean that leisure will be technology based?

"Will technology have a greater influence on our leisure?"

I guess it will, because it will open up new avenues for leisure. There will be acts which will be perceived as leisure pursuits which are perhaps not even known about now, so yes, I guess it will.

I tend to have some concerns about the isolation of people using some forms of technology and I think that is not necessarily a good thing so I think we are going to have to work very deliberately to try and have group interactions. As to whether technology will increase leisure time, I doubt it very much.

"There is not a lot of evidence of it so far is there?"

No there is not and I think the so called approach of working smarter not harder is a nonsense because what has happened in other societies that I can see with which we are competing they are working harder and smarter.

"What about privacy is that a concern?"

Yes, absolutely, it's a big problem with trying to get the system interrupted once information is into a system it's very hard to break it, it's stating the obvious anyway, but also when organisations, government organisations in particular, set up processes we seem, even though we may talk to the clerks or whoever, for them to actually break that process once it is in train is exceedingly difficult. I am not sure whether it's a lack of will or a lack of ability to break into the system.

"Do you think people will have much control of what is going on around them?"

I think that is difficult. Individuals are going to be hard pressed to break into it and it's going to take the development, further, of organisations which will look after individuals rights and so on, whether you agree or not with the current organisations. I cannot think of the name of it, the human rights type of organisation? I am just trying to think of the local one which is always bobbing up and down, and I do not think they will just sit back and I think they will gain increased support as individuals see themselves impacted upon. I mean, at the moment they are probably seen in some ways as almost fringe

groups that get carried away with all sorts of fairly sensitive issues. Unless the computing and technologically based information systems are controlled very well you are going to see a lot more people hurt.

"Literature suggests that we will see a lot of computer based cults spring up?"

I had not really thought about it; I can see the logic in it. It's likely, the more I think of it now. There are always cults in one form or another about the environment in which you live. I think about this very simplistically. I suppose you go back to the trade unions and whilst they were originally set up for worker support they were also very cultist about their levels, skill, and so on, in the original craftsman based organisations. So, why couldn't it continue in the same way.

COMPUTERS IN EDUCATION

"Relationships between kids or teachers?"

Well, I alluded to that earlier. I think it is a real concern that you get all these people staring at screens all day. Ok, that is an oversimplification but, I think, particularly in the classroom there is a risk that they will lose the skills of listening to people.

They may very well be able to concentrate on the machine because they have something continuously happening before them but life does not work like that and sometimes you are required to be involved and be able to respond to people who are leading groups or whatever, so I think that is going to be a problem.

I also wonder if there are not going to be kids who, for whatever reason, cannot successfully learn by a computer and are going to be in need of special education in the future, a kid being taught one to one by a teacher as opposed to by a machine.

"Learning Ability?"

I tend to think that people have different ways of learning and some are better in some ways and others better in others, so it will probably broaden the base as long as we do not forget about the other systems.

As to their ability, I suppose you can only use anecdotal evidence as to the effect of television, and the repetition and all those sorts of things, which may improve people's ability to absorb information. Whether it helps with their thinking though is another question.

"Motivation?"

In my experience at the moment, they are motivated because it's something different. When every kid has access to one, and maybe, has their own, or maybe, has a portable or whatever, or a modem at home that they have to plug into them, it may not be so motivating. It will be just the same as when I got my first fountain pen. I thought it was pretty good but after a while it was not any different from a pencil or pen and ink.

"Will computers have a beneficial effect?"

May improve confidence levels. I guess it's a cliché that you do things that you can do well. I would not sit down and draw because I know I am a lousy drawer so I would not even try. Where as, if a kid could go to a screen and do something they would not normally try, I have my doubts about that. If they are going to be creative in one format they are going to be creative in another format. If they are not going to be creative, they are not going to be creative. Does not really matter what you add to it.

It may change the group of people who are creative. It may pick up on some and others will drop by the wayside. Again it's a matter of whether it's a cure all for every one.

"Will technology be detrimental to females?"

If I just think of my own contacts I do not see any big discrepancies in females using technology. I guess, for children it's going to depend on I have a 9 year old son and he is mad keen to get on the computer and I have a 6 year old daughter who would rather play with her dolls. Now, in 3 years times will she be the same? I don't know.

"Would computers help students make better choices?"

As far as this goes it is imperative that all kids get an opportunity to be involved because I think in 10 years time so many jobs will require literacy. Literacy will mean using the computer as much as reading, writing, arithmetic and it will be the function of putting reading, writing and arithmetic on the screen, if you like or whatever, as to tell them more about jobs. I doubt that very much. In the same way reading at the moment, does that tell you more about jobs? Only if you go looking for it.

"Will it lend itself more to one subject than another?"

No. What it does is allows quicker calculations. It allows quicker recall of information and so on, but I think that, if you like, a computer is only an upgraded calculator.

In a Science based employment point of view it may allow a little more efficiency in handling information but from a social science point of view or more literacy occupations, and again it is still retrieval of information, quick editing and all those sorts of things, so I do not see it specifically more one way than another. It may have been promoted more from a science base but I am not sure it is real.

"Redundancy of Knowledge?"

In pure knowledge levels, I guess that is true, but what it will do is conceivably allow for knowledge of systems or how to retrieve information, as opposed to - the population of Australia is 10 million, or whatever it was when I was at school, if they are able to access ABS data or something and pull out the most up to date information then that will be a matter of knowing how the system works, then perhaps there is a benefit to be achieved there if that is focussed upon.

The question that has always concerned me, I suppose, and it goes right back to calculators, is whether or how important the basic knowledge is. Calculation, I mean how important is it that we know how to do a long division as opposed to being able to punch it into a machine and have it do it for you. I do not know the answer to that. I think some where we need the basics but as far as absolute information goes, apart from; I am jumping around here, I got a bit lost. I am more concerned about the basic information I mean . . . well all right that's fine but what does it mean? How do you use that? It's the problem solving process rather than solving the answer, provided we get back to the basics.

"Will equity be a problem?"

I think it already exists and I believe that is probably the biggest problem of all because unless prices fall absolutely dramatically it's going to be a very real issue. The time where a kid who was bright enough and smart enough to fight his way out of the crowd, if you like, either by using libraries or sheer intellectual will, it's going to be much harder if they cannot get their hands on to the technology and I think it's going to be a problem with money put into schools and which schools get priority and how do you standardise, and so on, to offset the kids from private schools and will they get better access or will

the school which is seen as the disadvantaged school in the state system end up with the best system in the state, disadvantaging schools in other parts of the system.

"Will they improve efficiency and effectiveness?"

Maybe the level of efficiency in running of schools. Just on documentation, and those sort of things, I am sure that will gradually improve in the same way as other office systems have improved.

As far as the efficiency of teaching and the effectiveness of teaching then it comes back to what we are trying to achieve and are we really going to get the message across to all kids or are we really just restructuring the groups of kids who are going to benefit out of the education system and those who are going to struggle through all the way. As I said earlier about the special education, well maybe that's going to change the scope of that sort of approach although I am not sure about that effectiveness - doubtful, efficiency - should be.

FUTURE OF SCHOOLING AND COMPUTERS

"How do you believe computing will effect the future of schooling?"

"Do any of the following descriptions meet your image?"

A place which conducts lessons as at present but which uses increasing amounts of computer technology for learning.

A place from where students' progress is managed, records kept and advice given but with much of the learning occurring out of the school in houses, libraries and other public institutions.

A place where students spend time on individual study programs monitored and recorded by computer.

A private company which manages computer learning programs for individuals for a fee in their homes or in small learning centres.

A place where students gather for group and social activities but specific knowledge is gained personally using computer technology.

A place which becomes irrelevant as technology removes the need for separate institutional education and replaces it with centralised data banks of learning material which can be used as required throughout life.

None of those described.

All of the above. I think, in fact, that schools will still be there and that they will be technologically advanced. I do not think our society will allow all training to be handled over to private companies because you get into, what happens if someone is not prepared to expend or what ever, you get the hillbilly scenario.

I think there will certainly be a lot more individual interaction, individual needs based education and I think that has been one of the great weaknesses of the current system in that it has not been able to allow kids to learn at their own rates and encourage them and keep them challenged and so on. So there will be more of that but I think it will still be based on the school structure as people know it today, but maybe a lot more movement between classes or levels or whatever; there will be classes, perhaps, based on age. So, you will have a class base but then people will study at different levels. So I imagine that is how it is going to work, maybe a different sequence.

"Will the role of teachers change to any degree?"

I am not certain. I think teachers are going to have to be more responsible to see that people do not fall off the edge. They are going to have to pick up and highlight those who have problems coping with the system, those who are able to operate within the system will run ahead and you could argue, that should already be the situation anyway. That kids are going to be rescued, I do not believe that is true at the moment, I think that too many get too far through the system without their individual problems being addressed. So, I think it will be more easily highlighted if kids are falling off because of their inability to use technology and I think it will show up more quickly, perhaps, and it will be harder to fake it so teachers are going to have to be able to pick that up and be a bit more remedial.

"I was going to ask you if you thought that their role was becoming more diagnostic than it is at the moment?"

Yes

CONTROL OF TECHNOLOGY IN EDUCATION

"Have people made a choice?"

Largely, it's just happened, I think some people have said, "Oh yes it is necessary," and some have used that as a justification for purchasing home computing equipment. Often, I think, without any idea of what it is really going to do for the education of their children. I think very few people have given very much thought as to what it should do within the education system except to make their kids smarter, whatever that means.

"Inevitable?"

I think it is. Purely as a consequence of the view that it is in society, therefore, we need it, therefore, it will be in the school system. People expect, again without necessarily knowing what it is going to do, they expect it to be there, so, therefore, it is up to the main players in the system to make sure it's there for some good purpose.

"Would you make a personal choices to include computers in education?"

Yes, Yes I would. I think for two reasons, one is that we have to be part of the main world, you cannot isolate yourself and if other countries are using them in whatever format, and if they are necessary as a part of careers then you have to train people to be able to utilise them. To stick your head in the sand is ridiculous, it's a matter of controlling it and getting a balance and that to me is a far bigger problem.

"Schools be reshaped?"

Ultimately, they will I think, there will be a fair amount of resistance. I can see the teachers unions, for instance, giving a lot of resistance. They will, I think, first of all be looking at the number of heads and they will be using arguments which have been around for a long time, the student/teacher ratios, which may no longer be as pertinent or at least change. The other aspect of it though . . . I still think that the school base will be there as a base. We talked about that before and that will be there, it's just how the structure changes.

"Exciting Future?"

I guess, on the basis that change is exciting, then it's an exciting future. If it is something that you are necessarily looking forward to then I am not so sure that is true.

"Frightening Future?"

If handled badly, and again we have discussed some of the things which I think are problems where if it becomes the over-riding thing if we lose interrelationships, if we forget about the kids who cannot cope with that particular system of learning and so on, then it's frightening.

"Will teachers lose control of the curriculum?"

That is assuming teachers have control of it now. I am not sure that some of the them would agree with that especially with changes in SACE and things like that. I think that it will change, and again, we come back to the basics or the methods of thinking or whether we are teaching pure fact as it occurs at the moment, now, that's going to change and its going to depend a lot on the ability of teachers to be able to control that. The control is in their own hands in large part and I think a lot of teachers are going to have a lot of trouble changing in that way.

"Will education be constrained by technology?"

Constrained is the word, the problems are going to be keeping up with technology and I suppose that is a constraint and it will be the expenses incurred with that and the spread across the whole system so that everyone whose in that system has the same opportunity and I think that has already been reflected in my experience in technology.

The technical studies type classes were for schools to keep in the race; it is almost impossible. Their concepts of NC machining and things like that now how are they going to teach that in schools and have that technology there. Even if industry was to give them their cast offs they have already outlived their life so it is very, very difficult and having looked through a few schools and seen their technical study centres you can

only feel sorry for them and wonder how the hell they get anything over but maybe it gets back to teaching them basics.

PROMOTION COMPUTERS IN EDUCATION

Media?

Ah yes, it's taken as complicated and they have beefed it up, "isn't this wonderful", and so on, yet, I think there is a fairly shallow basis on which media operate.

Government?

When it suits them politically, yes.

Employers?

They make noises but I do not know that they have been that effective. They say that the system should provide skills, and so on so, that people are able to use but I do not know that they have actually advised on what they want.

Educational Department?

I think they perceive a need to equip people with skills but I am not sure that they, I am not aware, that they have addressed the issue as far as the equity one goes and the keeping up with technology. I think its too big a problem for them.

Parents?

Again, there are pressure groups, there are small groups which jump up and down and make comments, and all those sorts of things, but I am not sure that they are being particularly effective.

Computer Companies?

Yes, considerable, as I am sure Coles supermarkets and so on would attest. I think it is a very good marketing ploy which is being used by Coles and is it Apple. As a matter of fact it is a great marketing ploy. How much of it is genuine directed towards our kids is another matter.

Teachers?

I do not have a wide contact with teachers. Those which I do know and see in action, I would say not. I would think that they just clamber along trying to keep up with their daily demands without really getting involved in where it is going.

Unions?

As a body, I suspect not, I think that again, they are more interested in saying it's going to reduce working hours or is it going to cut employment or whatever without really articulating where they see it is going.

EVALUATION OF SCHOOLING

"How do you believe schools are performing at the moment?"

- **Are schools satisfactory?**
- **Need radical change?**
- **Irrelevant?**
- **Always are the same?**
- **Not sure?**

I do not know that schools are ever satisfactory and I think that is a good thing because it means that people keep on trying to improve it if you just become biased about it saying that the schooling systems are fine.

I do not know about radically change. They need continuing change and continuing pressure. Radical changes means you are going to throw a lot of things out and that worries me because I think it needs to be done on a timely basis you can choose as you go along without chucking the baby out with the bath water.

"Any Other Matters?"

I am concerned about those people who are not going to fit into a computerised society, for whatever reason. What are we going to do with them? How are we going to handle them? I do not think to date we have handled very well those people who cannot read and write or have not been able to learn those skills easily, we have tended to shove them aside, we have pushed them through the system and sent them out with a piece of paper which is irrelevant, and I think we are only changing the focus a bit or maybe we are going to have two groups of people who cannot cope and that is a real worry. We are going to end up with a sub-class of people unless that is addressed very early in the piece. Factories are moving away from having the jobs for those people who do not fit. We no longer employ lots of trades assistants or sweepers or whatever we usually require people to look after their own work area and be multi-skilled as the jargon goes and unless they can do all things we are just not going to employ them.

Summary of Interviews with Employers

TECHNOLOGICAL FUTURE		
RETAIL INDUSTRY (A)	SERVICE INDUSTRY (B)	MANUFAC INDUSTRY (C)
<p>WORK Part of the unemployment today is because those people cannot be employed because of the fact that there is no work for them. We used to have 200 people working in Accounts Receivable we now have 50 because of computers.</p> <p>...what you'll see is that middle management has been eroded away.</p> <p>... people will manage their own environment they will create their own paper work, their own letters, their own memos, they will use electronic mail as it comes around and so what you will see, you will get rid of whole layers of the structure in society.</p> <p>... for each manager or each person of a technical nature they will have to be fully conversant with the ability to use computers...</p> <p>Education, as such, is a process that comes from about three (3) areas I think. It's the education you get in the home from the parents. It's the education that you get from the school and the teachers and then there's the ability of the cultural values that you have around you.</p> <p>... the three (3) factors affect the child's education or anybody's ability to get on and then in the workplace later on.</p>	<p>WORK ... we will have to have a new social charter.</p> <p>Technology will be a very changing thing.</p> <p>The only fall back to where we are starting is to get to a stage where we are employing technologies, changing the way people work.</p> <p>Now what is happening accompanying that in 1992 is the down sizing of the organisation.</p> <p>You have organisations which rely heavily upon technology. You have operators who are well trained that can make decisions on the shop floor... ... so the role of management is changing now.</p> <p>So you have your leisure class, they are called the unemployed, they go to the CES and pick up their money.</p> <p>I do believe that unless we have a social contract we are going to have a hell of a lot of unemployed people and we are going to have a hell of a lot of unrest so I guess we had better sit down and talk it out.</p> <p>Instead of having a high standard for those working and the rest just hang on and we use them as we need to when the economics are good and put them away when the economics are bad.</p>	<p>WORK ... a lot greater play on audio visual type equipment.</p> <p>... the skills that are needed ... are a lot more basic than are generally given credit for and that is good keyboard skills ...</p> <p>... I think that keyboard skills have to be taught at much the same time as children are first taught to write.</p> <p>Now voice actuation may overcome that, I am not sure.</p> <p>I do not know that is going to work adequately sitting at home using a keyboard or something it removes them and isolates them from the work process.</p> <p>... people across the work force are going to become more and more skilled and are going to be using the same technology anyway.</p> <p>I see nothing to suggest that it is going to slow down the growth, the speed of growth or the speed of change.</p> <p>I tend to have some concerns about the isolation of people using some forms of technology and I think that is not necessarily a good thing ... I think we are going to have to work very deliberately to try and have group interactions.</p>

TECHNOLOGICAL FUTURE

<p align="center">RETAIL INDUSTRY (A)</p>	<p align="center">SERVICE INDUSTRY (B)</p>	<p align="center">MANUFAC INDUSTRY (C)</p>
<p>WORK ... in 5-10 years time, I suppose, everything will become slowly more automated and you will have more functions to do.</p> <p>... although you are doing that it has already been built into the equipment. The person who is serving the customer is no more clever ...</p> <p>... things like expert systems, artificial intelligence, things like that will make much more complex processes still transparent to the user.</p> <p>... it will be much more user friendly ...</p> <p>... the intelligence of people is not increasing overall. You will still have a clerk doing a clerk's job...</p> <p>... in education it is important that the children that are coming through in 5-10 years time are very comfortable with where the data is and where it's moving and things like that ...</p>	<p>WORK ... we are going from a time when we had high human involvement in industry to a time when we have high tech involvement in industry with such clever people - but if we are not careful we are going to have such a whole group of people with nothing to do.</p> <p>With technology there are a lot of things people can do at home and feed into work.</p> <p>... the key to the whole thing of work and life is a social interaction, people who think that business and social interaction are two separate things.</p>	<p>WORK As to whether technology will increase leisure time, I doubt it.</p>
<p>PRIVACY ... we have some databases with customers ... but I think people are more concerned about tax information, health information.</p> <p>If you want total privacy it is very, very expensive, you have to have a balance between what you need to keep private and what you can afford to keep private.</p>	<p>PRIVACY I have problems with this.</p> <p>... far too many people have got too much information on people.</p>	<p>PRIVACY Yes, absolutely, its [privacy] a big problem with trying to get the system interrupted once information is into a system it's very hard to break it.</p>

TECHNOLOGICAL FUTURE

<p align="center">RETAIL INDUSTRY (A)</p>	<p align="center">SERVICE INDUSTRY (B)</p>	<p align="center">MANUFAC INDUSTRY (C)</p>
<p>CONTROL If you are talking about our ability to allow new technology to come in and take over jobs etc, no, we don't have. Because you're talking about competitive advantage ...</p> <p>... everybody else has to take up that technology regardless of the cost because it's a matter of survival.</p> <p>So the role of competitive advantage will eventually force people to use the technology whether they want to or not.</p>	<p>CONTROL I don't think we have any control.</p> <p>I do fear that we have lost control as individuals over what is being done in the community.</p>	<p>CONTROL Unless the computing and technologically based information systems are controlled very well you are going to see a lot more people hurt.</p>
<p>CULTS There have always been people who have pushed the technology to more than what it is on the basis that it gives them some special place in society...</p> <p>If it's economically feasible then it will make progress in society, if it's not economically feasible it may be a great idea for a while but eventually it will not survive.</p>	<p>CULTS I don't know that they are coming straight out and saying, "I worship this computer", but their behaviour starts to look that way.</p>	<p>CULTS It's [cults] likely, the more I think of it now. There are always cults in one form or another about the environment in which you live.</p>
	<p>LEISURE We come back to that balance of a work life and a leisure life and not just having a lot of people working with little leisure life and having people with leisure life and no work.</p>	

COMPUTERS IN EDUCATION

<p align="center">RETAIL INDUSTRY (A)</p>	<p align="center">SERVICE INDUSTRY (B)</p>	<p align="center">MANUFAC INDUSTRY (C)</p>
<p>RELATIONSHIPS Theoretically, the next thing would be ... [to give] every child in the class a laptop ... where they put all their work.</p> <p>... it has to be part of the tools of every student ... but if you cannot get that and it's not economically viable to do it ... because it has to be funded by parents and if you're in a rich school you can have it and if you're in a poor school you cannot.</p> <p>You are better off to concentrate in giving them the skills by putting them all in one room.</p>	<p>RELATIONSHIPS ... students learn as much from the methodology and the behaviour patterning of the teacher and the interaction with the teacher is as important if not more important than the actual content of the course.</p> <p>... it [computers] allows students to work at their own pace.</p> <p>... when they come to work we can teach them specific things that we want them to be taught - I would like every child at school to be able to ... type to Australian standards ... handle a spreadsheet ... use a graphics package.</p>	<p>RELATIONSHIPS I think it is a real concern that you get all these people staring at screens all day.</p> <p>... there is a risk that they will lose the skills of listening to people.</p> <p>[concern for those who] cannot successfully learn by computers and are going to be in need of special education.</p>
<p>LEARNING ABILITY I think so ...</p> <p>What you have got to be worried about though is that education is not about technology purely and simply, education is about appropriately rounded students...</p> <p>Computers, I am sure can help in many of these areas of accessing data but they don't necessarily help in areas of expression and things like that.</p>	<p>LEARNING ABILITY ... it will speed up their processing of the learning process and ... allow them to apply more information and knowledge and ... allow them hopefully to have better relationships with their teachers.</p>	<p>LEARNING ABILITY ... people have different ways of learning and some are better in some ways and others better in others, so it will probably broaden the base as long as we do not forget about the other systems.</p> <p>... repetition and all those sorts of thing which may improve people's ability to absorb information. Whether it helps with their thinking though is another question.</p>
<p>MOTIVATION [Will computers motivate students?] Yes</p>	<p>MOTIVATION I do not think that computers are highly motivational themselves, but the person on them might be motivated by using them and getting answers out.</p>	<p>MOTIVATION ... they are motivated because it's something different.</p> <p>It will be just the same as when I got my first fountain pen ... after a while it was not any different from pen and paper.</p>

COMPUTERS IN EDUCATION

<p align="center">RETAIL INDUSTRY (A)</p>	<p align="center">SERVICE INDUSTRY (B)</p>	<p align="center">MANUFAC INDUSTRY (C)</p>
<p>CREATIVITY My general feeling is no, they're not going to ...</p>	<p>CREATIVITY I don't think it does actually - I think it is just a tool ...</p>	<p>CREATIVITY I have my doubts about that. If they are going to be creative in one format they are going to be creative in another format.</p>
<p>GENDER EFFECTS ...if you can segregate the sexes in the education process ... then the girls can, in fact, do as well, if not better.</p>	<p>GENDER EFFECTS The computer is sexless. I've found computing no different between the sexes.</p>	<p>GENDER EFFECTS I do not see any big discrepancies in females using technology.</p>
<p>CAREER NEEDS ... career understanding etc, comes from areas outside of curriculum and schools. I think schools can only play a part in that but a lot of that comes from the attitudes in the home.</p>	<p>CAREER NEEDS</p>	<p>CAREER NEEDS ... it is imperative that all kids get an opportunity to be involved because I think in 10 years time so many jobs ... will mean using the computer as much as reading, writing, arithmetic...</p>
<p>SUBJECT RELEVANCE ... sciences, and biology and the chemistries and some of these and the learning abilities through those, I think are much greater.</p>	<p>SUBJECT RELEVANCE Well at the moment it does but I think in the future it will be just an extension of the typewriter and the calculator ...</p>	<p>SUBJECT RELEVANCE It may have been promoted more from a science base but I am not sure it is real.</p>
<p>KNOWLEDGE REDUNDANCY I am sure that education has to be about learning about thinking processes and how to put things together and because really, education is not about how to live in our society and how to make a living in our society but fitting in.</p>	<p>KNOWLEDGE REDUNDANCY ... I think we have to clean out the old and bring in the new. I don't know that computing is going to have that much influence on that sort of principle.</p>	<p>KNOWLEDGE REDUNDANCY The question has always concerned me, I suppose, and it goes right back to calculators, is whether or not how important the basic knowledge is. It's the problem solving process rather than solving the answer ...</p>
<p>EQUITY Yes, those who have the resources will get a better education. The people who have had the resources ... have always been able to afford the better quality education etc. And education is not always going to school, it's education.</p>	<p>EQUITY I think is just a reality of life that some people are better off than others. What the government role is, is to try to redistribute wealth so that they get an opportunity.</p>	<p>EQUITY ... it's going to be much harder if they cannot get their hands on to the technology and I think it's going to be a problem with money put into schools and which get priority ...</p>

COMPUTERS IN EDUCATION

<p align="center">RETAIL INDUSTRY (A)</p>	<p align="center">SERVICE INDUSTRY (B)</p>	<p align="center">MANUFAC INDUSTRY (C)</p>
<p>EFFECTIVENESS/ EFFICIENCY ... in order to make computing work better in schools it's not the children who can't cope, it's the teachers who can't cope. ... it's got to be implemented from the top down.</p>	<p>EFFECTIVENESS/ EFFICIENCY ... it has the opportunity to make them more effective. ... the principals will be more efficient.</p>	<p>EFFECTIVENESS/ EFFICIENCY ... it comes back to what we are trying to achieve ... or are we really just restructuring the groups of kids ... I am not sure about that effectiveness, doubtful, efficiency, should be.</p>

FUTURE OF COMPUTERS AND SCHOOLING

RETAIL INDUSTRY (A)	SERVICE INDUSTRY (B)	MANUFAC INDUSTRY (C)
<p>I think the school structure as it is and the learning by going to school will stay very similar to the way it is.</p> <p>... I don't think the majority of people in our society are forward thinking enough to allow the change to occur.</p> <p>A lot of people use school as a child minding centre ... or they don't want the kids during the day ...</p> <p>... if we try to change it to home base learning ... they won't want it ...</p> <p>... more technology in the schools, ... more experience with the teachers and maybe more individualised learning programs ...</p> <p>[Given that work will take on a different shape will it have any influence?]</p> <p>I don't think so, ... examples like programmer working from home can do it but they lose the interaction.</p> <p>... when you go into flexitime and shorter weeks ... you lose some cohesion in the team effort.</p> <p>You can change the number of hours that a department store operates but you can't change the location.</p>	<p>My view looking out 20 or 30 years ahead is that schools will still have the same organisation.</p> <p>Buildings are becoming less relevant.</p> <p>... with school industry links the closer we can lock in education to life the more motivated kids will be to learn.</p> <p>... if you can lock that future aspiration into the learning process they have a reason for doing things, the motivation just churns it's way in and the creativity does as well.</p> <p>... you then come to the question of whether there will be a need for a social interaction as part of the learning education process or whether it can all be done on computers but I do believe that the social interaction will augment learning.</p> <p>... there would be a whole lot more socialisation of the education system using computing as a medium to make things work.</p> <p>... the hours that we are locked in to at the moment with secondary education and primary education for instance, could be blown out of the window.</p> <p>... the bare foot teacher ... type concept will be in where a teacher will have a group of people and act as a mentor for that group.</p>	<p>... schools will still be there and that they will be technologically advanced.</p> <p>I do not think our society will allow all training to be handled over to private companies ...</p> <p>... there will certainly be a lot more individual interaction.</p> <p>... one of the great weaknesses of the current system is that it has not been able to allow kids to learn at their own rates ...</p> <p>... it will still be based on the school structure but maybe a lot more movement between classes or levels ...</p> <p>... teachers are going to have to be more responsible to see that people do not fall off the edge ... and highlight those who have problems coping with the system ...</p> <p>... those who can operate within the system will run ahead ...</p> <p>... if kids are falling off because of their inability to use technology and ... it will be harder to fake it so teachers are going to have to be able to pick that up and be more a bit more remedial.</p>

FUTURE OF COMPUTERS AND SCHOOLING

<p align="center">RETAIL INDUSTRY (A)</p>	<p align="center">SERVICE INDUSTRY (B)</p>	<p align="center">MANUFAC INDUSTRY (C)</p>
<p>... the basic concept of 5 days per week will probably stay the same but what you will do is introduce more technology better learning procedures in schools.</p> <p>... you will do that sort of thing so that the quality of education and maybe the productivity of education can improve but the basic framework will probably remain the same ...</p> <p>... in schools will gradually reduce down a bit as they try to eliminate the extra teachers and aids but that's independent of technology.</p>	<p>... you still could have the concept of the primary class contained if specialist information came such as the computer is and you could call in experts to answer questions where persons failed competency based type tests ...</p> <p>You could have specialists come in who actually designed the modules.</p> <p>So I see this in human terms being an explosion of potential.</p>	
<p>ROLE OF TEACHERS</p> <p>... they [teachers] have got to change and they have to be able to understand the technology and be able to use it as an integrated part of their lesson structure and that's going to be difficult for them.</p> <p>... the actual teaching itself may be taken over by the computer packs but all the work associated around them, the checking, the marking, the management of the students ... that is all still there.</p> <p>... eventually there will be computers everywhere and they will use computers as one of their tools.</p>	<p>ROLE OF TEACHERS</p> <p>There are far too many teachers these days out there who tend to teach the same stuff year in year out and they are still out there ...</p> <p>... the needs of children have changed in the last 10 years ... even things like the economic situation are different now ...</p> <p>[What happens to those people who are so content focussed?] I guess they will be the ones which fall by the wayside.</p> <p>I think we should be teaching people how to learn. I think we should be encouraging them to do it themselves with the teacher acting as a mentor.</p> <p>I think teachers are going to have to come to grips with the fact that they are not the king pins in the classroom, the student is ...</p>	<p>ROLE OF TEACHERS</p>

FUTURE OF COMPUTERS AND SCHOOLING

RETAIL INDUSTRY (A)	SERVICE INDUSTRY (B)	MANUFAC INDUSTRY (C)
	<p>... as you speed up processes and get people learning through mediums like, the computer, you'll have perhaps greater class sizes than you have now.</p> <p>... you will be able to have greater class sizes as you will be able to have some of your teachers spare to actually go through the relearning process and recycle them ...</p>	

CONTROL OF TECHNOLOGY IN EDUCATION

RETAIL INDUSTRY (A)	SERVICE INDUSTRY (B)	MANUFAC INDUSTRY (C)
<p>[Have people made a choice?]</p> <p>I think that parents believe that the stuff ought to be there.</p>	<p>[Have people made a choice?]</p> <p>I think it's just happening at the moment.</p> <p>I think that there will be an economic forcing of control.</p>	<p>[Have people made a choice?]</p> <p>Largely its just happened.</p> <p>... few people have given very much thought as to what it should do within the education system except to make their kids smarter, whatever that means.</p>
<p>[Inevitable?]</p> <p>No I don't, because I think it is seen as a bit of a competitive advantage ... so that the student that comes out the end has skills that you don't get if you go to another school.</p>	<p>[Inevitable?]</p> <p>There is in society a certain inevitableness about it, because there is a loss of control of the way things are happening ...</p>	<p>[Inevitable?]</p> <p>... it is in society, therefore, we need it, therefore, it will be in the school system.</p> <p>... it is up to the main players in the system to make sure it's here for some good purpose.</p>
<p>[Schools Inhuman]</p> <p>... they will be doing interactive work which is more active rather than a passive environment, therefore, they should get more out of it.</p>	<p>[Schools Inhuman]</p>	<p>[Schools Inhuman]</p>
<p>[Education Constrained]</p> <p>... it will be dictated to some degree by the companies that are prepared to put money into the software development ...</p>	<p>[Education Constrained]</p> <p>Teachers in the system have a fair degree of flexibility about the way they teach and the good ones are developing good stuff.</p>	<p>[Education Constrained]</p> <p>... the problems are going to be keeping up with technology.</p>
<p>[Schools Reshaped]</p> <p>Yes, but not for the reasons of technology ... it will be reshaped because of the economy.</p>	<p>[Schools Reshaped]</p>	<p>[Schools Reshaped]</p> <p>Ultimately, they will I think, there will be a fair amount of resistance.</p>

CONTROL OF TECHNOLOGY IN EDUCATION

RETAIL INDUSTRY (A)	SERVICE INDUSTRY (B)	MANUFAC INDUSTRY (C)
<p>[Exciting Future]</p> <p>Yes, exciting development.</p>	<p>[Exciting Future]</p>	<p>[Exciting Future]</p> <p>... on the basis that change is exciting, then it's an exciting future.</p> <p>If it is something that you are ... looking forward to then I am not sure that is true.</p>
<p>[Frightening Future]</p>	<p>[Frightening Future]</p>	<p>[Frightening Future]</p> <p>If handled badly, ... if we lose interrelationships ... if we forget about the kids who cannot cope ... then it's frightening.</p>
<p>[Teachers Lose Control]</p> <p>Never thought that teachers had any control.</p>	<p>[Teachers Lose Control]</p>	<p>[Teachers Lose Control]</p> <p>The control is in their own hands in large part and I think a lot of teachers are going to have a lot of trouble changing in that way.</p>
<p>[Personal choice to include computers?]</p>	<p>[Personal choice to include computers?]</p>	<p>[Personal choice to include computers?]</p> <p>... Yes, I would, ... you cannot isolate yourself ... and if they are necessary as a part of careers then you ...have to be able to utilise them.</p>

CONTROL OF TECHNOLOGY IN EDUCATION

RETAIL INDUSTRY (A)	SERVICE INDUSTRY (B)	MANUFAC INDUSTRY (C)
[Who has most promoted computers in education?]	[Who has most promoted computers in education?]	[Who has most promoted computers in education?]
MEDIA Irrelevant	MEDIA	MEDIA ... they have beefed it up ...
GOVERNMENT Did not really have any push.	GOVERNMENT	GOVERNMENT When it suits them politically.
EMPLOYERS Did not have any push.	EMPLOYERS	EMPLOYERS ... I do not know that they have been that effective.
EDUCATION DEPARTMENT Did not have a great degree of say.	EDUCATION DEPARTMENT	EDUCATION DEPARTMENT ... they perceive a need to equip people with skills.
PARENTS Did have a say.	PARENTS	PARENTS ... there are pressure groups ... but I am not sure that they are being particularly effective.
COMPUTER COMPANIES Very little.	COMPUTER COMPANIES	COMPUTER COMPANIES Yes, considerable.
TEACHERS Yes, teachers had a great deal to say.	TEACHERS	TEACHERS ... I would say not.
UNIONS No	UNIONS ... to some extent but just as there are in companies there are a hell of a lot of reactionaries around.	UNIONS I suspect not ...

CONTROL OF TECHNOLOGY IN EDUCATION		
RETAIL INDUSTRY (A)	SERVICE INDUSTRY (B)	MANUFAC INDUSTRY (C)
[Evaluation of Schooling]	<p>[Evaluation of Schooling]</p> <p>I think that schools need radical change ... we have to take them in the new directions ... is not in concrete, it's a hazy thing ... but we got a fair idea of the parameters ...</p> <p>... I think things will evolve and I think technology helps to evolve quicker ...</p> <p>... if we do not do it properly and get people to talk about it, ... we will muddle along and end up in some back water.</p>	[Evaluation of Schooling]

Summary of the Theorising by Employers

TECHNOLOGICAL FUTURE	
ISSUE	THEORETICAL PROPOSITION
Technological Work Impact	<ul style="list-style-type: none"> - Greater use of technology in the future. - Greater levels of automation will result. - Job profiles will change. - Work will become more integrated and more highly skilled - Equipment will become easier to use (user friendly). - Workers will need to be very conversant with computers. - Skills more basic than assumed (keyboard skills). - Children should be taught use of computers when very young.
Economic and Organisational Impact	<ul style="list-style-type: none"> - Computer technologies will be damaging. - Organisations will reduce in size. - Middle management will be eroded - People will have less work time. - Unemployment will rise. - Some people will have a very high standard of living - Others will have a poor standard of living and wait to be used
Sociological Impact	<ul style="list-style-type: none"> - Rate of change will increase. - There will be greater use of technology (computers). - No perceived control over the increasing use of technology. - Concern expressed about the isolation of some people due to the nature of the technology. - People need to maintain social interaction now found at work places. - Concern for privacy of information.

COMPUTERS IN EDUCATION

ISSUE	THEORETICAL PROPOSITION
Relationships	<ul style="list-style-type: none"> - Relationships would not be damaged and may be improved due to additional time teachers can give to their students. - Students learn as much from the behaviour of teachers and interaction from them as educational content. - There is some risk that students may reduce their listening skills.
Equity	<ul style="list-style-type: none"> - Inequity will always exist with respect to resources; but governments through schools must enable students to gain at least limited access.
Learning Ability	<ul style="list-style-type: none"> - Computers will speed up the learning process and give them access to more information. - Education provides for more needs than technology. - Some students will not be able to learn successfully by computers.
Motivation	<ul style="list-style-type: none"> - Computers will motivate children. - Computers themselves will not motivate but their use may motivate due to the desire to gain more information. - Their motivational effect is because they are new - but after a while will not be any different from pen and paper.
Creativity	<ul style="list-style-type: none"> - Computers will not enhance creativity
Gender Effects	<ul style="list-style-type: none"> - Computing does not differentiate between the sexes
Career Needs	<ul style="list-style-type: none"> - Career understanding will not improve as it comes from areas outside of schools. - Careers databases help students - Many jobs will require using the computer as much as reading and writing skills
Relevance	<ul style="list-style-type: none"> - Computers more relevant to the science disciplines. - Computers are relevant to all disciplines. - Computers presently more relevant to some subjects more than others but in future will be an extension of typewriter and calculator.
Redundancy of Knowledge	<ul style="list-style-type: none"> - There is a need to replace the old with the new. - Problem solving process is more important than solving the answer
Efficiency and Effectiveness	<ul style="list-style-type: none"> - Computers will enhance the efficiency and effectiveness of schools. - If teachers had computer skills schools would be more efficient and effective. - Efficiency should improve. - Its not the students who cannot cope its the teachers.

CONTROL OF TECHNOLOGY IN EDUCATION

ISSUE	THEORETICAL PROPOSITION
Decision about Computers in Education	<ul style="list-style-type: none"> - Parents do not think about how computers should be used in education - Parents expect computers to make their kids smarter. - Teaching may be taken over by computer programs. - Computing in schools is inevitable. - The society expects computers to be in schools because they are in society. - Technology is pushed as a competitive advantage between schools. - Students will be doing interactive work on a computer and therefore will get more out of it. - The potential of computer learning will be dictated to some degree by the investment put into software development by companies. - Schools will ultimately be reshaped but teachers and teacher unions will provide considerable resistance. - The fixed hours of schooling will be removed. - The teacher will act as a mentor to a group of students. - The concept of a general teacher could be retained if you could call expert advise through the media. - Schooling will be reshaped for economic reasons not technological reasons. - The direction for computers in schools must be directed from the top down. - People are starting to expect students to leave schools with word processing, spreadsheet skills. - Parents believe that they have introduced computers into schools - Computers should be integrated through all subjects. - Society is not creating basic first entry level work. - There are many highly skilled people who do not have employment - The future will present many changes but people do not necessarily look forward to change. - If inter-relationships are reduced and schools do not respond to those who cannot cope with technology then the result is frightening. - Teachers do not have any control over the curriculum. - Teachers will have trouble changing. - Schools will have difficulty keeping up with technology due to the costs. - It is almost impossible for schools to keep up with technology. - Schools could be built like houses or shopping centres so that they can be reused. - Computing will be an important part of the linkages in society. - There are too many teachers who teach the same material year after year - The needs of children have changed during the last ten years - Teachers who are content focussed will fall by the wayside. - Discipline is a problem for content focussed teachers - Schools should be teaching students how to learn and encourage them to direct their own learning and use the teacher as a mentor. - Class sizes will increase as computers are used for learning. - Teachers will be able to be retrained.

FUTURE OF SCHOOLING

ISSUE	THEORETICAL PROPOSITION
School Organisation	<ul style="list-style-type: none"> - Will stay as they are for next 20-30 years. - Will be technologically advanced. - Will have same organisational structure. - Buildings will be less relevant.
Social Response	<ul style="list-style-type: none"> - Schools used as child minding centres. - Society will not want home based learning. - Society will not allow education to be handled over to private companies - Schools will form closer links with industry. - Closer links with industry will improve student motivation.
Teachers Roles	<ul style="list-style-type: none"> - Teachers should be more responsible for student performance. - Teachers need to be more remedial and diagnostic. - Productivity and quality will improve. - Teachers must respond to the change and use technology as an integrated part of learning/teaching. - Teachers will be required to have greater experience. - Number of teachers will continue to reduce independent of technology
Learning Methodology	<ul style="list-style-type: none"> - Individualised learning programs will/should be used where children learn at their own rate. - Greater movement between classes and levels

Appendix 12

APPENDIX 12

Appendix 12 presents the unabridged interviews of Educational Administrators representing a Curriculum Director, Information Technology Director and Technology Adviser

This is followed by a comparative analysis of the key issues of concern for the three (3) core studies.

Finally a summary of the theorising of all Educational Administrators is presented.

INTERVIEW ONE

COMPANY: EDUCATION DEPARTMENT
POSITION: CURRICULUM DIRECTOR
DESCRIPTION: The most senior position responsible for the management of school curriculums

TECHNOLOGICAL FUTURE

"What images do you hold about the future society and technology in which schools will operate?"

Certainly, one would have to acknowledge that more and more homes will have their own personal computer for a variety of purposes ranging from a recreational entertainment model to people who use it for sophisticated supports to employment, or their own interest, and in terms of their own areas of knowledge.

A second strand, I would be thinking about, would be the way in which people are on the receiving end of information which is stored and then letters and reports generated, and then those bigger incidents in eastern states when letters went to wrong people and the suspicion that generates in some people, in people's minds, that some malevolent force is acting on these and technology is really inappropriate because it intrudes in people's lives in adverse ways.

On our part, we have the people increasingly familiar with the home based stuff while at the other end, the macro-level, the government some how it's malevolent and sinister and it's going to lead to the breakdown of society and the intrusion into their lives.

I think people tend to have an ambivalence, they are quite comfortable sitting in front of a screen/terminal playing a game, writing to a friend or keeping track of their finances. They don't seem to relate those things or that they can stuff things up and press a wrong key and you obliterate a screen or mismatch an address to a letter with the stuff which at a government or organisational level, where they seem to think that there are some other forces at work it's different to me sitting down at my little keyboard, making a simple mistake but it's not tolerable when somebody else does it and it has something to do with the fabric of society.

I suppose it comes down to the level that we find in a lot of areas of life, that people are comfortable with the things in which they have direct control but they are suspicious of the same sort of things which operate in another area. A classic example of this is that most parents, I suppose, are reasonably supportive and comfortable of the schooling their children receive in their school but when you talk to them about the educational system, it's failing and the kids are hopeless and the kids hang around street corners and vandalise etc. My kids are ok. My kids school is OK, but it's all those other people out there. It's that level of familiarity, people seem not to make connections - if my kids are ok perhaps most schools are ok for their kids.

WORK

"What do you believe will be the effect on work?"

Well certainly, I believe it is having an impact in terms of employment opportunities in that they have changed and some employment opportunities now will require some level of sophistication with technology support such as Caddsmen or computer assisted operation in various manufacturing industries or in working just in places such as motor vehicle department with keyboard skills. Even that level is becoming a very important

part of the skills a person brings to a potential employer. So, you do not have to stand at a counter while somebody pecks your name into a keyboard. So I think that sort of thing will be an increasing demand, and I would hope that eventually all kids will leave the school system with quite well developed keyboard skills, but we haven't actually got that formally as a requirement.

CULTS OF TECHNOLOGY

"As computing becomes more sophisticated, do you believe, as expressed in the literature, that as computing becomes more and more developed we will actually see the development of cults which worship computers?"

Yes - it's a possibility, but I see it as no more than an extension - in an office setting. Traditionally, the woman who is the stenographer, personal secretary to the CEO or Chief of a Division is a **very powerful person** and is often regarded by people as being very influential and that is because he or she is in a position, because of their skills - to be part of that intimate workings of the department - now that's about information - now, if people are working with information sources which give them additional, I suppose, power then people will see them as very influential and important people - and I suppose what technology does is give people access to information and enable them to massage and manoeuvre the information in new ways. People who have skills to do that then use that information in ways to influence people.

COMPUTERS IN EDUCATION

"Computers have intruded into the education system but many things are still unresolved. I will go through some of those things with you now, for example, what do you think will happen to relationships?"

I think it increases people's need to be interdependent. Well actually, it can be a two edged sword, can't it? People can use technology to increase interdependence because

they draw on information and software and processes from a range of groups and so, particularly if you are in a networking situation, you can access a much greater range of information so you have that interdependence where this is my bit of information and I'm going to lock it away behind my key word and nobody can access that unless they know what my key word is and it's mine and I'm not going to share it with anybody.

I would like to think that within the educational sector it actually leads to people sharing more information because it is so accessible in a variety of forms and you can transfer it either by text or in hard copy or whatever, and you can manipulate it so that I generate something as an economics teacher and a mathematics teacher sees it and says that's a useful model, I can also use that, and so you get that transfer of information but I think that can only happen as teachers become familiar and comfortable with the extent, the ever extending use of technology, and I don't know that a lot of teachers are yet comfortable.

"I don't think they have come to grips with a different way of conducting their business. Some people would argue that computers actually damage relationships while others argue that they enhance relationships."

I guess that's what I was starting to hint at. Part of my view of the usefulness of computers is technological access to information such as bulletin boards and all those sort of things.

It ought to increase the capacity for teachers to enable students to be much more independent as learners and to develop a way of accessing information which is not dependent on them saying now turn to page 32 and we will read this together as a class, and that kids ought to become much more familiar with saying what is the information I need, where is it held, how do I access it most effectively? You access

some of it by going and reading a book, you access some of it by dialling up through a database etc, etc.

Now that leads to people having confidence in their capacity to work through a series of questions such as:-

- what information do I need
- how do I access it
- how do I put it together
- and how does this answer the original question.

Now, that whole information thing, that I do not think that teachers have really come to terms with. How does this relate to relationships? It comes back, I think to teachers willingness to allow kids to become independent. Now again, one could develop a scenario that a teacher with 25 to 30 kids who is actually allowing them, within broad parameters, to develop their own thing as a series of individuals or small groups - that actually enables the teachers to interact with, on a very personal level much more than by standing at the front and saying now everybody do this, so I think there is the opportunity for teachers to actually interact more personally with kids by giving them independence and in turn, by seeing the kids grow as independent learners and develop their self esteem, and that enables them to develop relationships at a much higher level.

LEARNING ABILITY

"What about the learning ability? Some people would argue that learning ability will actually be enhanced with this sort of technology where as other people would argue that it is innate and there is no way you can do anything about it and you are only changing the mode?"

I suppose I am being a bit idealistic but one would like to hypothesise that because students start to develop some rigorous way of identifying how they use information towards particular ends - that is a preferable learning model rather than listening to teachers and repeating back - and they are learning about accessing information and problem solving and those sorts of things which are higher order skills than just gathering information and repeating it back.

It does not mean that they are more intelligent but they develop higher level skills of using information. They are operating at a much more sophisticated level within the boundaries of their own personal capabilities because they are learning at starting to work at things of analysis and synthesis rather than straight repetition.

MOTIVATION

"Some people would argue that using this technology will motivate students."

I do not think there is any doubt about it. There is enough research around, even small scale research, to show that kids writing improves when they use a keyboard to write their stories than when they have opportunity to write it, cross it out, write it, cross it out, draft it. That whole process of drafting becomes less primitive when you can actually change a word on a screen and you don't see a line through it or an amendment. It still looks like clean text and I think the evidence is there that kids respond much more positively than using paper and pencil.

Oh, something, because a kid can capture a bit of an idea and replace it in an earlier part of the text. It encourages them to, sort of, think more where as if you are writing something on a piece of paper it's messy to have to go back and introduce another paragraph between your second and third paragraph when you are actually down to

your fifth whereas on text you go straight back to it. So I think in terms of creativity, again the research that I have read and it's been fairly basic, in kids private writing they tend to be more expansive when using a laptop than when using a paper and pencil.

Well again, research suggests that if you have an area dedicated to computers, if it's open slather, boys seem to be more attracted to those sort of processes than girls.

"We don't even know the potential benefit's to come out of virtual reality. It seems quite remarkable to be able to say to a person - hoping here we will give you the effect of being blasted off to the moon."

But even voice activated stuff is going to revolutionise because it is going to take some of the tedium out of the clickity clack. I suppose voice activated stuff will become reasonably prevalent. I suppose eventually it will be in the home and everywhere. That provides a means of additional communication and the capacity of a program to have a spell check is a great advantage to kids. I mean, I don't ... I mean some people will decry that and say that, jolly gosh, they will never learn to spell because somebody is going to do that for them, but if that is the major means of communication they are going to use because they have a computer at home and a printer, and even writing a letter to grandma to say thank you very much for the \$10 you sent me for Christmas - er that, they are going to do that in typed form, so what!

"This may even be more beneficial because it instantly provides feedback."

Spell checks are not actually foolproof because you do have to make choices. They just give you a range, you still have to make choices - you just can't chose at random.

RELEVANCE TO SUBJECTS

"Do you think that the computing technology is more relevant to some subjects rather than to others?"

The capacity for technology to provide modelling of a variety of activities in science or geography or history, as well as the mathematical modelling that might apply to economics or mathematics itself.

One can imagine, I presume, that there must be programs around which model wave formation in a physics lesson, for example.

Now again, I don't think teachers use those as affectively as they could to demonstrate the theory about which they are talking, they still tend to use diagrammatic stuff. So I think there is quite a large market for modelling programs which teachers can use, but the one I keep coming back to and I suppose, it is a bit of a hobby horse of mine, is the way that we ought to be empowering kids to use information because that is the direction in which we are moving in the twenty first century. It is going to be information rich and a society in which it will be essential that you are able to discriminate between the information which you use or don't use because no person is going to know or have access or store all the stuff you need to make a useful life.

REDUNDANCY OF CURRENT KNOWLEDGE

"Do you think computer technology makes a lot of current learning redundant?"

I think we always do that. I spent hours and hours of time in the 60's going to courses down in the University of Adelaide and learning how to program in Fortran - and I taught that to year 11 kids. Nobody does that now. It was an interesting intellectual exercise because I did not use it to any sophisticated purpose but that is now deemed to be not

really relevant, and similarly, I spent hours and hours teaching kids how to use a slide rule and logarithms; now even the most basic calculator can do all of the things a log book or a slide rule could do - so I think we are continuously jettisoning parts of the curriculum processes and knowledge as we grow smarter and as information becomes wider; so we do that almost automatically.

I think it is to do with, again, how much the system allows kids to become independent and that means that you don't require all kids in a cohort, or a class, or a group to do exactly the same thing and we become more focussed on the skills that are used rather than the end product per se, and I think this is the direction we are going in terms of the Mayer Committee, Finn Committee stuff which is really focussing on ... it's interesting that they have used words like social and cultural skills, science and technological skills, not social and cultural knowledge - now obviously you must have some knowledge in order to be able to develop skills but they weren't talking about pure content that you have to be able to answer these 6 questions with 90% accuracy in order to be deemed to be socially and culturally aware. I suspect it is more about what are the skills that we want people to have in order to operate within a social and cultural context.

EQUITY

"Do you think the technology creates a problem associated with access to it?"

If we hypothesise that there are valuable outcomes associated with having access to information, in developing skills in managing information, in developing confidence as a person because you are able to do all those sorts of things, then if you don't have the access to the resources you don't have a keyboard at home and you are not a member of a bulletin board like Nexus, or whatever, then if they become very important components then you can get a differentiation of people on yet a different set of criteria yet which are part linked with affluence and the economy.

So there are issues of equity but I don't know, I have not bothered to find out what the research says, as to whether people, in fact in low socio-economic situations, actually do spend their money on technologically related things - I suspect they do, but it's often more for entertainment than for education, so you are more likely to find a place in Elizabeth with television and a video cassette recorder despite their low income, or a computer game but often it's at the level of entertainment and that's possibly more related to qualities of boredom or whatever than it is for educational enhancement.

EFFECTIVENESS AND EFFICIENCY

"What about the question of effectiveness and efficiency?"

Effectiveness is a very relative question and one would like to think that in terms of handling information, people become more effective in the sense that they learn how to ask questions which lead them to access the sort of information they want - which is the whole problem solving approach, to know how to deal with the information in appropriate ways which means that you are communicating effectively through chasing the right information and expressing it in the appropriate form for your audience.

So, from that perspective we ought to be able to be more effective. In terms of efficiency, again just using the analogy between the person who has to rewrite three pages of hand written stuff in order to change the third paragraph because it wasn't quite right compared with somebody who can just change the third paragraph, press a button and add one box on a printer, is more efficient because you are not having to invest a whole lot of time in doing stuff over again which does not need doing over again.

REDUCTION OF TEACHERS

"Do you think this may mean we will require less teachers?"

Yes and No. Schooling is about personal relationships and so you do need that interaction and I have never quite worked out what my response is to the possibility that, in fact, there are no schools. It's an unreal scenario, but a lot of kids sitting at home accessing some educational database, and a lot of people sitting in a building, all you are doing is communicating via text and there's no personal stuff. I do not know whether it will ever get to that point and so, I suppose, while it will lead to greater efficiencies in terms of the teaching arrangement, if the teacher is still the monitor and the manager of the range of learning processes then we will still need teachers but maybe they may get better outcomes in terms of student performance.

FUTURE OF COMPUTERS AND SCHOOLING

"Which is the more likely future for schooling emerging down the track?"

"Do any of the following descriptions meet your image?"

A place which conducts lessons as at present but which uses increasing amounts of computer technology for learning.

A place from where students' progress is managed, records kept and advice given but with much of the learning occurring out of the school in houses, libraries and other public institutions.

A place where students spend time on individual study programs monitored and recorded by computer.

A private company which manages computer learning programs for individuals for a fee in their homes or in small learning centres.

A place where students gather for group and social activities but specific knowledge is gained personally using computer technology.

A place which becomes irrelevant as technology removes the need for separate institutional education and replaces it with centralised data banks of learning material which can be used as required throughout life. None of those described."

I see where we ought to be in the first one and moving towards the second one where there is a range of technological support both for students and teacher purposes and administrative purposes in schools. Certainly, much denser than we have got them at the present time and that schools ought to be places where learning is managed, but where they are not places of instruction. But moving beyond that point I do not know whether we will get there by the 21st century, but it may be further down the track.

I think it is bound up with the question about how much longer we are going to be committed to a model of organising schooling and learning essentially linked with how the factories operated a long time ago.

We are stuck with, here you are kid, jump on the conveyor in Year 1 and you go past a whole lot of places and we squirt stuff at you and all the rest of it. Now if we move away from that model where you can have kids working at home in the afternoon or morning and there would be gathering places for other purposes, I think is a fairly big society conceptual leap. I think society likes to think of schools as places where kids are, they will never say locked away, but they are supervised and they are controlled by people who are supposed to know what they are doing.

I think it will take awhile for us to move away from that but there ought to be that capacity in the system. I suppose the system ought to be free enough so that if you have a number of students and parents who say we would prefer our kid to stay at home and work in this way and link the supervision with a teacher - that is possible. Not every body has to walk through a gate in the morning and stay there until 3:30 because that is a way in which a group of students learn best.

So, I think at this stage I would support the second of your scenarios. We ought to encourage teachers to see themselves as managers of learning and not as instructors.

I am a great believer in teachers giving students the freedom so that by negotiation students say, in order to do this I need to spend, if we just take a trivial example, Thursday and Friday working in the museum by myself, and that's a negotiated contract, and on Monday the kid comes back and says this is what I have done but the way technology impacts on this I have not thought it through yet.

ROLE OF TEACHERS

"Does the use of computers imply a change in the role of teachers?"

There are huge changes in approach which teachers have to go through and I think that's going to be the thing which will impede the development of some of the ideas we have been talking about. The technology will always be much further advanced than teachers have the capacity to utilise.

My observation is that kids are more amenable to a new technological development and learn faster than the teachers do. It's moving away from what I call the custodial view of teaching to the other end where it's giving kids the power and responsibility, and I think that's partially an emotional laden value thing that I am responsible for the learning of these kids, therefore I have to constrain and constrict what they do or they might get away from me, stuff.

And a lot of teachers, and we have reinforced this by putting kids and teachers in a room 24 x 24 with 20 desks and the teacher being able to shut the door and say these are mine and I will be responsible for what happens within these four walls.

A negative spin off is that kids tend to divorce real learning, that is, what they do out of school with what they do in school. So what you do in school is not actually directed at life. The end of schooling is to finish schooling; the purpose of schooling is not to make you a better person. We have made people passive learners. So, I suppose if I had a magic wand and I wanted to change people I would want to change teachers from being primarily custodial and perceiving themselves as instructors, to managers of learners and freeing kids up rather than constricting and constraining them.

Our educational system basically constrains, it does not liberate. Teachers must become more diagnostic, yes!

We have just finished developing a series of attainment levels in all the areas of the curriculum. I was managing that project and we had a management committee which received in drafts of attainment levels from working groups and the question we continually found very difficult to resolve was that question of process versus content.

Do you lock people in to saying that they have got to know the towns, rivers, and mountains of South Australia in year four or are we more interested in a question say, a question of geography, that there are some processes that kids need to know how to utilise rather than being able to regurgitate fairly moribund information and we did not actually resolve this question.

We tend to still be more locked into the content than before, we are more process aware but I do not think we have gone far enough at this time and it is a tension and it comes back to a lot of debate about is there knowledge which people ought to have which makes them a fundamental operating Australian citizens. I mean, what things about Australia in terms of it's politics, it's laws, it's rules, it's government, it's mores do people need to know about how to operate as an Australian citizen.

It is a very vexed question. One of the things I observed while I was on the Board of SABSA was we shifted quite dramatically from an assessment process which was basically an end of year exam which was fairly traditional in it's approach with some influence from school assessed stuff on the quantum on the proportion changed to an acknowledgment that assessment processes had to reflect the actual nature of the curriculum and so there were bounds drawn so that subjects could be designed so that there are objectives which we want to achieve, a student to achieve and have in the range of assessment practices we will use to determine that and it was not just here in a 3 hour exam they will have to sit at the end of November and I think SABSA has started to realise that there is a variety of ways of determining whether people have achieved that but it still tends to be in class or cohorts forms of, if you are doing geography in Year 11 you will have this balance of stuff it's not so individualised that you can say - the teacher of geography can allow that student to be deemed to be progressing satisfactorily by having 50% of the marks on a individualised project, 25% for that and

25% for that but somebody else only 10% for a project. There's not that variability but I think there is that acknowledgment that we now have to tailor more and more the program to certainly cohorts of students and certain assessment processes have to be linked to the purposes of the course or process and not an arbitrary end on thing - but we have a lot further to go on that.

CONTROL OF TECHNOLOGY IN EDUCATION

"Do you think that most people have actually made a decision about whether technology will be used or not?"

No, I don't think people have made a decision in the sense of a specific cognitive process - I think we just continually bump up against new things and we accommodate them. I think it is more a process of accommodating than a stop start decision, new information, decision, it's a rolling accommodation and adjustment.

"When we look to the future there appears to be two views of the future; one, we are moving to a more inhuman society and the other that we are moving into an exciting future. Which one would you support?"

The latter, the exciting one. One would like to hypothesise that as technology provides opportunities for some of the more routine tasks which are undertaken within the manufacturing sector, for example, to be done with fewer and fewer people that, that liberates people, removes some people from that very deadening and restrictive activity. I think our society's problem is that we don't have any alternative employment for a large number of those people so while one says that's liberating, that component actually can also produce a whole range of other tensions in other areas but I suppose my general world view is more along the lines that people are more likely to take a development and utilise it for their ends for the general benefit and the development of society and that we tend to be adept at creating valid and alternative solutions to problems; so for example,

my view on the management of nuclear wastes is that eventually there will be a technology developed to manage that but it won't be such a negative thing which makes me want to join a movement which says you should never build a nuclear power station, you should never do any of those things. I believe we will develop the technology to overcome that particular problem in the same way as waste management can be more effectively managed by using technology, otherwise we are going to drown under a sea of waste.

"Do you think education will be constrained in any way by the adoption of this technology?"

I think that education will be constrained by not being able to resource it adequately. And I think that will be the major constraint and we won't be able to keep pace with the developments as they occur. Although, as we get further into the technological arena the price comes down. As it is now the access to home PC's is now much more accessible because the price is so low - but that is always a problem.

PROMOTION OF COMPUTERS

"Who do you believe has most promoted the use of computers in education? The media, the government, employers, education departments, parents, computer companies, teachers or unions?"

Not overly. I think the availability of cheap PC's has enhanced that so as kids come to school from a home where they have a PC they are more likely to look around and say where are they here because I want to be able to use them, I want to be able to play a game or I want to be able to do something here. So, I think the general availability has done as much as the formal channels. There have been people who have been quite influential in terms of policy makers and decision makers who have pushed it, individuals, I can think of in this department who have given it a very high profile, so I

don't know that I could identify one particular factor but I think the general availability would be as prominent as anything in that I think the world outside of schooling has gone faster than the world of schooling and therefore it's influenced schooling.

EVALUATION OF SCHOOLS

"How do you think schools rate at the moment?"

I think they need a substantial change and it is in that area of methodology, and I think teachers tend to be clinging and because we have got an ageing teaching service where the medium age must be around 40 plus, that teachers skill resort - let me start again - and because there have been some reasonably significant changes to work loads that when teachers are under pressure they are more likely to resort to traditional and what they believe to be safe methods of teaching rather than risk taking, so our current environment actually discourages teachers from taking risks and using new methodologies yet all of the other elements of society suggests that our teachers ought to be risk takers and more developmental in their approach.

INTERVIEW FOUR

COMPANY: EDUCATION DEPARTMENT
POSITION: DIRECTOR INFORMATION TECHNOLOGY
DESCRIPTION: Provides a management role in all aspects of information technology within the Education Department

FUTURE TECHNOLOGY

"What images do you hold about the future society and its technology in which schools will operate?"

I think anybody who crystal balls twenty years into the future when you look back at it they get it wrong, and sometimes I think we over estimate the rate of change but I think in the next twenty years the technology will force changes that will happen a lot quicker than people realise.

If I can use the model of another technology that has been around for a while now, that of television, where on your television you can actually see the places that we only read about in book; for example, the Pyramids in Egypt or the ecological disasters of the Great Lakes of North America, things like that. So that indicates that there is a change coming in education. I think it is coming very very slowly and a lot slower than what a lot of people would like because the resources available to bring these technologies in are not there; or if they are there, they are not perceived at a high enough level to make them be in the front line. They are always somewhere in the background.

The technologies; for example, CD-Roms, where you can put an encyclopedia on a network, 20 or 50 students can do research at the one time and get information not only in the written form but also visualise it as well, because as you know, you can digitalise pictures. Now if you extrapolate that onwards then I see study being less imparting

information as a teacher into you, as a student, and more of we - we are going to learn about mathematics, and we get back to the basic concept of the building blocks of mathematics, not that 1 and 1 makes 2 or $6 \times 7 = 42$. What is the relationship between those numbers and not only do it in the abstract, as we have always done, but you visualise it and you get the children to call it up on a small screen or ideally on a 2m x 2m screen and then try it and you can say 3×3 what does that really mean? What that means that a group of 3 by 3, so put up 3 groups by 3, - now what does that give you? 9, now why is it 9, well 3 groups and 3 in each group, and that thought process, and you can visualise it as well as the conceptualisation and I think that is going to be the biggest change that is going to come and no longer are we expected to accept things because I am telling you; which has been the traditional school teaching model, but we are into a lot of the stuff at a lower level at what were to a university which is the research, the analysis, the assessment and the report.

What Changes Do You See in Society?

While I have been talking about the cottage industries but, for example, I cannot see bureaucracy changing. This is a good model of that. This bureaucracy was decentralised and we went to five areas and, I believe, that they were a reasonable success. They were not as good as they could have been but they were improving and like all bureaucracies having just set the darn thing up and giving them a chance to settle down, we demolished it. Now part of that was because there are too many managers who are fixed in their ideas, and that has got nothing to do with age, and a lot has to do with power and I think power is greatly under estimated when we look at organisations and the other issue is of the resourcing.

It costs money to decentralise whether you do it physically or whether you do it electronically and I am not sure whether if you do it in twenty years time, society will have adjusted to do it electronically. I think we will still need that social contact which is so essential in the work place.

"Does it bother you that Governments may have more control over people?"

I think governments have a lot more control over people at the present time than people realise. I think any sort of electronic technology will just make that easier. I do not think in its self technology is good or bad or evil or whatever.

The issue is whether society is willing to let government get away with it and I am a great believer, very strongly, that if you do not like something you stand up and you tell the politicians and if the politicians will not listen then the next time there is an election then you vote them out of office. I think that the controls that we are prepared to accept really come back to us as a society.

"Leisure time changes?"

The answer is yes, but I think people will become bored with leisure or specific elements of it a lot more quickly than we do at the present time. In fact, just use the analogy there of computer games. I think all ages like them but they are very quickly bored by them.

For example, if you play an arcade game and in a few hours, a few days, a few weeks you have got through and using my own children as an example; they do not want to go back to it again, they want to stretch out and do something else. So, in that one to one entertainment or leisure time activity, then I think that there will be percentage changes but not radical changes or any thing like that.

"How do you think, say, production will change 20 years down the track?"

Well, I think it will increase in certain areas. Anything in the production line, if we do it, then you can design a machine to do it better. Where people do come into their own, of course, is where there is creative thinking, which whether people recognise it or not, that is their innate skills. That is what separates us from a lot of other creatures.

A horse is a good example. A horse once it learns its routine, a movie horse or a police horse or anything like that, will follow the same routine down too dying. A human being will follow that routine and will say there has to be a better way of doing this and the lazy way of doing it; whatever way you want to put it, but it will change it, and I think we should machine out techlike, technologise if there is such a word, 'out' those jobs which could be done better by machines - by the same token, I think that society as a whole has got to bear the fact that we are looking at a change in our work ethic and I believe that there are people who are going to go to formal work, say, what I am doing here now, and there are people who are in different types of work, such as people who may be classified as unemployed, and there has got to be a sharing of the wealth of the nation.

Now I am not saying that all people have to get an equal amount because that takes away the initiative and the reward structure. You, now; people work hard and they expect to be rewarded. It never happens in government. Not necessarily wealth but to some sort of recognition. I hate to see us all irrespective of whether the assistant director of information technology or, I am not derogatory of somebody who cuts lawns, because somebody who cuts lawns, I suggest, has not put the effort into trying to improve themselves in the same way that I have. But that has got to be rewarded, perhaps, that is, on the margin rather than on the whole.

I believe that society should make sure that everybody has a right to a certain standard, but if you have prepared to lift yourself and work hard then you should be able to lift yourself up from that standard and get additional things.

"You may do other work?"

I am a great believer that I should not do this job any more than about five years. I thought of ... the difficulty is, when, years, the head of an organisation such as what I am here, you have to have a vision of where it is going and that is where the difficulty starts because you bring somebody else in here and they have another vision now their vision maybe just as valid as mine, it might even be better than mine but we are going to have a conflict and you put three people in and that's where these job sharing issues work to a certain degree, but you need somebody, right or wrong, to say, right this is where we are going and this is how we are going to do it.

If people thought very seriously about what outcome of, what, 20 years in the future is going to do regardless of what job they are in, if they really thought about the preparation for those people for those sorts of futures, if they are accepting the sorts of future you have been addressing well I think some people are, I mean, the Commissioner for the future and people like that, some of the think tanks we have here in Premier and Cabinet for example, do it. There are people in this department who do that as well; I do it. Not twenty years on but five years.

The danger is that you get too many people who become almost revolutionary in the fact that it's got to change and the thing to realise, I forget who created the thing, but it's government especially, and it's greater incremental change; it is not massive change and we see that every time we change political parties in government. Who ever comes

in thinks they are going to make a mighty change. They are going to do this, they are going to do that, going to do that and the other, and when they look at it they fiddle with the margins and that's it.

And we have a Director-General here who for four years has struggled to change the direction in which the Department is going and I applaud his concepts which I find very very disappointing in the way in which it has been done. It has been done through the fear and coercion rather than through leading and co-operation.

People then spend their creative talents thinking about ways to stop it. If it's worth making, let's go.

"What I think you're saying is that it is a very changing world and 20 years ahead it is almost inconceivable to actually put a picture together?"

I find it incredible to think that in 1969 I was sitting in front of a black and white TV set watching man step on the moon. Now that was in 1969, that was twenty two years ago; that's nearly half of my life time."

COMPUTERS IN EDUCATION

"Yet the things you're doing now are going to have an impact five to ten years into the future and it's going to affect the type of education on those kids as they come out of the Schools."

"What impact are computers going to have on relationships?"

I think it will be getting back to the old Greek concept of tutors rather than teachers. Teachers is a, I believe, if you look at the history of education, a fairly late development which really came through in the 19th century when we adopted mass education for the first time. If you go back to the way in which the Greeks did it and other similar

civilisations, there was a much closer relationship between the tutor and the students and I think we will see that come back.

The teachers will share, and we may not call them teachers, will be sharing those experiences with the kids. There will be a much closer relationship. I concede the fact that classes may well become slightly smaller but I am not a great believer, that, I sincerely hope it never happens, that my son is at home and your son is at home and the teacher is somewhere else and they communicate through the medium.

I think what will happen then, we will lose our capability of socialisation. I think one of the greatest benefits out of schools not only in the formal learning but in the sport and other activities is our socialisation, and people learning to mix together to accept individual differences and to realise that just because you're black or you're red or that you have only got one arm or what ever, you are not really that different from what I am. Learning will become far more individualised according to some writers.

"Do you think all this technology in education will improve the learning?"

What do you mean by learning? We will get back to a fundamental question.

"I am using it in the very general sense, learning experiences, gaining knowledge, gaining skills."

A lot of people think learning is stuffing facts into people. I believe that we never stop learning through the osmosis effect. The intensity of learning may reduce but for example, just sitting here talking to you is forcing me to focus on things which I may think of from time to time but I have never focussed on particularly well. It's a different experience, an additional experience and making me think and that is learning.

"Will computing have a motivating effect?"

Yes, I think there is a time for individual research and if that is all we ever do we will become so dam intolerant, because I know, because I have learnt it, and you know because you have learnt it but we have never ever got together and exchanged what you have learnt and I have learnt so that we can modify each other. So that's the worry that I have. If we went down this track to complete individual learning then we just become a mob of more intolerant people than we already are now.

"You are also saying that some of the trends in education are a bit of a worry to you."

I really do not know. I have two sons and two daughters. They all use computers but my oldest daughter is 17 and in matric, is not interested in computers. She uses the computer as a delivery mechanism for doing assignments. My younger daughter who is 10 uses the computer for writing essays, also for other experiences; she likes playing games and she likes learning because we have from some very simple databases to do with dinosaurs. Now she is taking information from it and she has made a poster of it and she is taking it to school, today actually. She is actually into the experience of computers - then she wants to share that experience with others.

Others are doing it as I did it for the individual, but she is showing that she is not only doing it for herself but to share those experiences with others. That is the way I would like to see it going. That is a good model.

"Will computing assist students career needs?"

You cannot stop technology. I really think it will become part of our life experiences and we accept the telephone but most people do not know how it works. They certainly do not know what a switchboard is or what a switching mechanism is or anything else like

that but they accept it. My beliefs is we have microprocessors in microwave ovens. Nobody gets terribly excited about it.

"Will computers improve creativity?"

My kids are much more, and I am using my youngest as an example, she is a computer kid. She has been using a computer from 3 onwards. She is much more creative than what I was at the same age. I will not sit down and paint a picture on a screen and I will not do any drawings. That may be a function of age; I am not quite sure. But to her it is just another extension and a bit more frustrating because you do not have the freedom. The technology is not free enough at this stage. And I suspect that it is another reason why a lot of children warm up to Mac's rather than PC's because the Mac is more friendly. We use the word friendly but the boundaries are not as visible.

Teachers are behind the kids. There are no two ways about it. I do not think that is an individual teacher's role, it is the system. It is the education system that is not. The education system is about two generations behind where it should be.

"What impact will the use of computers have on equity?"

Let's use a model of a different technology and that is the School of the Air. It did not matter whether you were on a small station or a large station, you had a radio. Now the radio had certain fundamental properties. It might have had a few more bells and whistles and some, but for all intense and purposes they were a piece of technology that met your needs.

If you have a look at those beasts that are sitting here you have got to ask yourself why are they improvements and the answer is because somebody somewhere thinks they can make money out of them, but if we were honest, we would say that with a

reasonable amount of effort the PC's that we had eight years ago would do damn near what they do today but a lot quicker and the other issue is that we create libraries of software so that if the class is doing graphic design then the department or school or something has a library of software so that it does not matter whether your dad earns \$100 million per year or not even employed, you can use, and this gets back to this concept of the society making sure that individuals in it do not fall below a certain level.

"That seems to be the dividing line. If in fact it is used as a library then it seems it will not be a problem. If education were to change radically then we may have some equity problems".

That is the nature of the human animal.

"But your personal belief is that will not happen?"

You're asking me to predict out 20 years. I would be disappointed if it did happen. I have a sneaking suspicion that elitism is a problem and we are not going to get rid of it in the next 20 years.

"Efficiency and effectiveness in education?"

Well, I get hung up about efficiencies, I would like to talk about effectiveness and in this place we normally are - our lord and masters or lords and mistresses keep hammering the issue of efficiency. I have done method study in industrial engineering and efficiency is just a measure of input over output or output over input. I am much more happy when we talk about effectiveness. I can demonstrate efficiency, I can take every file that is in there and put it in there and that is a measure of efficiency. I have got rid of them. Effectiveness is how I have dealt with them.

"Let me put it more bluntly, some people have suggested that fewer teachers will be required."

I do not think it will make a lot of difference. If learning was just stuffing facts it might but it is about relationships and I do not think society will tolerate that much change.

DIRECTIONS FOR SCHOOLING IN THE FUTURE

"Will computing effect the future of schooling"?

Do any of the following descriptions meet your image?

A place which conducts lessons as at present but which uses increasing amounts of computer technology for learning.

A place from where students' progress is managed, records kept and advice given but with much of the learning occurring out of the school in houses, libraries and other public institutions.

A place where students spend time on individual study programs monitored and recorded by computer.

A private company which manages computer learning programs for individuals for a fee in their homes or in small learning centres.

A place where students gather for group and social activities but specific knowledge is gained personally using computer technology.

A place which becomes irrelevant as technology removes the need for separate institutional education and replaces it with centralised data banks of learning material which can be used as required throughout life.

None of those described.

Not in my model. The nearest one to my model would be the fifth one.

INTERVIEW THREE

COMPANY: IBM AUSTRALIA
POSITION: SALES CONSULTANT
DESCRIPTION: South Australia agent for the multinational computing company
IBM

IMAGES OF FUTURE

"What images do you hold about the future society and technology in which schools will operate?"

I think it will greatly change our lives. I think that you can see if you look back the way technology has changed our lives and the way we go about things whether it be the technology of the television, the video, the automatic teller machine. So you can see how technology enters our lives in everyday, and how it has changed the way we live.

"How will it change our lives in future?"

Well, are you talking about? Generally, it's technology. Well I, you may not need to get to places in the future, I think a lot of things will be done from home, I think that a lot of work can be done from home so that you may have a link through a computer to your office and be able to deal with people across the computer screen. There is no reason why the telephone will not be linked to your computer and you will be able to actually have conversations seeing and hearing both ends, as though you are meeting together. However, it will be across a distance whether it will be within the Adelaide district or Australia or across countries. You will be able to move information across those like you might do today, with a video conferencing facility you will be able to pass information between each computer set up, so there may be no need to meet face to face as such, or to move out of your house to go to work. The same with shopping, banking and one can see the beginning now with a teletex type system that is available on the television, I can see in the future that a lot more will be done, I suppose not by

mail order but by computer order, so that there may be no need to have supermarkets where you go to look around, you look around through your computer to see what you would like to purchase, and so again for banking or shopping, no need to go outside the home they will be, things are delivered, basically. As far as your social life, you will open up more time for social interaction on a social basis as opposed to force from a work or a, all those other things like shopping, banking etc, so it can have, I think, positives and negatives from that point of view. I think a lot of things will be speeded up that you do, like your shopping etc, so it may give you more time for your sport, but I think that the important thing is we obviously do not all sit on our bottoms in front of a computer screen for the rest of our lives or our children do not, that they need to, I suppose, balance their time between doing those sort of things maybe at home, you could look at school. I suppose a bit differently is what I would say that there still is a role for that social interaction, so as much as people may say that technology could now deliver what you are learning at a university, I think is still important to have tutorial type system where you do interact with others and as with work, you might work at home four days a week but go in on the fifth day for that interaction and meetings or you can meet across the computer screen. I think that it is still important to have the social interaction. I suppose from a school's point of view I think we will see technology used so that teachers become more of a consultant and any of the facts taught by, you know, CD-Rom across the computer or whatever technology is after CD-Rom so that there is a lot more depth and children can self pace themselves, but then join back into the class for general discussion. I think you will see people going a lot further in that way and that teachers, as I say, will have to be more like consultants than teachers because the facts will be taught by computer not by the teacher.

"Is privacy a concern?"

I do not see it as a real concern but I can imagine some people would, it's very easy for

information to be accessed because, you know, there will be some time whether it be in the social security number, here, something else so that there is a trigger that all information can be held, so, but then again I think that it can help society in some ways if you look at some of those credit problems people are having at the moment. If there was a better system for banks to understand what sort of debt some people are in we would not have people running up the credit problems that we have today. That is a minor positive versus some of the negative some people feel but I do not see it as a real issue. It is not a real issue for me.

"Will technology and in particular, computers control our lives?"

I do not see a problem probably because of how familiar I am with technology. I think that for those that are unfamiliar with technology they could be quite uncomfortable about how technology could change their lives but for me I think it is a positive move because I think if we use technology or if we utilise technology properly we can gain more. We can do things smarter, we can do things quicker and we can make more time available for things that we like doing, leisure time, sport, you know, social.

"Will technology stimulate a new series of cults?"

Yes, it is possible I think, I mean you could almost look at them now with the people that, what is the term for it, the computer hackers and it could become a cult. However, I think it is important for the technology companies to do a bit more work on the security side of things and also the telecommunications carriers. But it is possible, I think there are probably people in some universities that just about do that now.

COMPUTERS IN EDUCATION

"What impact do you believe computers will have on education? For example, relationships?"

I think the relationship will mature in that, as I said earlier, the computer will be teaching the facts, however, the students as a group and the students with the teacher will discuss the issues, probably at higher levels so that, I would say that, relationships will not disappear by any means, I think in some ways will strengthen because they will be built on more of a consulting style role from the teacher's point of view, and peer to peer it will be more of a discussion focus rather than a competition over, you know, whose going to be the first person to put up their hand to answer this question. that will all be held on a computer basis and people will be given equal, I suppose, hearing by computers which does not always happen in the classroom setting.

"Will learning abilities be enhanced?"

Absolutely, I do not think there is any question of that, I think that the difficulty of a teacher handling students of different abilities is already proven to be a problem in many schools where some children do not get the attention others do, just from the attention point of view some students get left behind or also the fact that leaning disabilities are often ignored and often not recognised and I think through a computer a lot of those will possibly even disappear in that a computer can represent topics to be learnt in a number of different ways, and I think that from my experience people are a little backward with computers, it is not impossible to enhance the learning abilities and also teach people at different levels.

"Will computers have a motivating effect?"

I think that it will motivate them to do more I think especially those who are gifted students they will be able to move further ahead without the constraints currently in a classroom environment. I think for them that are a little behind they will be able to motivate to spend a bit more time on the work to catch up with the general mass of students and that they will be able to actually revise work at home in a way that they can actually get some feedback which they cannot now because once the class is over the teacher is gone. When your using a computer you can revise your work with some input from an expert effectively.

"Will computers improve creativity?"

I think that as long as it's managed it can enhance creativity but definitely not reduce creativity, however, it depends how the computers are implemented. If one, or if the school system chooses to use the computers to their utmost and they stay at the leading edge of technology, then I think creativity will be enhanced, students will be able to do a lot more than they could do today and, I mean, I think you can even just look at the way things are used to design equipment even to see how students can see how something that you could not necessarily do on a piece of paper or even with a lot of fancy tools can be done in an almost imaginary type format on a computer. So I think it can probably enhance creativity as long as, as I said, that we stay at the leading edge and we move with technology.

"Will computers have a detrimental effect on women?"

I think that the gender effects is probably something that comes from the parents of the students rather than the students themselves. I think it is something that may come from some backward teachers which I think there are plenty of around still, so, I do not think it is a gender effect or something that is inbuilt, I think it is society's push and society saying that science and maths is for boys and, you know, needlework is for girls still.

"Will computers help students career needs?"

Well, I think the way that the schooling system is going will make it possibly more difficult to move people back into the menial style jobs because you do see a lot of people then that would probably be more comfortable in the white collar area, however, as far as enhancing career needs, I think, I mean, this country, anyway to keep moving, if we are going to keep pace with other countries in the way that they utilise technology and how that does enhance people's careers so I think, yes it's quite possible that maybe we will see a change in the blue to white collar percentages because people will feel that they can strike further because of what they had learnt using the computers but I think that is a long way off still.

"Are computers more relevant to some subjects more than others?"

No, I really do not think that.

"Will computers constrain education in some way?"

I think that is possible but I think if the education system does that they are not educating the students, I think that it's important just like learning your times tables, a calculator can do that, but you do not always have, you know, it is important for your

now, I suppose, abilities, stretching your own brains, to be able to do some of these functions even though you know it does not mean because you can use a spell check on a computer, you should not learn to spell for example, and that, I mean, that is what could be said about the calculator and then, times tables and I am sure that there are some people who use that as a reason not to learn them.

"Will computers create a problem for equity?"

I do not think it will change the problem of equity, I think that the problem exists today and I think that will, well, just, you know, it will not change, those that are well off have better ability to go to tutors, or go to private schools and may be get better attention etc today, and I think it just may be spent in a different way but I do not think there will be any change, so yes, I think the problem will still exist.

"Will schooling be more or less effective and efficient if using computers?"

They will be huge, huge and like I said I think it will free up the teachers to, to do other, to perform other roles so that I think, not that we will not need the same number of teachers, they will need new skills.

FUTURE OF COMPUTERS AND SCHOOLING

"How do you believe computing will effect the future of schooling?"

"Do any of the following descriptions meet your image?"

A place which conducts lessons as at present but which uses increasing amounts of computer technology for learning.

A place from where students' progress is managed, records kept and advice given but with much of the learning occurring out of the school in houses, libraries and other public institutions.

A place where students spend time on individual study programs monitored and recorded by computer.

A private company which manages computer learning programs for individuals for a fee in their homes or in small learning centres.

A place where students gather for group and social activities but specific knowledge is gained personally using computer technology.

A place which becomes irrelevant as technology removes the need for separate institutional education and replaces it with centralised data banks of learning material which can be used as required throughout life.

None of those described."

I would say, management learning only, I think that teachers will be involved in the management of learning but like I said, also, this is a consulting process so they will manage the process so the computers can manage that almost as well. The computers will test and assess, the teachers will not. They would do, the fact based testing will be done on computers, the consulting will do more of the user style, how they may relate to people. It may not mean the same timeframes and the computers may be available at school or they may be available in another format, however, I think it is still very important to have the school facility for, whether it be, the discipline of students still having to spend some time doing this sort of thing, the social interaction with peers of the same age and abilities and different age different abilities, there is no reason why a class in this environment should not span different age groups as well. I think that, like I said, that the teacher will manage the learning process probably, but also act in this consulting style role and lead discussion within a class.

"Will the use of computers change the role of teachers?"

They have to do a massive relearning process and in some cases part of the problem is going to be the people that are teachers now are not going to be capable of this new role.

"Have most people made a decision about using computers in education?"

I think people think that their students will still go to school and that they will go in and they will use the computers to teach them typing. I think a lot of people do not understand how computers can be used. They can be used for learning to do a user word-processor, or learning to use a spreadsheet. They do not think about how you can apply that. 'Inevitable' - absolutely.

"Will society become more inhuman?"

If it is not managed well, if the opportunity is there to go without social interaction, it is possible that society could become inhuman.

"How much choice do we have about using computers?"

I think, if we do not we might as well, you know, shave ourselves off from the rest of the world because we are just getting so far behind.

"Do you believe that schools will be reshaped?"

Absolutely, I cannot imagine life without it now.

"Is the future exciting or frightening?"

I think for some people it could be very frightening, those that are currently illiterate, but I think it's good to see the number of people that are trying. People now that have

children or are going to be bringing children up in this new society are starting to try and learn with their children and they are the ones that are going to be the winners.

"Will teachers lose control of the curriculum?"

Teachers within schools I do not think have control of the curriculum now so I do not think that will change. I think curriculum is set by central departments or government, so it is being delivered through computing rather than through teachers.

"Constrain education"?

No

PROMOTING THE USE OF COMPUTERS IN EDUCATION

"Whom do you believe has most promoted the use of computers in education?"

Media? Not much

Government? Very little

Employers? Non computing company employers. Employers generally - no

Education Department? They have done what they can do with their constrained so called budget.

Parents? Uni, yes. I think parent have done quite a bit considering what they know, but then again I think that there are unfortunately a few parents in each school who think they know everything and maybe do not understand the full implications and the full abilities of using computers in education.

Computer companies? I think the computer companies, if your talking about hardware and software, I think, yes they are the main, the main sponsors or the main people that are trying to promote it. I think that, the difficulties are that there is no

money in it for the computer companies and so they do what they can and I think that, you know, the thing is a prime example. However, what are they promoting? Apart from hardware, in my opinion, nothing. It is not the total concept it's one of the smallest portions.

Teachers? I do not think teachers are given enough education. I have spoken to a couple of sessions of teachers and they just blow their minds with the sort of things that I have been able to show them. They really have not got across to the technology.

Unions? I probably really do not have an opinion, no that I know of.

EVALUATION OF SCHOOLING

"Are schools currently satisfactory?"

Not really.

"Do they need radical change?"

Well, I do, I do think they need radical change because I do not think they are implementing the technology available today and if they are not doing that today, when the students get out there, they are going to be seeing something totally different in the work force.

"Are schools irrelevant at the moment?"

No, I do not think they are irrelevant because we still need to learn these facts however we learn them, but I do think that we need to move to, to teaching students, on, you, more about what they need to know when they get out of school rather than just the facts.

"Will schools in the future be the same?"

I think we need better teachers at the top, at the top of these education departments to move them into the, into the real time, and I think part of the problem is that people at the top of these organisations are just moving funds from the bucket to another and not looking at the total problem or concept of education.

"Anything Else?"

I think the teachers are going to need a massive reskilling or teachers will not be suitable as teachers and maybe industry will be the teachers. I do not think they are doing it now but I think in the future that they, that people from private industry, whether it be, I do not know, you know, people from computer companies or people from wherever any have better, consulting, discussion leading skills than the current teachers and may feel more comfortable in that role.

"People moving in and out?"

Absolutely I think, I mean, I think it would be a good development exercise from both sides of the camp.

One where students go for group and social activities but where learning of specific knowledge is gained using computer technology.

But that does not go far enough. It is part of the way there.

"Will the role of the teacher change?"

Implies some changes in the educational process. In the training in the philosophical argument.

I think a lot of problems with children stem from two things. One is the home. I am not sure that a lot of people are fitted to have children, but accepting that as a given, children have behaviour problems because they cannot be compressed or fit in with the way that school wants it and they are bored. Let's be honest, schools at the present time, you either look after the bottom rung or the top rung, where as the guys in the middle who are the majority suffer as they suffer at each end, and that is a fact of life not a criticism of teachers as such. My belief is if we enrich the learning experience in the school then we will see issues which we identify as behaviour problems at the present time will reduce.

We will not get rid of them but we may well find that there are other manifestations around the place that are an output of the technology such as this mob who insist on writing viruses. But I believe that the behaviours of children change as we extend them, so if you sit them in a corner they will get bored and react. You keep on stretching them, well they do not get time any more.

"What about their role as Counsellors and Study Advisers?"

Well if you look at the model I suggested, teachers becoming pedagogs, then I think that is part of that. It also puts a damn site more responsibility on teachers. I am not sure that teachers are equipped to do that. A lot of our teachers now finish up as social counsellors because there is nobody else to do that.

"Are teachers just child minders?"

I think that society changes a lot slower than most people want it to change.

Writers of computer programs, or just users of them?

I am not a great believer in reinventing the wheel. Although it may come to that because I ran a programming department and I only want to do a job once and then get on with something else, but there are people like programmers who are more than happy to rewrite a program 50 times if I let them. As each time they twig this, change that and buy something else. What that does come back to the effectiveness. What that does for the effectiveness is not worth writing on. My belief is nothing an individual can do, this is a general statement, can equate to what is available off the commercial software market.

CONTROL OF TECHNOLOGY IN EDUCATION

"Do you think that most people have made a decision about computers in education or let them wash over them."

No - let them wash over them.

"Do you consider the question of computers in education inevitable?"

Yes

"Teachers will have to use computers in education?"

In the next twenty years I do not think that it will come in to such a degree that every teacher in every place will have to use them but one may find - what I call the parachute effect. If you want to deploy a big parachute the drogue comes out first and fills up and drags out the rest of the parachute. A lot of teachers I know will not have a bar of computers.

"Is a computer society inhuman?"

Provided that he does not internalise it then it is a better thing. I am not saying that it is good or it is bad. If it encourages us to become more and more individualised, sort of turning inwards, then I think that it is a bad thing. I think we have to keep our socialisation going.

"Will people be given a choice about where the technology will be used?"

No; because I will tell you why. You do not get a choice about whether you will use a micro processor in your microwave or video recorder or your car. We all know that if you have a car from about 1984 onwards you will have a micro processor in there irrespective of whether you are a luddite when it comes to computers or not.

"Will schools be reshaped by the computer?"

Which of the following descriptions do you agree with?"

- Schools are satisfactory as they are?
- Schools are in need of radical change?
- Schools and schooling systems are becoming irrelevant?
- Schools will always be the same?
- Or none of these.

I would like to think that the learning environment becomes more intimate and I think the outside shape remains the same.

"Schools - where are they?"

I would be happy with a word other than radical ... I would put progressive change. I often get accused of being radical myself.

INTERVIEW NINE

COMPANY: EDUCATION DEPARTMENT

POSITION: TECHNOLOGY ADVISER

DESCRIPTION: The Technology Adviser provides a service to the various arms of the Department regarding the ways in which technology may be used in education.

TECHNOLOGICAL FUTURE

"What image do you hold for schools and society in a technological future?"

It's pretty difficult to predict the future. The only thing you can do is look at any extrapolation of what exists now. There is no way you can take account of quantum leaps that occur just because of their very nature. So, if one extrapolates through now then clearly there will be an increase in the variety and messages put over the electronic media. The variety of media will increase in terms of the actual artefacts and the ways in which it is used to influence people; What they do, what they buy, how they are entertained are also increased, in fact, the way of doing this seems to be narrowing down so that everything comes to be transmitted using digital data techniques, and, really, all we will look out for in the variations is in the nodes at the end.

I think that will become more personalised. That portable television, portable communication devices of various kinds will increase in scope. Portable phones and they will have, one of the applications of those, effectively, is a security device. You have a portable phone which can be turned on at any time, you have the means of contacting anybody if you need assistance. Portable video, portable faxes, more fax styled machines. I think faxes are a general subset of general electronic information service. Portable music; the whole range of things that are available now so that's one aspect of it. They will also, I think, extend. You will see, increasingly, a decrease in the

use of cash and an increase in the use of credit, so credit transaction and all the things which go with that being done electronically, there will be a significant increase in that area.

"Very much moving to a cashless society do you think?"

I don't think in our it's very hard to change something like that under several generations because of people's habits. You can cut out one or two cent coins but there are still billions or millions of them sitting out there because people are hoarding them. Society is not cashless in that sense. I think there will be a reduction in the number of applications in which cash changes hands.

"Do you think that if technology is becoming, I mean, in one sense there's going to be more technology that's the sort of picture you are painting and we are going to be involved with it much more, at the same time some of it will be less obvious?"

Well, yes, I think so, the infrastructure that's there will be less obvious. I doubt if you were to ask many people now what the extent of fibre optics networking of South Australia is, whether they would be aware of the extent fibre optics has been installed to major suburban and country nodes in South Australia. In a little over a year's time there will be a new satellite put up which has the capacity, will have the capacity, to receive, send signals which can be received in something a little over the size of an A4 page, won't need the bulky receivers in the past. It won't matter to people, to you or me, it doesn't matter whether the signal comes via satellite, fibre optic, micro wires, or whatever, that structure is invisible to us. What we're concerned with is what's transferred and what's the mode, what are we sitting with in our hands.

"So that has an effect on what we know as work or how we might work?"

It may, it will have a larger effect on personal lifestyle, entertainment, and of course there is the application of this in education or open access to education. There is a proposal currently before government which is being worked on to provide Australia wide education through various aspects of television, either broadcast or narrow cast. The implementation of that is planned within 5 years. It was announced in last Saturday's 'Australian'.

"And, as you say that is going to have implications for education. If in fact technology is going to be much more a part of our lives, I've got to be careful about that as it is already a large part of our lives now. Amongst some of the literature is the suggestion of new cults of technology, notions of worship of levels of technology. Do you have any view on this sort of thing?"

I don't know about the worshipping but you have to be fairly careful to describe what you are talking about. We use the word technology fairly loosely. It refers to artefacts, the things we make. It refers to processes by which we make those artefacts, the type of processes and it refers to those organisations and structures in which those processes are made. We talk about a technological society we talk about a structure.

"We are also talking about the possibility of quite mammoth computer systems which have, possibly, capabilities we are not yet thinking about."

We already know that it is technically possible to put a library into a one inch cube. Extracting the data, information, that's another issue. That's part of the problem, the interface with people, that's part of the problem but to go back to what you were talking about worship.

Last weekend, why did 100,000 people go to the Grand Prix, that's rampant interest, worship, I don't know, in machines that are true modern technology, and in fact, it's not the elements that caused the race not to be run it was money, marketing, television tied up in overseas television, they could have quite easily have delayed it two hours, the weather blew over in two hours, by 4 o'clock it was clear and the roads were dry. They didn't go on with the race then because they had missed the international television spot, which meant that it could not be beamed around the world which meant there was no money in it, which meant that it was not worth the risking the machines. So the worship side; in some ways we do, in some ways, it's obvious.

"That also raises the point of some sort of restriction by the technology."

Who puts these restrictions on?

"We do of course"

Do we? Whose we?

"Well, let's put it this way, within society there seems to be restrictions, well that's one of the things we need to ask ourselves. Whether in fact there are any restrictions or whether, in fact, they are self imposed or governed by groups of people, or what ever."

Well everything we do is socially constructed to an extent. If we take the example say of biology and aspects there. About 10 or 15 years ago there was an international ban placed on genetic engineering because it was feared that things could get out of hand. We could change the human genome in a way which may be irreversible but with greater information being developed, research in that area is now going ahead so at one time there was a ban or a restriction placed by a very small group because very few people understood it. That ban has been lifted to an extent although there are still strict

precautions but the implications of that work, mapping the compositions of the chromosomes, has enormous repercussions if a group of people will need to know about that if they are going to make sensible decisions.

"You mentioned earlier, privacy. Does that raise any concerns about the fact that there's all this information that's able to come to use because of the description you have already given us about a very intensive information society. Does it give you any concerns about the questions of privacy and control or government interference or anything of that nature?"

The knowledge that's held, the information, is there already. All we are talking about is accessibility in different forms. The individual human being has only got so much time. Nothing has happened that has increased the capability of the brain that I am aware of, so, in some cases having access to much wider set of information will make absolutely no difference because people tend not to use it. Well, not in general, they will turn to more specific things in which they have an interest in, but certainly as soon as you make stuff more generally available you do have to look at privacy considerations, and it may be easier in some ways to relax more general privacy legislation with everything held electronically in a common media, than it is now with information held in a wide variety of media and relatively insecure; physically insecure.

"I haven't heard that argument put before."

Again it's, it does depend on what you regard the current level of security to be and what could be imposed electronically.

"I dare say most people are not aware of how much information is available about them which is well and truly available about them at the moment."

I could give you a folder at the moment in a locked box. If you broke the lock on the locked box you could read the folder. I could give you an encrypted disc in a locked box and you broke the box and you tried to read the disc on your machine. Now, unless you are extremely expert you won't get to it. So, the stuff which is in written form is more generally accessible once it's in front of you than if it was encoded electronically.

COMPUTERS AND EDUCATION

"If I turn from that one now and turn to computers and education I really want to pursue a couple of areas."

We do know that regardless of what the Department or the schools might think parents also have views about what they ought to be getting out of the system and also have some views about the technology which is being applied, computers in particular. It doesn't matter whether these views are accurate or not the fact that they hold those views is putting pressure on the system to respond.

"The first one I wanted to ask you about is: How do you think with increasing use of computers in schools, both for delivery purposes and for other uses, how do you think that is going to have a bearing upon relationships. Relationships between students, between teachers and between student and teacher?"

Well, there are various levels of the impact of computers on schools. Clearly with the move to greater devolution to schools and schools are in most country towns the biggest business in the town then the administrative running of the school, staffing, scheduling, student records, etc, has moved into a computerised form and that has an impact too in terms that tends to set an agenda for the structure within which education operates

within the school. You have a computerised timetable. There is not always the same flexibility within that than there might have been with manual methods. It might be more efficient overall for all students but it can remove flexibility within that structure and does effect what can happen within the School.

But I won't talk about the admin side of it.

The use of computers within the classroom, it has the capacity to **increase** interaction. Some of the research which is around shows that the image of a single student sitting in front of a computer isolated is an erroneous one. You only have to walk into a classroom to see that. Usually there are two or three kids interacting, depending on the nature of the program, and there is a fair bit of give and take between students. I did some research on this some time ago on the IBM project we ran here. The interaction of student student was high the interaction of student/teacher was high, in fact, far higher than in conventional teacher centred approach.

"That was what I was going to ask you; do you think that it increases or enhances that?"

It can, it can be used to decrease it. In some areas if we are looking at this training then using computer assisted instruction with the student, whether it is a network situation or a laptop or whatever, then clearly that is a one to one, one machine one student and a fixed agenda which is training, not education, but that also leaves the teacher free to interact with a smaller group of students rather than the teacher trying to be the trainer.

So, again that has the potential - it depends on how it is used. At the other end of the scale and something that we have been using computers here for, and it's been our policy with the computer, as a tool, to make education more effective. If we take an

example within, perhaps, a practical physics class. One technique of exploring motion in the past was to photograph, set up apparatus, laboratory apparatus and to take multiple flash photographs of a moving object and to use those photo flash photographs to analyse the motion of the object and therefore, learn something about speed, velocity, acceleration. A better, better technique that is now being used is to use a distance sensor similar to the ones used on a camera, which feeds information directly into a computer and the computer processes that and displays a graph of displacement, or velocity, or acceleration versus time instantaneously, as it happens, so we've cut out about forty minutes of busy work.

"You're into the conceptual stuff"

That's right. You can see the mathematical representation of the motion at the same time as the motion is occurring and the object can be you so you can feel it, see it, do it all at once. You can do it, you can repeat it twenty or thirty times with variations in the classroom and get at the underlying concepts, so, in that sense you've improved the interaction by using technology.

"That leads on to the next one which suggest, in fact, and most of these questions I'm asking are derived from the literature in one form or another. It doesn't mean the literature is right, much of it is speculative. One of the pieces looked at learning ability. I was wondering whether you thought the use of technology enhanced learning ability?"

It's not a question you can really answer because you have to decide what is learning ability. Do you mean access to information, access to a range of activities. Yes, it can. If you mean the innate learning ability of an individual, one doesn't know what that is. I couldn't really answer it.

In terms of the capacity to become engaged with something in a variety of ways, you may have seen the video disc of Mozart's Work, you can play it, you can stop it, you can play little bit's, you can go off and see where Mozart lived with the pictorial images of the time, it will put up the score at the same time as you're playing it and move it along. That provides a lick.

"Are you saying that it enables you to get closer to the material in more variety of ways?"

Yes, a double edged sword always. It can bring an individual closer or in the same way it can lock you out. If it's applied to the lock step single person directed thing like every teacher standing there saying, "you may now push enter, you will now push one", that's not enhancing learning, the sword cuts both ways.

"What about motivation. They seem to have made a big thing of this in early literature. Do you think this is a motivational factor at all?"

It is for some students. It can be a real turn off. For some kids give them a can of worms and a question and that's highly motivating to find out about worms. There is no technology involved at all. It's really how one builds on natural curiosity and exploit's, exploit's is the wrong term, uses the natural curiosity most people have.

"Of course, most classrooms are geared in such a way that the questions kids are asking are not in step with where kids are. The question, is whether computers are able to because of the variety of levels at which they can approach it, whether they can more satisfactorily answer the kids natural curiosity as opposed to the manufactured one."

Most of the stuff that is pre-programmed because of the, I programmed a lot of this stuff in the past. You've really got to predict what the major responses are going to be and allow for your response to come back on that limitation of space, limitations of your own capacity to think up what's possible to ask.

So really, at this stage, with technology at it's current stage, allowing students to use generic software or communication software to get access to information, to process data and to leave the curiosity to them, you can take out a lot of the drudge which in effect is motivating. I'm not, I've seen some stuff presented in the games format and that motivates some children. I'm not overly enthusiastic about games but if it's a way in for some students, well I think you've got to give multiple pathways.

"The games makers have been trying to carve out a niche and to claim that that is the whole of education from their perspective for some time."

Life is a game.

"Actually, the survey of this I did amongst children showed that some of them hated any form of computers and were quite happy to get it through much more traditional forms. What about the question of creativity, do you think with the technology available and the way in which it operates, do you think it is actually going to sponsor opportunities for creativity with kids, more so than in the past?"

Yes, you can and there's evidence that is the case, but often if you're somebody as stupid as I am, if you want to determine a design I'll sketch it first and then use the machine to extend those sketches in ways which would not have been otherwise possible to them and the same with music, a lot of children have been locked out of music in the past because of just physical inability to operate an instrument. Well, if you

can input the notes slowly and then think about them, edit them in the same way as you would a word processor and then play it back and build up an orchestra. Yeh, and that allows you to work in an extended timeframe and then compress it for the final result.

The same way with some of the design packages, by being able to put something in, rotate it, explore it, get the machine to do all the line drawing stuff and then look at it from different views, different lighting, you can reject bits, reshape it. The potential is there for enhancing creativity.

On the other hand, you can stifle it, if the machine that is being used, the software, is limiting the student, where you're frustrated, I wanted to do that. I don't know how to do it. It will only draw this line from here to here, I wanted it to go from there to there, I'd rather use pen and paper.

"I suppose to some degree it depends on the developments of computers and the freedom that the new developments may or may not create, certainly it's getting easier to use computers. It's interesting that most people have the belief that it will enhance creativity."

"I will ask you the obvious one - gender effects. Do you have any reason to think that's going to be sorted out using computers?"

There is a fairly significant body of literature that says that there is gender bias in technology, in society overall, and I think that is one of the social constructs which dominate the world in which we live, does place people in particular roles.

I think that it is changing and technology has the capacity to hasten that change. Because it is opening up a whole new range of activities which means that people could enter those activities without the inertia of the past. The main problems are where

males and females are looking at established activities which may have had a bias one way or the other, like nursing; women, or construction; men, or management for men. More men are involved in management.

It's when you're looking at the older structures and you are looking for a better balance that is more difficult to achieve but certainly, within schools there is evidence, clear evidence, that there has been a bias towards boys rather than girls in some aspects of the use of technology.

"One of the problems which have been put forward regarding the computer and the gender effect is that boys have been quite happy to sit down and work on a problem with a computer individually, whereas girls prefer to do it through group activities, and whether the computer actually enhances, that is the question."

Well, I've seen, if we take examples

I mentioned that physics program, I've been in the classroom there, there's no difference boys or girls.

The notion of preferred learning styles does depend on the social setting and the social background. There are girls, quite a significant number of them, who prefer to operate individually and prefer to work alone. There are boys who prefer to work in groups. Preferred learning styles I think there is a socialisation, the socialisation factor. Certainly, all the research says it's there. I think it's because of the hypertension on it, it's becoming less of an issue.

"Yet, the public still believes very much that this is a very strong point."

It's a perception and because it's a perception then it has to receive continuing attention.

"It is interesting that within the education sector this has been dealt with by saying from our experience this is not a major issue."

It's an issue. There have been ways of approaching it like single sex classes. We have one position to the Technology School of the Future. I created a position there which was for women only. We ran a women in technology program, women only and girls only. There are those areas where there is evidence that girls have not had access, stuck at control technology; ah, but once you overcome that initial barrier then you can run heterogeneous classes quite successfully. The problem, actually, is the home experience in that those in groups are different. Boys may have been encouraged to tinker, to play, the girls might not, so if you can bring that in as a single sex environment and to get them to have confidence in their ability, then when you bring them together the girls and the boys, compete is not the right word, but they are able to carry through the activities quite successfully. We found this with logo technic and year two and three students; no problem. It is only when you are looking at bringing together older students who have different experiences.

"I can tell you a story about a lecturer friend of mine who was busy telling everybody about years, working very hard at this because it was part of the program and all the people participating and then finally as the lesson ground on as he was talking about the angle of gears, lubrication and the flow of motion, this girl put up her hand and said, 'Sir, what is a gear?' Brought him to ground very quickly about establishing where people are to start with and he had to put a lot of work in to it after that. He related the story to me so it made a big impression on him."

All the boys now, as young children, have no direct interaction with the sort of things which might have happened in the past with tinkering.

"I think that's really causing more of the changes than otherwise because I am also staggered by the number of boys who have no idea, and yet we seemed to, I don't know how it happened. Perhaps it was a time in history where we had to tinker to get things to work."

Less prepackaged material, less final product, you had to build it yourself.

"What about the career needs of people do you think that computing and the demand, if you like, from the parents and others and the outcome that is, what people must do when they leave schooling, is an important factor?"

There is probably a perception that some skilled knowledge in the use of information technology enhances job prospects although in the current state of unemployment that is a bit curious but I think it is clearly there. There is also a significant fear amongst the general community that technology is de-skilling and it's true that one becomes an operator of a machine where as one did what the machine did and therefore had a set of skills.

So there are two views, one is that you have to be able to be confident with and use machines in order to operate in society, the other is the de-skilling.

"I put that view to a Principal about the way the technology could de-skill because he was a very firm advocate that you all had to have lots of computing skills because that's the way everybody was going. When I pointed out that many people working in industry effectively are being de-skilled by the technology he was shattered. It had never occurred to him."

A lot of the skills you learn are throw away skills. How to load a disk, how to access an application. In five years there will be different forms of media, different forms of access, different applications, those skills are critical now but different skills will be critical in terms of the mechanics. How you employ that tool in a more creative fashion, that is the key to de-skilling, it is moving your skill level up away from some of the mechanical aspects. If you put people in a race with technology they are going to lose.

"That's not a view that is well understood by many people."

It's true; we no longer see bank workers and insurance workers sitting over pads with paper and pencil. We no longer see people on assembly lines doing every task simply because, for one thing, they were menial tasks in the first place, and machines do the job better and cheaper. We have to look at people doing what people can do best.

"Do you have any thoughts about the relevance of the technology to various subject areas. Do you have any notion that you can use computers any more logically to say science subjects rather than arts?"

No, I have no worries about that; Information Technology is at the basis of the lot, every area of study and the computer is a generic tool.

"The one worth pursuing is the redundancy of current knowledge. If we move into a society where information is much more readily accessible. The question we have to ask schools is how valid is the current curriculum?"

The content of any curriculum has to be constantly under review because it's got to relate to the society in which the schooling, education system is embedded.

I'm not an advocate of content free total process thing because all the research indicates that context is important and the context is what makes observation scientific. The context, the scientific context which is important, you observe in english, you observe in, art but scientific observation, you don't teach observation you teach how to observe something in a scientific manner.

"That puts content into a relationship with knowing and knowledge and learning a little differently than what's often used at the moment, where in fact, content is seen as important in it's own right."

Aspects of it, at any particular time, will be! You need to know how to access information, but you need to know what is there to at least have some idea of what you're starting with. In order to operate in the world, each of us has a conceptual framework within our heads which is built up in many ways from our experiences. That our education, in effect, provides a relatively common set of experiences on which that conceptual framework can be developed and built, and once you know how to do something in one field it is easier to transfer it to another.

"The next one is a question of equity. It runs something like this. If technology becomes more commonly used in educational processes, and as some people would have it ,more widely available in the home, as well as in other places, then that raises the question regarding those people who have access to expensive, latest, top of the line, both hardware and software. Does that cause a problem for you generally?"

It does now. It's no different now from a hundred years ago. Some children then would have come from homes where there were personal libraries. Other children came from places where there were no resources at all. It is really saying that it is accentuating, continuing that same problem.

One thing schools can do is to provide a level of access to technology and information which is common to all children. Schools can't change the social structures totally in which they operate. You cannot deny that this group of children are going to have this experience but in their home life they are not. You can't change that.

"Neither can you afford to keep up with all of the possibilities which are there."

That's one of the basic tenets of having a public education system as against a totally fee paying system in that it does provide that access to all children regardless of their economic background.

"The next questions are really questions of effectiveness or efficiency.

Do you think that technology in education is going to make it more efficient or more effective and there are a number of ways in which you might look at that?

Do you think it will require less teachers as more technology is used or would they be used in different ways?"

Using people, employing your personal resources in different ways is the key, I don't think it will require less teachers because if you look at education, part of it is straight didactic information giving, some of it is based upon coaching.

Analysis of what's needed, coaching and some of it on Socratic questioning, individual one to one and that's always going to be there, we need interaction with other people. Now this may occur in different settings, as with our open access all year, but again the research has shown the most effective open access programs are not the ones where the information has been sent out on books or videos, the students interact with them and then send them back to some anonymous teacher.

The key to success in that interaction is personal contact between student and teacher. How those networks are set up might vary with the technology. We already know with our nexus electronic information system, on a weekend, students get on to that, they don't have to be from the same school, they can be from anywhere in the country or anywhere in South Australia, and they can set up their own one-to-one network so technology does have the means to make just the administration of education a business and it is in terms of employing people, more efficient. It can make access to information or a broader range of information, both video or print, more readily available to students and, therefore, you may say it's more effective, more efficient, than other means and as I explained before in terms of taking some of the training components, what I would say is busy work.

'That raises the question which I have asked some where in the surveys which I think you have answered. Those schools which pursue the technology as opposed to others which don't. Do you see one as being more effective more efficient than the other?'

Each school has to come to grips with how it is going to do this in it's local community. In this State we have never imposed a single way of doing it in the classrooms not even down to the level of equipment. If you as a school believe that brand "X" is the brand for you and if you are going down that line without our support then fine, but bare in mind that it has these implications. If they choose to do this then fine but increasingly that tends not to be the case and go outside the system.

There are still somewhat individual variations and in a way that's good provided that the School's have thought it out, know that they can get some support from somewhere if it's not centrally from say, Angle Park with the software produced and the training course, but from some local agency, and that the system is reliable and cost effective

then what we have around the State is diversity that other Schools can draw upon, for example, when they are looking to expand. I think that is a strength rather than some mono-culture where everybody is using exactly the same products but in different contexts. Now it is easier to manage bureaucratically.

There is no one item of equipment currently that is affordable and is the best machine for business, education and say for the arts with manipulating video images.

You pick on the equipment which is best suited. It might be that a particular teacher has a personal computer where they have developed enormous expertise for processing video image. Now if the school buys that brand for that application they get his enthusiasm with the students, and provided it's recognised that unless they train up within the school somebody else, it will go when that teacher shifts or they are sure he is going to be there.

"Some of the relationships some people have set up with other organisations to get them to give that support are quite diverse and quite interesting."

There are exceptions to that where you actually have to transfer the data like in admin system where there is a need for commonality of data format, then you have to have uniformity of the machine and the same with a video application. If it is intended that it is part of a course that all schools will do, then you must have the means of converting it to a common format.

DIRECTIONS FOR SCHOOLING IN THE FUTURE

How do you believe computing will effect the future of schooling?

Do any of the following descriptions meet your image?

A place which conducts lessons as at present but which uses increasing amounts of computer technology for learning.

A place from where students' progress is managed, records kept and advice given but with much of the learning occurring out of the school in houses, libraries and other public institutions.

A place where students spend time on individual study programs monitored and recorded by computer.

A private company which manages computer learning programs for individuals for a fee in their homes or in small learning centres.

A place where students gather for group and social activities but specific knowledge is gained personally using computer technology.

A place which becomes irrelevant as technology removes the need for separate institutional education and replaces it with centralised data banks of learning material which can be used as required throughout life.

None of those described.

We are looking at roughly a decade ahead?

"At least a decade."

All of those options are likely given the fact that schools are embedded in society. They won't change any faster than society changes, so all those scenarios you painted will exist; they all exist now and they will continue to exist in varying degrees.

"Are there any that you believe will be more predominate?"

The trends, I think, are towards more open access of education. The trends of this country are towards national, collaborative development of curriculum materials and that's going to be the picture over the next five to ten years at all levels, not just schools, TAFE, tertiary sector and therefore, if you have got those materials being developed the obvious extension of that is for the delivery of that material Australia wide. Increasingly students will be in settings, not just because of distance where full-time attendance in a normal class room is not possible or necessarily desirable, so open access materials with contact with the teacher, or somebody, a tutor of some sort, I think will increase in scope.

In terms of the actual artefacts, there is a different line from the early 70's of the Xerox book through to the notepad computers which are becoming available now. So we are looking again at, as I mentioned earlier, portable devices which go where you need to use them rather than having to go to the computer room.

"This gives you enormous flexibility to go to say, the Grand Prix, and do speed trials or something as part of your learning."

We had students down there who had portable computers there as part of the activity associated with the four days associated with that. Once you have the infrastructure there it can be used for transmitting system developed materials but it can also be used for transmitting privately, commercially developed materials.

"So that's where your point about it already existing and what you are really saying is that although we will have more of a network effect, you will have access to either the private material which are developed and probably will be developed by the computer companies, equally, you will be able to tap into national stuff which has been developed for national reasons."

Some of it may be transmitted by television, some may be for commercial television, some may be transmitted by the six channels being developed.

"This leads on to the question, how do you see the role of the teacher changing?"

If I take those 3 modes of teaching which I have discussed before. Straight didactic, the front of knowledge is the race against technology; you have to lose that one. You will get beaten on that one.

Coaching; not in an instrumental sense but tailoring programs or even adapting a fairly common program so that individual students have access to them, is one role. The other is credit questioning which is asking the question without leading the student necessarily to the answer, giving them cues but questioning students so the students come to know, understand more fully, what they do know. Often we know more about something than we realise ourselves.

"What you're suggesting now describes a role where teachers will play a much more developmental role both at a maturity level, and the behavioural level and thinking level as well. It is a much more personal and fuller model than what we have now."

Teachers bring to the classroom the benefit of their experience, the benefit of mature judgement and making that accessible to students, providing guides rather than dogma, is a very valuable thing which technology will never be able to do.

That entails a much greater change in the basic preparation of teachers, as well, I guess, our tertiary system has to adopt a somewhat different approach.

CONTROL OF TECHNOLOGY IN EDUCATION

"Do you think most people have already made the decision about where computing will be used in education?"

No, there is a fairly naive view I think. Most only see a surface notion that using computers has got to be better than not using computers.

If a school has lots of computers then it has to be a better school than one which doesn't have so many computers regardless what they do with them.

"What about the question of its inevitability, do you think that the wider use of technology in schools is inevitable?"

To a degree it is, because it's again come back to the fact that schools are social constructs, society is moving down that line and schools can't be too far out of step. So there is a degree of inevitability, but society can vote with its feet, with its spending patterns, as to how it wants to employ technology.

"They have done that in some degree haven't they because they put a lot of money into computing earlier on and now they are not putting so much money in to it expecting the government to put more into it."

That's part of the government.

That's part of the socio economic pattern at the moment where we are in a recession.

"Even before the recession came on there was perhaps a reduction of money that was being put in."

I don't know, I have not had the surveys.

"Certainly the media suggest that was the way things were moving."

I am not sure how much notice you take of the media.

I don't think - there have been any surveys that I am aware of.

"Do you think people actually look at this scenario of greater use of technology in the schooling system and feel that we are developing a sort of inhuman society?"

I guess that view is there. There are some who see technology in an association which is deterministic. That is, the hard side of technology, there is a softer side which is the organisation side which I spoke about earlier. Again, you will get a wide spectrum of views depending on what people's backgrounds are and what their motives are in putting that point.

"Do you think people will in general, that is the users of education, the parents etc, will have a lot of choice about where computers will be used?"

Increasingly, if they wish to exercise that choice, certainly, for people in this state it is towards much greater involvement of parents on school councils and the restructuring of schools that is proposed at the moment by the department requires the school development plans be negotiated with the school community, including students. Certainly the means for doing it has been created.

"The picture you have suggested so far says that schools will be fairly heavily reshaped. Is that your view?"

Some aspects of school if you walked into a new one are vastly different from twenty years ago. Other aspects are almost no change. Certainly, there has been a reshaping that's going on the whole time, in terms of devolution.

"Do you look at this notion of a computer society which we are describing as an exciting prospect?"

Yeh, I don't know that exciting is the word for it, but I am not apprehensive about it personally, but there again, I come to it with knowledge from a particular direction. I am prepared to make choices that say, I'll turn the television off and listen to music or read a book. I'll use the video recorder to time shift, I do not want to watch that program now but I do want to watch it later.

"It certainly doesn't create a frightening future for you?"

It doesn't for most people either in terms of the positive impacts on their lifestyle. Most people accept the television, the fast food, the transport.

"Oddly enough when you ask people the question many of them say their perception of the future of the technology is frightening."

I think some of the environmental issues but technology if you want a broad definition of technology is the means of exercising control over the environment. That may seem to be a harsh deterministic view of it but that's what we use it for.

"I certainly did not find a frightening future view so prevalent amongst students as I did amongst parents."

It may be that they had not thought about it so much.

"A lot of the students I found, in fact the thing I would argue, is that while parents and teachers are struggling with the technology it is already common place for the kids, it's taken for granted."

Most of the things which are changed for the parents have been in the students life for the whole of their lives.

When I was young there was no television but my children do not know the world without television. The emphasis in our framework for technology which is in draft form at the moment and the fundamental tenant of that is design, make, appraise, use.

Design - the students should be involved in all of those things, the appraisal is not just what they make. The appraisal is technology generally. How do you appraise the impact of technology, it's never neutral and the use part is, chose and use.

"It's interesting that you raise that question as I skipped a question earlier which raised that question, it says do you think we should really be teaching children more about, as part of the curriculum the approval of technology and it's shape in society therefore enabling them to have a more conscious choice about it?"

Yes, that is part of the studies, assuming it gets passed, and is eventually published and that is part of studies in technology.

"The next question asks whether teachers will lose some control over curriculum in this scenario?"

Not unless they give it up. The process of consultation, processes of consultation are there. The national frameworks - they're fairly broad they have to be to be acceptable in all states and the interpretation of those is very much at the local level and there is a good case to be put to say that all kids in Australia should have some common experience.

The maths you do if you are in the western suburbs of Sydney or Oodnadatta ought not to be vastly different otherwise you block those two schools and have different pathways to careers, but the manner in which the concepts are developed, the education achieved will be different for the student in Oodnadatta than in the western suburbs because their experiences are different, but to try and have the same course would not be appropriate. The best person to make that judgement is the professional teacher, the one that's there.

"Do you think that education will be constrained in anyway as it moves down this path?"

Financial, finances are always an issue. It depends upon what society is prepared to pay and the inertia of established practice is always an issue. They are the two major constraints, and they will always be there to a degree. They are a nuisance but they are also a safe guard.

PROMOTION OF COMPUTERS IN EDUCATION

"When we look at who has promoted the use of computer technology, do you think any particular group has had more say than another?"

They have all been promoting it to a degree. The positive side of it and at different times, different way. I was a consultant to the National Computer Education Program about 6 years ago when the government put about \$25 million into it.

So at that stage the federal government had quite a significant input. Parent groups in an individual school might decide to spend \$80,000, as they did in one of our schools on installing computing equipment, so for that period of time the parent group had a lot of say.

We put out a policy on schools computing and that determines directions. We develop software through Angle Park Computing Centre. Particular packages that have an application at a particular time. They have an influence. So, you know, it's an ebb and flow in the tide of influence.

"So what you are saying is that you don't see any prevailing force which has been working away but you see variety of forces which have taken a different role."

Parents and teachers working at the local level.

EVALUATION OF SCHOOLS

"Do you think schools currently are satisfactory, in need of radical change, irrelevant, will always be the same or don't you have an opinion?"

Do you realise that ACR have a large contract looking at effective schools at the moment.

There is an effective school campaign which two weeks ago there was public phone in, there will be questionnaires out in schools. What makes a school effective, are our schools effective? It is managed nationally by ACR. It is a Commonwealth Government funded program.

Schools certainly are not irrelevant, they can't be. If they were totally irrelevant you would have to ask why they were there.

Are they perfect? No, not by a long shot. Some schools serve educational needs better than others, and that changes over time. But it is interesting when you look at the national press it is full of disasters in education. The state press tends to focus on those who read the Messenger Newspapers then you get a different picture. If you ask parents about their local schools, their schools are ok. It's the other schools which are not performing.

So, there's a lot that could be done within schools but I think in the current climate it's not brilliant as you would imagine with the industrial issues, the recession there's a whole range of things which impact on schools. Every time there's a social problem the solution is, there are problems with divorce, teach marriage guidance in schools - we have problems with, teach that in the schools.

We really have got to focus on what our mission is. Our education for the twenty first century says our prime function of schools is to enhance the intellectual ability of students. You have to have an environment where that's possible and a lot of effort has got to go into that.

I think we have got to focus on that and there's no evidence to suggest that our schools are any worse than twenty years ago and they are catering for a much wider range of students in a more complex society, so, even if they were not doing any worse than twenty years ago and they are taking on a broader task you would have to say that they have improved.

Thank you for your time.

Summary of Interviews with Educational Administrators

TECHNOLOGICAL FUTURE		
CURRICULUM DIRECTOR (G)	TECHNOLOGY ADVISOR (H)	INFORM TECH DIRECTOR (I)
<p>... more homes will have their own personal computer for a variety of purposes ranging from recreational entertainment model to people who use it for sophisticated supports to employment or their own interest.</p> <p>... the suspicion that generates in some people, in people's minds that some malevolent force acting up these and technology is really inappropriate because it intrudes in people's life in adverse ways.</p> <p>... we have people increasingly familiar with the home based stuff while at the other end, the macro level, the government some how it's malevolent and sinister and it's going to lead to the breakdown of society and the intrusion into their lives.</p> <p>... most parents, I suppose, are reasonably supportive and comfortable of the schooling their children receive in their school but when you talk to them about the educational system, it's failing and the kids are hopeless and the kids hang around street corners and vandalise etc.</p>	<p>... there will be an increase in the variety and messages put over the electronic media. The variety of media will increase in terms of the actual artefacts and the ways in which it is used to influence people.</p> <p>... we seem to be narrowing down so that everything comes to be transmitted using digital data techniques.</p> <p>... it doesn't matter whether the signal comes via satellite, fibre optic, microwave or whatever, that structure is invisible to us. What we're concerned with is what's transferred.</p>	<p>I think we over estimate the rate of change but I think in the next twenty years the technology will force changes that will happen a lot quicker than people realise.</p> <p>... there is a change coming very very slowly and a lot slower than what a lot of people would like because the resources available to bring these technologies in are not there or if they are there they are not perceived at a high enough level to make them be in the first line.</p> <p>... you can put an encyclopedia on a network twenty or fifty students can do research at the one time and get information not only in the written form but also visualise it as well ... no if you extrapolate that onwards then I see study being less we imparting information as a teacher, you as a student and more of we - we are going to learn about, mathematics and we get back to the basic concept of the building blocks of mathematics.</p> <p>... you can visualise it as well as the conceptualisation and I think that is going to be the biggest change that's going to come and no longer are we expected to accept things because I am telling you which has been the traditional school teaching model.</p>

TECHNOLOGICAL FUTURE		
CURRICULUM DIRECTOR (G)	TECHNOLOGY ADVISOR (H)	INFORM TECH DIRECTOR (I)
<p>WORK I believe it is having an impact in terms of employment opportunities in that they have changed and some employment opportunities now will require some level of sophistication with technology support.</p> <p>I would hope that eventually all kids will leave the school system with quite well developed keyboard skills but we haven't actually got that formally as a requirement.</p> <p>What technology does is give people access to information and enable them to massage and manoeuvre the information in new ways and people who have skills to do that then use that information in ways to influence people.</p>	<p>WORK ... it will have a larger effect on personal life styles, entertainment and of course there is the application of this in education or open access to education.</p> <p>We use the term technology fairly loosely. I refer to artefacts, the things we make. It refers to processes by which we make those artefacts, the type of processes and it refers to those organisations and structures in which those processes are made.</p> <p>... it is technically possible to put a library into a one inch cube ... the interface with people, that's part of the problem.</p>	<p>WORK I can't see bureaucracy changing, this is a good model of that I think, power is greatly underestimated when we look at organisations and the other issue is of the resourcing. It costs money to decentralise whether you do it physically or whether you do it electronically and I'm not sure whether you do it in twenty years time society will have adjusted to do it electronically. I think we will still need that social contact which is so essential in the work place.</p>
<p>WORSHIP</p>	<p>WORSHIP ... why did 100,000 people go to the Grand Prix, that's rampant interest, worship, I don't know, in machines.</p>	<p>WORSHIP</p>

TECHNOLOGICAL FUTURE

<p align="center">CURRICULUM DIRECTOR (G)</p>	<p align="center">TECHNOLOGY ADVISOR (H)</p>	<p align="center">INFORM TECH DIRECTOR (I)</p>
<p>PRIVACY</p>	<p>PRIVACY Nothing has happened that has increased the capacity of the brain that I am aware of so in some cases having access to much wider set of information will make absolutely no difference because people simply tend not to use it.</p> <p>... as soon as you make stuff more generally available you do have to look at privacy considerations and it may be easier in some ways to relax more general privacy legislation with everything held electronically in common media than it is now with information held in a wide variety of media and relatively insecure.</p> <p>I dare say most people are not aware of how much information is available about them which is well and truly available about them at the moment.</p>	<p>PRIVACY ... governments have a lot more control over people at the present time than people realise.</p> <p>... I think any sort of electronic technology will just make that easier.</p> <p>I don't think in its self technology is good or bad or evil or whatever.</p> <p>I think that the controls that we are prepared to accept really come back to us as a society.</p>
		<p>LEISURE ... people will become bored with leisure or specific elements of it a lot more quickly than we do at the present time.</p> <p>... just use the analogy there of computer games - I think all ages like them but they are very quickly bored by them.</p> <p>... the demand will be for more and more changes and more traditional type activities like listening to music and social activities-like sport</p> <p>... there will be percentage changes but not radical changes or anything like that.</p>

TECHNOLOGICAL FUTURE

**CURRICULUM
DIRECTOR
(G)**

**TECHNOLOGY
ADVISOR
(H)**

**INFORM TECH
DIRECTOR
(I)**

PRODUCTION

Anything in the production line if we can do it then you can design a machine to do it better - where people come into their own, of course is where there is creative thinking which whether people recognise it or not that is their innate skills.

WORK

... society as a whole has got to bear the fact that we are looking at a change in our work ethic and I believe that there are people who are going to go to formal work, say, what I am doing here now and there are people who are in different types of work such as people who may be classified as unemployed.

COMPUTERS IN EDUCATION

<p align="center">CURRICULUM DIRECTOR (G)</p>	<p align="center">TECHNOLOGY ADVISOR (H)</p>	<p align="center">INFORM TECH DIRECTOR (I)</p>
<p>RELATIONSHIPS People can use technology to increase interdependence because they draw on information and software and processes from a range of groups.</p> <p>... it can also lead to independence where this is my bit of information and I'm going to lock it away behind my key word.</p> <p>I would like to think that within the educational sector it actually leads to people sharing more information because it is so accessible in a variety of forms.</p> <p>I think that can only happen [transfer of information] as teachers become familiar and comfortable with the extent, the ever extending use of technology and I don't know that a lot of teachers are yet comfortable.</p> <p>It ought to increase the capacity for teachers to enable students to be much more independent as learners and to develop a way of accessing information which is not dependent on them.</p> <p>I think there is the opportunity for teachers to actually interact more personally with kids by giving them independence and, in turn, by seeing the kids grow as independent learners and develop their self esteem and that enables them to develop relationships.</p>	<p>RELATIONSHIPS ... with the move to greater devolution to schools and schools in most country towns are the biggest business in the town the administrative running of the school, staffing, scheduling, student research, etc, has moved into a computerised form.</p> <p>... that has an impact too in terms that tend to set an agenda for the structure within which education operates within the school.</p> <p>... it might be more efficient overall for all students but it can remove flexibility.</p> <p>The use of computers within the classroom it has the capacity to increase interaction.</p> <p>... the image of a single student sitting in front of a computer, isolated is an erroneous one.</p> <p>I did some research on this sometime ago ... the interaction of student was high, teacher was high, in fact, far higher than in conventional teacher centred approach.</p> <p>... its been our policy with the computer as a tool to make education more effective, then clearly that is a one to one, one machine one student and a fixed agenda which is training not education.</p>	<p>RELATIONSHIPS I think it will be getting back to the old Greek concept of tutors rather than teachers.</p> <p>The teachers will share, and we may not call them teachers, will be sharing those experiences with the kids. There will be a much closer relationship.</p> <p>I concede the fact that classes may well become slightly smaller but I am not a great believer that, I sincerely hope it never happens, that my son is at home and your son is at home and the teacher is somewhere else and they communicate through the medium.</p> <p>I think that will happen then we will lose our capability of socialisation. I think one of our greatest benefits out of schools not only in the formal learning but in the sport and other activities our socialisation.</p>

COMPUTERS IN EDUCATION

<p align="center">CURRICULUM DIRECTOR (G)</p>	<p align="center">TECHNOLOGY ADVISOR (H)</p>	<p align="center">INFORM TECH DIRECTOR (I)</p>
<p>LEARNING ABILITY ... one would like to hypothesise that because students start to develop some rigorous way of identifying how they use information towards particular ends - that is a preferable learning model rather than listening to teachers and repeating back - and they are learning about accessing information and problem solving and those sort of things which are a higher order skill.</p> <p>It does not mean that they are more intelligent but they develop higher level skills of using information.</p> <p>... learning at starting to work at things of analysis and synthesis rather than straight repetition.</p>	<p>LEARNING ABILITY If you mean innate learning ability of an individual, one doesn't know what that is. I couldn't really answer it.</p> <p>It can bring an individual closer or in the same way it can lock you out.</p> <p>If it's applied to the lock step single person directed thing ... that's not enhanced learning.</p>	<p>LEARNING ABILITY</p>
<p>MOTIVATION I do not think there is any doubt about it, there is enough research around even small scale research to show that kids writing improves when they use a keyboard.</p>	<p>MOTIVATION It is for some students. It can be a real turn off. For some kids give them a can of worms and a question and that's highly motivating</p> <p>... with technology at its current stage allowing students to use generic software or communication software to get access to information to process data and to leave the curiosity to them, you can take out a lot of the drudge which in effect is motivating.</p> <p>I'm not overly enthusiastic about games, but if its a way in for some students well I think you've got to give multiple pathways.</p>	<p>MOTIVATION ... the worry that I have if we went down this track to complete individual learning then we just become a mob of more intolerant people than we already are now.</p> <p>... my oldest daughter is 17 and in matric is not interested in computers.</p> <p>... my younger daughter who is 10 uses the computer for writing essays, also for the experiences ... she is actually into the experience of computers - then one wants to share that experience with others.</p> <p>That's the way I would like to see it going. That is a good model.</p>

COMPUTERS IN EDUCATION

<p align="center">CURRICULUM DIRECTOR (G)</p>	<p align="center">TECHNOLOGY ADVISOR (H)</p>	<p align="center">INFORM TECH DIRECTOR (I)</p>
<p>CAREER NEEDS</p>	<p>CAREER NEEDS There is probably a perception that some skilled knowledge in the use of information technology enhances job prospects.</p> <p>There is also a significant fear amongst the general community that technology is de-skilling and it's true that one becomes an operator of a machine where as one did what the machine did and therefore had a set of skills.</p> <p>A lot of skills you learn are throw away skills.</p> <p>How you employ that tool in a more creative fashion, that is the key to de-skilling it is moving your skill level up away from some of the mechanical aspects.</p> <p>If you put people in a race with technology they are going to lose.</p> <p>We have to look at the people doing what people do best</p>	<p>CAREER NEEDS You cannot stop technology. I really think it will become part of our life experiences and we accept the telephone but most people do not know how it works.</p>

COMPUTERS IN EDUCATION

<p align="center">CURRICULUM DIRECTOR (G)</p>	<p align="center">TECHNOLOGY ADVISOR (H)</p>	<p align="center">INFORM TECH DIRECTOR (I)</p>
<p>CREATIVITY In terms of creativity, again the research that I have read and its been fairly basic, in kids private writing they tend to be more expansive when using a laptop than when using paper and pencil.</p>	<p>CREATIVITY Yes you can and there's evidence that is the case but often if you're somebody as stupid as I am, if you want to determine a design I'll sketch it first and then use the machine to extend those sketches in a way which would not have been otherwise possible.</p> <p>... the potential is there for enhancing creativity. On the other hand you can stifle it if the machine that is being used, the software is limiting the student.</p>	<p>CREATIVITY My kids are much more, and I am using my youngest as an example, she is a computer kid. She has been using a computer from 5 onwards. She is much more creative than what I was at the same age.</p> <p>... to her it is just another extension and a bit more frustrating because you don't have the freedom. The technology is not free enough at this stage.</p> <p>Teachers are behind the kids. There are no two ways about it I don't think that is an individual teacher's role it is the system. It is the education system that is not, the education system is about two generations behind where it should be.</p>

COMPUTERS IN EDUCATION

<p align="center">CURRICULUM DIRECTOR (G)</p>	<p align="center">TECHNOLOGY ADVISOR (H)</p>	<p align="center">INFORM TECH DIRECTOR (I)</p>
<p>EQUITY ... if you don't have the access to the resources you don't ... if they become very important components then you can get a differentiation of people on yet a different set of criteria yet which are partly linked with the economy.</p>	<p>EQUITY</p>	<p>EQUITY Let's use a model of a different technology and that's the School of the Air ... now the radio had certain fundamental properties ... they were a piece of technology that met your needs.</p> <p>If you have a look at these beasts that are sitting here you have got to ask yourself why are they improvements and the answer is because somebody thinks they can make money out of them.</p> <p>... the department or school or something has a library of software so that it does not matter whether your dad earns \$100m/year or not even employed you can use, and this gets back to this concept of society making sure that individuals in it don't fall below a certain level.</p> <p>I have a sneaking suspicion that elitism is a problem and we are not going to get rid of it in the next 20 years.</p>

COMPUTERS IN EDUCATION

<p align="center">CURRICULUM DIRECTOR (G)</p>	<p align="center">TECHNOLOGY ADVISOR (H)</p>	<p align="center">INFORM TECH DIRECTOR (I)</p>
<p>GENDER EFFECT ... research suggests that if you have an area dedicated to computers, if it's open slather boys seem to be more attracted to those sort of processes than girls.</p>	<p>GENDER EFFECT There is a fairly significant body of literature that says that there is a gender bias in technology in society overall.</p> <p>I think that it is changing and technology has the capacity to hasten that change.</p> <p>... within schools there is evidence, clear evidence that there has been a bias towards boys rather than girls in some aspects of the use of technology.</p> <p>The notion of preferred learning styles does depend on the social setting and the social background. There are girls, quite a significant number of them, who prefer to operate individually. There are boys who prefer to work in groups.</p> <p>The problem actually is the home experience ... boys may have been encouraged to tinker, to play, the girls might not so if you can bring that in a single sex environment and get them to have confidence in their ability then when you bring them together - they are able to carry through the activities quite successfully.</p> <p>... the boys now as young children have no direct interaction with that sort of thing which might have happened in the past with tinkering.</p>	<p>GENDER EFFECT</p>

COMPUTERS IN EDUCATION

<p align="center">CURRICULUM DIRECTOR (G)</p>	<p align="center">TECHNOLOGY ADVISOR (H)</p>	<p align="center">INFORM TECH DIRECTOR (I)</p>
<p>RELEVANCE to subjects ... it is going to be information rich and a society in which it will be essential that you are able to discriminate between the information which you use or don't use because no person is going to know or have access or store all the stuff they need to make a useful life.</p>	<p>RELEVANCE Information technology is at the basis of the lot, every area of study and the computer is a generic tool.</p>	<p>RELEVANCE</p>
<p>REDUNDANCY OF CURRENT KNOWLEDGE I think we are continuously jettisoning parts of the curriculum processes and knowledge as we grow smarter and as information becomes wider. ... that means that you don't require all kids in a cohort, or a class or a group to do exactly the same thing and we become more focussed on the skills that are used rather than the end product.</p>	<p>REDUNDANCY OF CURRENT KNOWLEDGE The content of curriculum has to be constantly under review because it's got to relate to the society in which the schooling, education system is embedded. I'm not an advocate of content free total process thing because all the research indicates that context is important and the contexts are what makes observation scientific. In order to operate in the world each of us has a conceptual framework within our heads, which is built up in many ways from our experiences. That our education, in effect, provides a relatively common set of experiences on which that conceptual framework can be developed and built and once you know how to do something in one field it is easier to transfer it to another.</p>	<p>REDUNDANCY OF CURRENT KNOWLEDGE</p>

COMPUTERS IN EDUCATION

<p align="center">CURRICULUM DIRECTOR (G)</p>	<p align="center">TECHNOLOGY ADVISOR (H)</p>	<p align="center">INFORM TECH DIRECTOR (I)</p>
<p>EFFECTIVENESS ... one would like to think that in terms of handling information people become more effective in the sense that they learn how to ask questions which lead them to access the sort of information they want - which is the whole problem solving approach.</p> <p>Schooling is about personal relationships and so you do need that interaction.</p> <p>I suppose it will lead to greater efficiencies in terms of the teaching arrangement if the teacher is still the monitor and the manager of the range of learning techniques that will still need teachers but may be they may get better outcomes in terms of student performance.</p>	<p>EFFECTIVENESS</p>	<p>EFFECTIVENESS I don't think it [computers] will make a lot of difference. If learning was just stuffing facts it might but it is about relationship and I don't think society will tolerate that much change.</p>
	<p>EQUITY It's no different now from a hundred years ago ... it's really saying that it is accentuating, continuing that same problem.</p> <p>One thing schools can do is to provide a level of access to technology and information which is common to all children</p>	

FUTURE OF COMPUTERS AND SCHOOLING

<p align="center">CURRICULUM DIRECTOR (G)</p>	<p align="center">TECHNOLOGY ADVISOR (H)</p>	<p align="center">INFORM TECH DIRECTOR (I)</p>
<p>Schools ought to be places where learning is managed but where they are not places of instruction.</p> <p>I think it is bound up with the question about how much longer we are going to be committed to a model of organising schooling and learning essentially linked with how the factories operated a long time ago.</p> <p>I think society likes to think of schools as places where kids are, they will never say locked away but they are supervised and they are controlled by people who are supposed to know what they are doing.</p> <p>... the system ought to be free enough so that if you have a number of students and parents who say we would prefer our kids to stay at home and work in this way and link the supervision with a leader - that is possible.</p> <p>We ought to encourage teachers to see themselves as managers of learning and not as instructors.</p> <p>There are huge changes in approach which teachers have to go through and I think that's going to be the thing which will impede the development.</p> <p>... kids are more amenable to a new technological development and learn faster than teachers do.</p>	<p>... one of the basic tenants of having a public education system as against a totally fee aying system is that it does provide that access to all children regardless of their economic background.</p>	<p>[Future schooling would be] one where students go for group and social activities but where learning of specific knowledge is gained using computer technology.</p> <p>... I think a lot of problems with children stem from two things. One is the home, I am not sure that a lot of people are fitted to have children - but accepting that as a given, children have behaviour problems because they cannot be compressed or fit in with the way that school wants it and they're bored.</p> <p>Let's be honest schools at the present time, you either look after the bottom rung or the top rung where as the guys in the middle who are the majority suffer</p> <p>My belief is if we enrich the learning experience in the school then we will see issues which we identify as behaviour problems at the present time will reduce.</p>

FUTURE OF COMPUTERS AND SCHOOLING

<p align="center">CURRICULUM DIRECTOR (G)</p>	<p align="center">TECHNOLOGY ADVISOR (H)</p>	<p align="center">INFORM TECH DIRECTOR (I)</p>
<p>It's moving away from what I call the custodial view of teaching to the other end where it's giving kids the power and responsibility and I think that's partially an emotional laden thing that I am responsible for the learning of these kids therefore I have to constrain and constrict what they do or they might get away from me.</p> <p>A negative spin off is that kids tend to divorce real learning, that is, what they do out of school with what they do in school so what you do in school is not actually directed at life.</p> <p>The end of schooling the purpose of schooling is not to make you a better person. We have made people passive learners.</p> <p>... I would want to change teachers from being primarily custodial and perceiving themselves as instructors to managers of learners and freeing up kids.</p> <p>... the question we continuously found very difficult to resolve was that of process versus content.</p>		

FUTURE OF COMPUTERS AND SCHOOLING

<p align="center">CURRICULUM DIRECTOR (G)</p>	<p align="center">TECHNOLOGY ADVISOR (H)</p>	<p align="center">INFORM TECH DIRECTOR (I)</p>
<p>ROLE OF TEACHERS</p>	<p>ROLE OF TEACHERS If I take those three modes of teaching ... straight didactic, the fount of knowledge is the race against technology, you have to lose that one. Coaching, not in an instrumental guide but tailoring programs or even adapting a fairly common program so that individual students have access to them is one role.</p> <p>The other is credit questioning which is asking the question without leading the student necessarily to the answer ...</p> <p>Teachers bring to the classroom the benefit of their experience, the benefit of mature judgement and making that accessible to students, providing guides rather than dogma, is a very valuable thing which technology will never be able to do.</p>	<p>ROLE OF TEACHERS It also puts a dam sight more responsibility on teachers. I am not sure that teachers are equipt to do that.</p>
	<p>EFFECTIVENESS I don't think it will require less teachers because if you look at education part of it is straight didactic information giving, some of it is based upon coaching, analysis of what's needed and some of it on socratic questioning, individual, one to one, and that's always going to be there. We need interaction with other people.</p> <p>The key to success in that interaction [open access learning] is personal contact between student and teacher. How those networks are set up might vary with the technology.</p> <p>... you may say it's more effective and efficient than other means ... in terms of taking some of the training components</p>	

FUTURE OF COMPUTERS AND SCHOOLING

<p align="center">CURRICULUM DIRECTOR (G)</p>	<p align="center">TECHNOLOGY ADVISOR (H)</p>	<p align="center">INFORM TECH DIRECTOR (I)</p>
	<p>Each school has to come to grips with how it is going to do this [be effective and efficient] in it's local community.</p> <p>In this State we have never imposed a single way of doing it in the classroom not even down to the level of equipment ... the fact that schools are embedded in society they won't change any faster than society changes so all those scenarios you painted will exist, they all exist now, they will continue to exist in varying degrees.</p> <p>The trends, I think, are towards more open access of education.</p> <p>Increasingly students will be in settings, not just because of distance where full-time attendance in a normal classroom is not possible or desirable, so open access materials with contact with the teacher or somebody, a tutor, of some sort, I think will increase in scope.</p> <p>So we are looking at ... portable devices which go where you need to use them rather than having to go to the computer room.</p> <p>Once you have the infrastructure there it can be used for transmitting system developed materials but it can also be need to transmitting privately, commercially, developed materials</p>	

FUTURE OF COMPUTERS AND SCHOOLING

CURRICULUM DIRECTOR (G)	TECHNOLOGY ADVISOR (H)	INFORM TECH DIRECTOR (I)
		<p>CHILD MINDERS I think that society will change a lot slower than most people want it to.</p> <p>WRITERS OF COMPUTER PROGRAMS My belief is nothing an individual can do, this is a general statement, can equate to what is available off the commercial software market.</p>

CONTROL OF EDUCATION

<p align="center">CURRICULUM DIRECTOR (G)</p>	<p align="center">TECHNOLOGY ADVISOR (H)</p>	<p align="center">INFORM TECH DIRECTOR (I)</p>
<p>[Have most people actually made a decision about whether computer technology will be used or not?]</p> <p>I don't think people have made a decision in the sense of a specific cognitive process - I think we just continuously bump up against new things and we accommodate ... its a rolling accommodation and adjustment.</p> <p>[Will society be more inhuman in future or are we moving towards an exciting future?]</p> <p>... the exciting one.</p> <p>... as technology provides opportunities for some of the more routine tasks which are undertaken within the manufacturing sector, for example, to be done with fewer and fewer people that, that liberates people, removes some people from that dead ending and restrictive activity.</p> <p>[Will education be constrained?]</p> <p>I think education will be constrained by not being able to resource it adequately.</p> <p>... we won't be able to keep pace with the developments as they occur.</p>	<p>[Have most people actually made a decision about whether computer technology will be used or not?]</p> <p>... most only see a surface notion that using computers has got to be better than not using computers.</p> <p>If a school has lots of computers then it has to be a better school than one which doesn't have so many computers, regardless what they do with them.</p> <p>[Wider use of technology in schools is inevitable?]</p> <p>... schools are social constructs, society is moving down that line and schools are moving down that line and schools can't be too far out of step, so there is a degree of inevitability but society can vote with its feet, with its spending patterns as to how it wants to employ technology.</p> <p>[How do you think schools rate at the moment?]</p> <p>I'd be happy with a word other than radical. I would put progressive change.</p>	<p>[Have most people actually made a decision about whether computer technology will be used or not?]</p> <p>Nope - let them wash over them.</p> <p>[Are computers in education inevitable?]</p> <p>Yes A lot of teachers I know will not have a bar of computers.</p> <p>[Will society be more inhuman in future?]</p> <p>If it encourages us to become more and more individualised, sort of turning inwards, then I think that it is a bad thing. I think we have to keep our socialisation going.</p> <p>[Choice about where technology is used?]</p> <p>No; because I'll tell you why, you do not get a choice about whether you will use a micro processor in your microwave or video recorder in your car.</p> <p>[Schools reshaped]</p> <p>I would like to think that the learning environment becomes more intimate ... and I think the outside shape remains the same.</p>

CONTROL OF EDUCATION

**CURRICULUM
DIRECTOR
(G)**

**TECHNOLOGY
ADVISOR
(H)**

**INFORM TECH
DIRECTOR
(I)**

[Who has most promoted the use of computers in education?]

There have been people who have been quite influential in terms of policy makers and decision makers who have pushed it, individuals, I can think of in this department who have given it a very high profile so I don't know that I could identify one particular factor.

[How do you think schools rate at the moment?]

I think they need a substantial change and it's in that area of methodology.

... our current environment actually discourages teachers from taking risks and using new methodologies yet all of the other elements of society suggests that our teachers ought to be risk takers and more developmental in their approach.

Summary of the Theorising by Educational Administrators

THEORETICAL FUTURE	
ISSUE	THEORETICAL PROPOSITION
Technological Impact	<ul style="list-style-type: none"> - Technology will force changes at a rapid rate. - Information will be easily accessible via computer in a variety of forms. - The technology will be transparent (invisible) in many cases. - Homes will have computers for recreational and employment purposes.
Sociological Impact	<ul style="list-style-type: none"> - The technology human interface is the problem. - Employment opportunities will depend on technological understanding and skills. - Informational technology will enable many students to research information at the same time which will change the concept of education from teaching to learning. - People will become comfortable with technology in the home but be suspicious of technology at the macro, social levels (government). - Schools suffer from criticism in a macro sense although parents satisfied at their local level. - Invasion of privacy will not be an issue because people only have the capacity to deal with so much information. - Legislation to protect privacy may be able to be reduced if information is held electronically. - Governments have more control over people than they realise.

COMPUTERS IN EDUCATION

ISSUE	THEORETICAL PROPOSITION
Relationships	<ul style="list-style-type: none"> - Computers can increase interdependence and they can also lead to independence. In the education sector it should be used for improving interdependence and sharing of information. - The capacity to increase interdependence should lead to better personal relationships between teacher and student. - Computers will enable students to become more independent as learners thus developing their self esteem and improved relationships. - Learning via computers will reduce human capability of socialisation. - Classes may become slightly smaller. - Many teachers not comfortable with the technology. - Computer learning might be more effective but can be less flexible. - The policy to make education more effective relies on training rather than education.
Learning Ability	<ul style="list-style-type: none"> - Students will learn how to access and use information, problem solve and how to work at analysis and synthesis rather than repetition.
Motivation	<ul style="list-style-type: none"> - Students writing improves when they use keyboards. - For some students the computer can be demotivational. - Removing the drudgery from learning by the use of computers is motivating. - Total reliance on individualised learning will produce more intolerant people.
Career Needs	<ul style="list-style-type: none"> - Technology cannot be stopped. - People cannot win against technology. - All people will be affected. - Fear that technology is de-skilling. - Many skills are throw away skills. - Need to move skill levels up away from the mechanised aspects of work.
Creativity	<ul style="list-style-type: none"> - Children who use computers are more creative than those who do not. - Computers are limiting to creativity due to the lack of freedom in the technology. - The education system is restricting children's creativity.
Equity	<ul style="list-style-type: none"> - Public schools are there to provide access to certain levels of technology regardless of economic circumstances
Gender Effects	<ul style="list-style-type: none"> - Without controls applied boys are more attracted to computers than girls. This bias is reflected in society.
Relevance to Subjects	<ul style="list-style-type: none"> - Information is the basis of all disciplines and the computer is a generic information technology suitable for all subjects.
Redundancy of Knowledge	<ul style="list-style-type: none"> - Curriculums must be constantly reviewed to relate to the society in which the schooling is located. - Education should provide a common set of experiences upon which further learning can develop. - All children do not have to do the same thing. The focus must be on the skills that are used rather than the content.

COMPUTERS IN EDUCATION

ISSUE	THEORETICAL PROPOSITION
Effectiveness/Efficiency	<ul style="list-style-type: none"> - Schooling is about personal relationships. - If the teacher focussed on managing and monitoring learning they may get better outcomes in terms of student performance.

FUTURE OF SCHOOLING

ISSUE	THEORETICAL PROPOSITION
	<ul style="list-style-type: none"> - Public education provides access to all children regardless of their economic background. - Schools should be flexible enough for some children to be studying at home supervised by the teacher. - If the learning environment is enriched many of the present behaviour problems will disappear. - Society likes schools to be places where children are supervised and controlled by people who know what they are doing. - Schools ought to be places where learning is managed but not be places of instruction. - Many of the behaviour problems stem from the home. - Teachers ought to perceive themselves as managers of learning rather than as custodians of children.
Role of Teachers	<ul style="list-style-type: none"> - Tailoring programs or adapting them so that students can access them. - Questioning students without leading them to an answer. - Teachers should bring their experience and mature judgement to students and provide guidance rather than dogma. - The responsibility may be beyond teacher skills.
Effectiveness	<ul style="list-style-type: none"> - Number of teachers will not reduce because education is didactic information giving, coaching, analysis of needs and socratic questioning, that will always be required. - Teaching requires personal contact between teacher and student. - Open access will increase in scope. - Portable devices capable of use where you need them will be developed. - Education material will be a mixture of private and public material. - Society will change a lot slower than many people would want.

CONTROL OF EDUCATION

ISSUE	THEORETICAL PROPOSITION
	<ul style="list-style-type: none">- Most people have not made a decision about the use of computers in schools. Most only have a surface notion, change is not a conscious process for most people.- Most people believe that schools which use computers are better than those which don't.- Schools will use more technology.- Schooling must focus on socialisation and individual learning may create problems in this respect.- Education will be constrained by lack of resources to purchase the latest developments in computer technology.- Schools need substantial change in methodology.- Current environment discourages teachers from taking risks with use of the latest computer technology.

Appendix 13

APPENDIX 13

Appendix 13 presents the unabridged interviews of Computer Suppliers.

This is followed by a comparative analysis of the key issues of concern for the three (3) core studies.

Finally a summary of the theorising of all Computer Suppliers is presented.

INTERVIEW TWO

COMPANY: CADDSMAN LTD
POSITION: MANAGING DIRECTOR
DESCRIPTION: South Australian based computer software development for the Engineering Industry

FUTURE VISION

"What images do you hold about the future society and technology which schools will operate?"

There is a couple of things immediately that I'll come back and detail. First reaction is to say that technology in education, is going significantly in the wrong direction in one particular area. I think it's government policy that really causes this, and, it's also expectation and, understanding of what technology can do in industry and I'll explain that this way, that, firstly, I think educational institutions are teaching people how to use technology, how to actually use the instrument, whereas, there is a need for people to understand what technology is, how it can be harnessed and in fact, the key thing too is to create. Where Australia is going wrong, where the governments going wrong in education and technology, is that, they're teaching how to use the technology not creating, an industry around technology so it can be created, shown how it is created, jobs are produced and an understanding of technology in itself, rather than just the means or a tool and that is where the whole of our Australian industry has come crashing down. You look at, some perspectives of the Australian computer hardware industry, five years ago there were seventeen manufacturers in Australia, there's not one left. Not one and yet the sort of importance of this is just astronomical, you have got a twenty billion dollar a year import into Australia for technology, engineering, scientific technology items and we are less than 3% self sufficient in the whole of that technology area and industry, if you cannot, if you don't build your industry on computing technology

as a store you have not got any chance of competing on the world market anyway. But for us to be less than 3% self sufficient and have less than, I think we had 30 million dollars worth of exports in Australia last year in our industry and there is 20 billion dollars worth of imports and that .000015 up or something or other, so there are real problems I see in Australia, that the government has no strategy in which to bring technology to bear through education and education is still teaching what, how to use the technology not how to create it.

How will computing change our lives?"

I think the pendulum swings a bit I think there's going to be a real surge in technology over the next probably decade, what I think is going to happen is that like morals, and everything else, it's going, going to get to the stage where human nature reacts against it and there will be a sort of return to perhaps a more equally balanced approach to human involvement and sort of, hands on approach versus technology approach. I think were in for a real heavy surge in technology though. It has to be, because there is so much pressure on industry, particularly in Australia, to update and be competitive and, it is going to be the strain that industry tries to grab hold of but I'm not sure it is the answer.

"What will be the effect on work?"

It will, I think the main things in terms of harnessing records within companies, getting expertise within and standards and quality control all of those aspects of it, computing technology because of memory base because of speed of, searching, those sorts of things will, will really become, absolutely, the basis of operations for industry but, I, do think that it's that, the main fill in area and then it's going to be minor in, terms of it's application to, other areas which are things like design, it will be an aid to design, I think.

What I am trying to say is there will be a replacement of a whole swag of human endeavour in terms of statistics and records, and standards and that will be all computer based and then when you get to the things that are more specific like design or engineering or building or manufacturing, they will be the aid basis rather than the complete standard.

"Will computing affect leisure?"

Just one further point, I think the integration of the tools, the computer aided tools, it's the integration that's going to make the impact. It is not the individual steps within it ... unless you harness that integration unless everything comes together, it's going to be spasmodic and sort of, non-effective. But that's a fair way off too, I think the integration the thing that you're going to have to bring business's together and whole industries together, that is a fair way off, it's like trying to get, Australians who, who naturally are, are competitive to one another the only way Australia is going to compete in the world market is you get all of the big ones in the Australian industry to combine together, collaborate use all our own skills, muscle in on the world market and come up with an export program and how far are we away from that I reckon we are a million years away from that. You look at Japan collaborate in their own environment and they take a product that they do not have any market share world wide in and they will look at that and they will combine four or five, of the competitive companies together and say lets go get this market and Australia's very much individualist they are compete and tear each other apart in disregard. It's no benefit to the whole industry.

"Just getting back to leisure, is computing technology likely to have any impact?"

I think it is and I think it's going to be opposite to what people expect. I do not think it is going to be a computer generated industry it's going to force people further and further towards nature and sort of using your hands and things that they do not do otherwise. I think it's that pendulum scenario again that the more you stack in on computing for a work environment, the more you go the other direction for a leisure environment.

"How important will privacy be?"

Big issue, it's going to be, it's already being networked up for use, that is, it's going to absolutely slash it apart. Privacy circumstances through finance is probably the most controlling factor in the whole of the human existence anyway, if you have not got enough dough to exist, well, you are pretty vulnerable and it might not be that it penetrates more than 10% of your, your sort of total environment but it will penetrate the environment that is, sort of going to hurt most and I think that it's wide open to corruption and everything else.

"Will we have more or less control over the technology?"

Less control because the more and more material that goes on to disks it's like books you know, they tried to stop books once, this is ten times more potent. It's going to be a tool I'm sure in that area, you know, it's because it's now bringing in a hell of a lot of different sensors, you've got visualisation, you've got artificial intelligence to make decisions, you're getting to the stage now where, you've got feel and look and touch combined together and that can be a very, I suppose you could turn it to brainwashing or whatever you like. Artificial realities are sort of high on the agenda but still a long way, still a long way out, but by hell you put a child in that environment and you could reap unbelievable damage I think.

Do you think new cults of technology will develop?"

I think human nature, I just off the top of my head here, is that human nature is always drawn towards, sort of power or knowledge, or, and it does not matter what your own opinion of God is, if you asked the sort of 15 different religions they'd all sort of have a concept of all knowing sort of perhaps all loving, but the knowledge based and the all knowing, the all sort of comprehending and I suppose there's a hell of a lot of that in a computer, the more you're thrown into it, the more advances it's going to give and when you get to the stage where you get artificial intelligence and reasoning and things like that, people can take their, your, analytical questions to a computer and get to sort of verbally give you some answers at some stage. I'm sure that emotional problems and financial problems you could, I could see a day where you get the computer that sort of takes this set of criteria and nuts it out and says there is your best option. I suppose audio today for psychologists you know, sort of soothing tapes and this sort of stuff and you stick someone in a capsule, a flotation tank, and you sort of put computer graphics up there and artificial intelligence and a few other things and they have a conversation and they are going to go out of there and say this is, so I think there is heaps of potential in the sort of direction that technology could go, it's all romance and daydreaming at the moment.

"What impact do you believe computers will have on education?"

I think again it comes back to how it's actually taught, if it's taught as a , as a method of similar to reading or mathematics or something, how to get into computing, it's going to be a fairly narrow field and people will perhaps tend to use it like a book whereas, I really believe that the opportunity in computing is the reverse to that, to have them understand what computing is capable of providing, and being able to use it as a tool and to work through the basis of, not 2×2 is four and knowing your tables off by heart

but being able to use it as a logical tool to get diverse range of answers and I don't know whether the education systems got the wherewithall to do that. 'Improve learning ability?' Again, only if it's, if it's done in a way where the student understands the technology before they use it, such as a, a learning aid.

"Will It have a motivating effect?"

I see it as a bit of a negative, I think it's a tool that needs, a bit like television, control. It's reactionary, rather than being proactive, you, you've sort of, if the computing is taught in the way that, I suspect it's going to be, it will be reaction, reaction, reaction. Whereas to get the thing working properly it's got to be a proactive, searching, enquiring arrangement from the students, otherwise it's just a lock in like a pair of headphones and, they listen and it goes over their heads. It's, the sort of scenario is, is sort of like getting on the Grand Prix track with these cars that are all sort of fixed to the track versus driving it and you have got to come off, you have got to spin the wheels, you have got to understand what the controlling mechanisms, are you have got to understand the vehicle on the scenario that you're in otherwise, I think what you will find is human endeavour looses it's sort of unique reasoning and other parts, I see it as being a real knife edge as to which way it goes and only those students that are taught well and get the principles and the, sort of handle on the computer they're going to come out with what I would say is effective, knowledge to use in industry, otherwise, they're, unless it's poked up to them on a computer they're not going to have any ability to control or redirect their initiatives in industry.

"Will computers improve creativity?"

They have to be, they have to be shown or, they have got to understand how to control the technology and this is how the industries get built, jobs get built too, but it's understanding what puts computer technology together and how it works and why it

works and where the broader opportunities are that creates an industry and, Silicon Valley is sort of a, the example, because, you, you have to get a whole understanding of how the stuff goes together and yet Australia is absolutely starved of that, all we do is import the bloody stuff in here, sit it down in front of people and use it and that is why we have got such a huge import bill and no ability to create it ourselves. "We are probably unharnessing what creativity we've got there?" We are killing it off at a rate that is unbelievable.

"What about gender effects?"

I think it will provide a bit of a common platform, actually, at the moment, well up until recently, I would have said that computing was, more or less, five years ago, computing was a man's domain, apart from sort of input of data, and now I think it's providing a bit of a tool between bringing a common platform together for students to work on. It's probably a great evener for the female side of learning, particularly to get into things traditionally, like engineering.

"Would computers be able to help identify career needs?"

I do not know, I am really unable to put a fix on that.

"Are computers more relevant to some subjects more than others?"

No, I think it will spread across everything, it's just a matter of commercial reality to it. I think engineering, it could go right through engineering, it could go right through scientific, right through anything, that is, maths or maths related. I do not think there is any limitations I think it's just a matter of commercial possibility.

"Will the user of computers make some forms of current knowledge redundant?"

It's the extension of the calculator from tables, it depends on how far divorced you get from what the principles of, well creating or solving the problem is if, if you are looking up information on computing you would again just need to understand what it is that you are doing so I suppose it's a change from, from the structure of how these things are calculated, if they understand it in general approach and then they have got the pool of instant information available and understand that it's a tool that can be used that way and they have been grounded properly. Well it does not really make a lot of difference but I suppose kids today really need the tables example provided they get the right answers and have calculators in exams, that sort of thing, and computers in exams will be the next step so I, again think it will get back to knowing how to get the information and what are the principles of solving the problem. With all that information it's even more important to start teaching the way of resolving and getting solutions. It's, the principles of maybe lateral thinking problems. So in grade one, in future, like straight out of kindergarten; how to use computing. What of the basic if, it's got to be an ABC language. The principles of computing and what it's about and get them at that stage and once they understand the language and why it works that way and etc. It's got to go right back to, whereas, what we have done is, we have brought in new technology and stuck it right at the end of the education stream and, been given the effect rather than how it sort of all comes into being. That is where Australia's absolutely going to get nowhere in building an industry unless they go back that way.

"What impact will computing have on equity?"

I do not think it will have a major impact on learning but I think it will have a major impact on output because those people that they can attract if they can get their central information and computing technology together, the best in the environment, they will

attract the people who know how to use it and that have got the creative minds. That is where they will bring, the advantage will come not from the information they have got but from attracting the people, the best brains in the business. As to how to use it, it's sort of, the result is the same but the cause of effect I think is a bit different. They will attract a lot of advantage.

"Will schooling be more or less effective or efficient using computers?"

The way it's going now, no, because I think there is a transition course needed because those that can use computers at the moment do not necessarily have the skills in knowing how to adapt to it in industry and when they go out all they can do is use the programs that are available. If it's Word or Lotus or CADD or whatever it is, that is where, I think, somewhere there has got to be a group of educationalists or government, it should be, sort of that, that government or government education group that understand how to apply these tools in new industry and to set up a collaborative arrangement between industries that build an export business and, you know, unfortunately what we are taking about is just a mammoth task. Australia is there, a real problem that I see coming up.

FUTURE OF COMPUTERS AND SCHOOLING

"How do you believe computing will effect the future of schooling"?

"Do any of the following descriptions meet your image?"

A place which conducts lessons as at present but which uses increasing amounts of computer technology for learning.

A place from where students' progress is managed, records kept and advice given but with much of the learning occurring out of the school in houses, libraries and other public institutions.

A place where students spend time on individual study programs monitored and recorded by computer.

A private company which manages computer learning programs for individuals for a fee in their homes or in small learning centres.

A place where students gather for group and social activities but specific knowledge is gained personally using computer technology.

A place which becomes irrelevant as technology removes the need for separate institutional education and replaces it with centralised data banks of learning material which can be used as required throughout life.

None of those described."

I think a bit of each, I think the social environment for kids is something that would be really lost out if the kids were put into terminal situations at home or in sort of, major, sort of terminal rooms or libraries or whatever you call it. However there is a lot to be gained from a computer orientated learning system that forces them to be creative that sort of has them use a whole range of other skills like the library or doing exercises it can be a controlling factor, but it has to be able to push people outwards if it's using computer technology all the way down so to follow this track, stay on the terminal, do everything. If it pushes people out to doing different, varying exercises using a whole range of centres, that is the way to go and they get the social environment as well. But my overall concept would be for Australia to be competitive then the university system, and it's got to be broken up and the TAFE system has got to be broken up to almost a category of vertical markets where the metal trades industry say, ok, there is a metal trades university and we have got all these facilities put together and we are working with the whole of the industry. You have got 335 companies in South Australia that are in the metal trades industry that are developing the curriculum once saying this is what

we need as a person that selects this as their career. You have universities that are based on perhaps the current concept but they are industry, vertical market based, if it's engineering, it's mapping or survey or if it's graphics or art and there is a centre to that end. Really that is where I think that industry has got to set up a computing centre in a whole range of skill exercises that puts them through instead of the university course.

"Primary and early high school?"

I suppose communities are still going to be a problem in transport circumstances to get the social skills they are going to have to be in an environment from there, but I would expect it if the tendency would be more and more like industry to have computing facilities at home to do a job from that direction. If you have got visual aid where you have got video and computing combined together you can enhance the social skills at the same time, then I can see the option that perhaps even 50% of that is gardening a curriculum that develops so that it can be done at home and the rest of the social skills are brought together when they have to do research programs or use libraries or go to centres for specific skills those sort of things. I really see like the MFP is the sort of centre that I would see for leaning where you bring an industry together to get the very best course unless we, unless we have at that level, Australia is not going to be able to compete worldwide. It is a global community already and if there is not an economically viable industry on a world basis, well there is just not going to be jobs.

"What about the teacher's role?"

Perhaps I see the kindergarten up to grade 3 or something like that being fairly similar, but I see a vast change sort of from the age of 10 or 11 to 15 where 14 would be what I see now as almost a university course where there is a lot more independence, a lot more, maybe it's a matrix style approach in there and then you have got, you are almost pushing university back into that category of learning. Then you bring in what I would

say is an industry based university course specialist, it's not, it's not so much non-productive learning or, maybe it's from 18-25 but it's an industry based, development and unfortunately it's going to get that specialised and Japan's already trying this. With there philosophy of this is the family, you know you have selected this industry and I see the only way you can beat that situation is if you take, maybe, the top 20 plastics industry people in South Australia and they all work as a conglomerate because they can no longer work as competitive individuals in the Australian market because they cannot survive. Everything that comes into the country is going to be cheaper and better quality if they work that way.

CONTROL OF TECHNOLOGY IN EDUCATION

"Have most people made a decision about using computers in education?"

The majority of people have not given it a great deal of thought. Where I believe the lead should come from is not education but industry. Industry has got to say this is what we have to achieve and really drag the, sort of, the education into that. More specific provision of skills if you still have the general and lateral broad based education approach that TAFE colleges have got and universities have got, you are going to have to add another five years to it.

"Is computing inevitable?"

Computing mode inevitable, I think it is, it will get down to the stage of hand held computers. Engineers that are on jobs, they walk onto the job and they sort of scan it and they do the specifically in our industry, that is what is going to happen.

"Will society become more inhuman?"

Yes, society will to an extent, but those that do that will be relegated to oblivion and those that still keep the human skills, this is where I was saying before that you, you will get the skills centre that might have everything but what they will really do is selectively attract those that have got the best ability to use the tools that are there and that is where again human sort of contact and in the relationships are going to be the thing that, that makes it's success, it's not going to be the computing power or anything else that is there it's going to be the human interaction.

"Will we have much choice about where computing used?"

Well two points; there will not be any choice for industry and economics and therefore that will dominate education.

"Would you use or not use computers in education?"

I would definitely use computers in education, but I'd definitely use them differently to what they are being used for.

"Will schooling be reshaped?"

Yeah, yes, if, industry has to do it through. Education has for a long time its been a ladder system to get to a platform then industry says, you have arrived, it's got to be, industries got to be right down at the bottom of the ladder instead of saying right there is 15 ladders now we have got a sifting system to here and we build up on those platforms to these specific areas and then when you have got through, sort of, the first third of education, it's a bit more specific and very much more defined and otherwise, you are just not going to have the level of skill.

"Exciting or frightening?"

I see it as hugely exciting on one hand but devastatingly frightening at the moment with Australian government policies the way they are and the education system going in the direction that it is and generally the lack of perception I suppose of the community, to say you should be, perhaps, changing things. I think Australia's opportunities are going to run out within 10 years.

"Will teachers lose control of the curriculum?"

Yeh, definitely, think you've got to break up the education system which is one block in to about 15 channels and at the moment the 1 block is going in the common direction and that common direction is 50.001% and you know, it's just got the majority like bloody governments do and they go in blundering off in a block direction. Really it has got to be broken down into all points of the compass direction with a common core and sort of, it's like a pebble in a pond. The common core goes out, sort of, a third of the way then the next third is, sort of, very specific in, sort of, different applications and then, sort of, when it hit's the bank you have got to a whole lot of specialist task that they take up.

"Will education be constrained by this?"

I think it will flounder simply because unless the government has the right policies in conjunction with industry and there is a whole lot of collaboration that's got to go in there to get the ground work right and education cannot hope to do it all on their own and unless, I think, education's floundering now.

PROMOTION OF COMPUTERS IN EDUCATION

"Whom do you believe has most promoted the use of computers in education?"

Media? No

Government? No

Employers? A little

Education Departments? Little

Parents? Little

Computer companies? Dominant, absolutely dominant and for the wrong reasons

Teachers? A little

Unions? I think that it's changing. Actually the perception there would be that at least starting to change

The question of the commercial sort of promotion of computing as a learning aid is now getting a very big push, and I am not quite sure that, well I'm positive, that it's going in the wrong direction. Really what it should be about is, maybe it's more that it should be education linking with government and computing and industry to find the way that it should go and at the moment it's very heavily handed in the big corporate dollars. You look at the Coles promotion, you know, all it is is shifting boxes. It's good in an extent, it's positive because it is getting computing there but it's totally unrelated to education. All it is is a methodology of, of fostering, seeding the need for computers without getting to the core of what education is about.

EVALUATION OF SCHOOLING

"How do you believe schools are performing at the moment?"

- **Are schools satisfactory?**
- **Need radical change?**
- **Irrelevant?**
- **Always be the same?**
- **Not sure?**

It's; it's not irrelevant but that scenario it's getting towards it, sort of. I think human nature, picks up in society as much now as you can learn in education and the curriculum that are there, particularly for the first, I suppose, it's a lot of basics but, but there are big blocks I think in the middle of the education system. Like kindergarten does it's role to sort of get up to the stage of social, sort of, equity and at least knowing language and doing those sorts of things. You know, there is a bit of formality in the first few grades then you have got to have English and you have got to know maths but somewhere in amongst all of that there is a great big block of stuff that just is not happening. I think, what I am really saying that perhaps the whole of the education system is fairly adequate for what it does but it lacks, it's two dimensional, you lay it out, you say all right those blocks are all being done year by year and term by term and, sort of, you can see that it's advancing but it's advancing along a flat plane. What you really got to do is, sort of, put these lanes into it in a third dimension that are all leading to something at the end. At the moment when I say it's two dimensional it's a learning process which has no direction to, perhaps an elevation, which is your job at the end of it. You come up to a brick wall at the end and you look up and you say, shit, the bloody job skills are nowhere and I got 350 metres to climb and I got to do that when I hit industry.

The vocational selection, sort of, has to happen a hell of a lot earlier and people with goals to, really go through an education system in an effective way at an early date with the skills that are required and at the moment it's a block system they turn out 450 at the end of the year from, sort of, matriculation class and then they say well what are you going to do and, what is even worse, that 450 say, well I'm going to go to university, then they select what they want to do and they cannot do it anyway so 287 will go into arts and there is 4 or 5 that are brilliant that have got just great academic skills but perhaps no human skills at all and they say, well I'll be a doctor. You finish up with a whole set of, I was going to say, I should not on the tape, that they really are mucked up. By grade 6 they should have been put into a not a channel but it's a, sort of, quarter of the entire segment that is available, like at the moment, what happens is that education they start and finish in matrix and they all the same what, what should be happening is that, it's broken into 15 directions or perhaps at the end of the first four years of school it's broken into four different directions and then at the end of 8 years of school it's up into 12 directions and then by the time it hit's university they have already got a focus which puts them into either engineering or law or something that is right down the track where they know what their best attributes are and what they enjoy most because to me it's bloody simple if you are good at it you will enjoy it. You do not build on people's weaknesses and, sort of, give them hours and hours of work to get them from 49% to 51% to say, I have passed. What your looking to do is taking them from things that they are 78% at and enjoy and are good at it and push them right into the 90's and, you just break them off into those groups. But we, we just do not seem to have that, that will.

Well, let me go on to industry. Today in Australian industry it is so, cut throat, competitive, tall poppy syndrome that your, your, Australian industry just cannot compete. Where it's got to come from is that industry gets together and they bring all of the best of the companies to create a harbour, where, there is, there is job and there is world competitiveness and everything else and that is where the government has got to start. You have got to have that harbour, you have got to have, and, you do not try and compete with the motor car industry in Japan. You take the wool trade and, we build it up to the stage where we can actually do something with the wool. We have, a finished industry, the whole structure wrong like that, like, like just here in South Australia, there is three granite quarries. Those granite quarries, all they do is send blocks of granite overseas and they sell, I know a farmer in the western district and he is selling cubic metres of export quality granite for \$25 per cubic metre, they take it overseas, it's cut and it's polished and it's cut and they finish up getting in the order of \$450 a linear metre for it and you multiply it out and they are getting in the order of \$26,000 per cubic metre and we are selling it for \$25.. Now there is no reason at all why we could not have that industry and we have got a great resource here, it's just ludicrous.

The, sort of, thing that is a tragedy in Australia right now is you get a whole lot of people that are highly educated doing things that they do not really enjoy, they have been pushed into it because they had to, you know, they want a university degree, they have to do something that they can get into they are not really attuned to it, the whole system is whacked.

INTERVIEW EIGHT

COMPANY: APPLE COMPUTERS
POSITION: SOUTH AUSTRALIAN SALES MANAGER
DESCRIPTION: Multi-national distribution of Apple personal computers

FUTURE IMAGE OF SOCIETY AND TECHNOLOGY

"What images do you hold about society and technology in the future?"

Well the image I hold of technology and the one reason that I got into this game is I had worked for all the standard industries, all the industrial commercial type industries, that were not really changing their ways. Yes, they were using technology to help them along that path but not really changing their ways. Technology itself will precipitate some of the greatest changes that we can have and it is precipitating them right under our nose. My own view is that the first thing we have got to do is start getting people working from home. If we can get just 40% of each of our capital cities people working from home, that is office people, because all they work with is information, then this country, rule number 1 does not buy another drop of oil. So first, economically, it is very attractive - ecologically, the greenies will love it. There's no more . . .

Socially there is going to be a few changes, divorce may go up even further but burglary is going to come down because people are going to be more at home. I think you would start to see job sharing so a husband and wife could take turns at doing the business end of the money income, so one day the wife can do it, one day the husband can do it because they both know the job intimately. They would sit at their terminal at home from which all information would be dispersed. I guess there would be arguments then, oh we need to have them meeting once a week at a cricket club or we need to have them once a week at another part of the office. I personally believe that they can see, ie they are on a window with text, data, speech and visual, which we have right

now that demands very close personal interaction, to top that, I think a lot of people under-estimate the number of folk that would like to work from homes.

The next point is, people will say, well your cities will be dead, but we have immediately solved our housing problems because all those folk that are out there without a house now have all this space in the city and if you have a good look now you will see there is 30-40% of each capital city unoccupied, they would be delighted to have people paying 20 or 30 bucks a week rent on that. They would just need to put in the partitions, put in the sanitary parts of it and your off. So my own view is, I think technology can help us get out of the jam we are in but only if we start thinking that way. No one wants to change the status quo, none of the industrialists want that. But the first person to do it will be right on the ball.

I would hope one of these days BHP did it and I would love to be the chap that walked in and said listen to all this, sell it, give me half, I'll have all your folks working from home. Attendance rates up, clothing, you do not have to spend as much on clothing, you might have to wear a nice shirt while your sitting in front of your camera but the freedom then allows the individual really is exceptional they will never have had that sort of freedom, they do not have to run out in the rain, hail and snow to go to work.

A lot of folks say, I really enjoy that half hour drive to work, well in Adelaide it's not bad, Hobart it's probably a little better but Sydney and Melbourne forget it. And the other thing is they build a tunnel under Sydney Harbour Bridge, that's not going to change anything, in, in effect it will make it worse because they are still coming from that area and across that narrow gap into the same areas. There they have a problem so they can dig 3 or 4 more tunnels. We are just going to sell more computers and that's the only thing that is going to solve it.

"So you are saying that computers are the major communication channel?"

With ISDN and satellite communication you can get, well, I was showing some people from channel 10 this morning a brain scan a CAD scan video put into the computer, no video tape, straight into the software and then simply cut and pasted into the letter sent over the modem to the doctor. Now instead of the doctor having to type the description all he does when he gets the letter over his modem, he clicks on the picture and the scan runs. He can also emulate it with voice and say, if you look carefully as the head revolves you will see at the cerebellum this particular patch, and you can stop the video running right there, just by clicking the mouse. So there is all the information that they have at their fingertips, compressed, thrown over the line, seconds later it's at the other terminal and it can be anywhere in the world.

All those folks that work in our offices do nothing but play with information. They do not make doors, they do not make cars, so in my own view the computer is a liberator, contrary to other opinions.

"Will leisure be effected?"

It will effect leisure. If my own leisures any, um, if I walk past the computer at home, well, ok, but if I sit down at it invariably I will be there for a couple of hours. Now, it can teach me a language, I have a preference for Japanese because I think we need to be dealing more and more with the Asian side of things, probably Indonesian shortly. At a click of a button I can run through the Japanese alphabet. I can have the computer, repeat and repeat and repeat until I get it word perfect. It never gets tired, it never goes on holiday, it does not have sick pay and it's always there when I turn it on. It has not broken down yet. If I want to play a video game just swap over to another disk and sit down and play it. I'm a little tired of them now, but if you look very closely at Nintendo

and Sega that market is huge and rapidly approaching our own markets and the people fighting and jockeying at the control of that are ruthless because they know that that's where entertainment lies and God help us all when virtual realities in.

For instance, virtual reality is in the early days. Two years ago Scientific American ran an nice little article on it and the chaps were using huge equipment, big helmets, whole suit's, body suit's, wired with excessive cabling and they looked for all like some sort of robotics thing gone wrong. That's now down to a head set that can be plugged in and a pair of gloves that will give that tactile feeling. To play a game in that vein is all consuming, the player literally is living the game and that's going to occupy a lot of folks. It also means too that a lot of people say you need that touch you need to be able to meet people in the work place but it could have a virtual work place.

Nothing is impossible, so whilst you might be many miles apart it would be that you are actually in the same room once you have your headset on you have entered, shake hands in inverted commas the cyber space. So again, I see the entertainment side as taking a real leap. 3D chess played between twenty players for instance, on a global net, all able to interact with one another without ever leaving your home. And that's why companies like Telecom and Optus are fighting tooth and nail to get hold of the airwaves, er, television, television, long the dominator of the airwaves will completely go underground so as much as they talk about cable television and we don't want it or we want these people to have it, it is inevitable that it will be delivered by cable because the airwaves will be full of technology, being full, with no room for television coming up very shortly. So I see a complete reversal of the roles coming up very shortly probably within the decade.

"What about Privacy"?

My views there are simply that if each home has a computer they should be allowed to log on to any database that has their particulars. I would be quite happy to push my local member right down that path. I as a taxpayer of long standing without any note of thanks from the government, demand the right to enter my file and have a look around, not to change it but to know that it is there and be given access to it and the opportunity to discuss it with any government body. What a lot of folk must remember is the first computer ever built, designed for the government, was the Census computer Holleriths in the USA, 1890's or something like that. The government from that point in time have been the major buyer of computers. That will continue to be the case. Now here comes the backlash from we who don't have the money to buy those great big beasts but do have the phone if you will to tap in to make the call and I believe that there should be legislation that every individual is able to go in electronically and have a look at that account here, this account there, that record there, births and deaths etc, I think it is a right not a privilege, a right. I see a lot of potential there.

"Control. I mean technology is moving along in some ways people are getting swept along with it. There is an argument about who has a right to have some control and where it goes or do we have any control?"

I think we've got limited control, er, I think as we've previously discussed our early government here in this country had no concept of anything in the future they simply staggered along the lines of the past. They did not sit back and eat a magic mushroom and have a vision and you have got to remember that the line between vision and hallucination is pretty far away. We have had some pretty forward thinkers in this country, Barry Jones is a classic. I think his book was Sleeper Wake, if I remember. I would put him in the same genre as Toffler, Arthur C Clarke, one or two other people

who are pretty good at looking out twenty years. If we are being swept along with it, it's because we don't know. I can't remember the old line, you know, show me and I can see. Almost biblical but unless we keep looking ourselves, yes, we will be swept along.

"Most people are using computers and they do not even know it, stoves etc."

Yes! The micro chip is built in to it.

"So they can be very invisible?"

Yes, well they are now working on houses and we are doing it in conjunction with the universities, the smart houses, all computer controlled, even voice activated. That has ramifications for a lot of things. For one, electronic locks rather than brass keys. When you stand in front of the door there is know way known that you can open it unless it's your voice or the voices the computer has been trained to recognise. Turn on the lights, turn up the heater, start up the cooker.

"Well if we have gone that far some of the literature suggests that what could emerge in society is cults of technology. Do you think this is a reality?"

No, I think you will have two groups of people although it may not be as easily cut as that but I think you will have those who adapt them and use them very quickly and if you watch any child with a video cassette recorder they just treat them, they accept them. You'll have the luddites, of course, who will say no I don't want any part of them and pull the power. Both should have the freedom to make the choice.

My own view is that because knowledge is expanding at such an exponential rate, what's the clique? We know 10% of what we need to know; the only way you can store it and access it will be via a computer. If we have no trees to make books anymore it must come in the shape of CD or digital data and if you don't have access to it, if you

pull the plug what are you going to do. If you are in it or out of it and I would imagine that folks would get by quite happily without it but they will be doing quite different jobs from the information navigations, if you will. There was another angle to that. What part of the question was that again?

"The point I was making was that according to some elements and this is people in the literature' writing sometime ago, that some of this stuff could become so awe inspiring that some individuals would worship it."

Well two books spring to mind don't they I mean Huxley - "Brave New World" and Orwell "1984". Interesting enough the Mac was released in 1984. In both books both writers had precedent views, they did, they had the old magic mushroom looking out ahead there. Orwell was so wide of the mark it's not funny, and by the way, neither book mentions computer once.

"They talk about information though?"

Yes, they do, not the vehicle, that's rather interesting.

I think of the two Huxley was closer to the mark with the race for genetic engineering and the featuring of all those DNA's right now. Although one wonders what the hell they're doing and again all that information will need to be sorted on a computer because there's billions of tons of it. To access it by computer because there is no other way of getting it across. A report, a bound volume of it will only give you a squillith of it and if they send a DNA chain which looks like a spiral of two and you want to have a look at it you need to drop it onto a computer, twist it and turn it through 360° etc. So I think Orwell got it wrong. I don't think there is a huge Orwellian presence driving everything nor do I think humanity is clever enough to have a total global coverage telling you what to do because there will always be these blokes running around pulling the plug on us.

I really think, I really do, it gets back to the core, if we use the technology and put it in to areas that will help us move forward we can take a jump, we can take a leap, it's like saying to, lets say, uh, any where, like a Pacific Island you're got a choice you can go down the industrial route now first off, you've got to put in highways, pave them, buy trucks or you can put in a data network system, communications, and they've really got to think very hard about that one.

I think they are pushed very quickly into the computer world, lets not say computing, a digital world.

COMPUTING IN EDUCATION

"Do you have concerns about relationships?"

I don't. I am very fortunate in my job I get to see a lot of children using computers in a lot of schools from the very junior levels through to the senior levels. At the junior level their concentration level has to be seen to be believed. They do not give up for any other subject to be at the door in their lunch hour and their morning tea break.

It really is, I still cannot get over the keenness that kids will happen with, even my own daughter is the same. Um, with the volume of information and with the turmoil that education is in right now and it's under going radical stress, radical change. The teacher I feel will become, if I can use the term, it's not my own, a knowledge navigator, a facilitator, a leader, a bit like a scout master or in equality, a girl guide master, or what ever, a person master.

Um, for instance a CD now days holds five sets of encyclopedia, Japanese have now doubled that to ten and Phillips have announced that they can get video on two of them. It's a small step from there to sending it over the wire. The video shops will disappear. The video shops days are now numbered. Like a fax machine it is about to be a dinosaur.

"It makes your library look a bit sick?"

Yes it does but it's very green. They don't chop trees down. Also you can sample at a faster rate but getting back to the point, the teacher now has all of this coming in on top of the curriculum that he's supposed to imbue our youngsters with. He has also the change in the way in the school or the Education Department are now pushing and pulling him or her or he and she, so all this, and it's more information, is landing on him. So, more and more the computer will play the role to relieve him of some of that burden so that at least spend time updating himself, herself, er, with knowledge because they too will be required to keep learning; it's now a lifetime process. Sad in some ways, pretty good in others because I can't remember who it was, probably Buckminster Fuller who said you can never learn less.

"What about learning ability. Do you think when we use computers we actually enhance learning ability?"

That's a tough one, you've got a couple of camps there. Um, my own view from what I see is, Yes! I have seen very backward children, awkward children who do not get on with a group sit down at a computer which of course will not admonish them, which will never lose patience, which will keep repeating, keep doing what they want to do over and over again and start to show some signs and sometimes dramatic improvement from their earlier educational role. So I, again whilst I, my view may be jaundice, I have

been lucky enough to have seen it. Um, one of the happiest moments I ever had in this game was that kid when he first spoke for the first time, he spoke through the computer. He had an impediment and he, I said how do you feel about that, he could hear and he wrote back with the puffer, puff, puff, puff, you know, typing you won't see that every day and that is very rewarding see, and all of a sudden he was on the job not withdrawn anymore, he could actually get back to those who were teaching him and now I understand that his word speed on that is probably one of the best in the country. So I think that's a good example.

"What you are also indicting is that computers are highly motivating?"

Oh yes, oh yes.

"What about creativity though, I mean creativity is a little different?"

It's a great word isn't it.

"Do we, is there potential within the computer system to enhance creativity and do you think that it is likely to have that effect in a school system?"

Um, Yes. If you go, let me give Camden Park as an example. There is a chap down there called Kim Nader who has done some magnificent work with his primary schools. Now they have put together, using the computer, the tour guide of Africa and sitting there you just point and click and the map of Africa comes up and then they have their own voice. This is Kim year five and we put this together and my specialty is Nigeria. Would you like to see Nigeria, click here, click there and up pops Nigeria and the population and then they pull in pictures of it and elephants and lions and tigers. Now none of them before that had much idea of Africa. Now you can pull any one of them out that have been involved with that project. Matter of fact it's now being held up as an example for all Australia and sit down and talk to them at length about Africa without

going anywhere near a computer and they will tell you more than you know about Africa. Which one is a democracy? Which is not a democracy? What their main food is; this one Eritrea, for instance, still suffering draught etc. South Africa, all the naughty people down there, the fights going on down there. Now that's all come from their own research which they have all put together in a piece of software called Hypercard which up until a few months ago was free with every Apple Mac.

"Gender effects this is one which features in the literature. The argument is that males by and large dominate computers and that males respond to computers more positively than females."

Interesting isn't it, because some of the best languages written on computers was invented by females and I guess that Ada Lovelace played a major role in the evolution in the computer by recording all of Babbages early works. I've got two daughters, I'm fortunate that they have access to the computer that I have home. They go to an all girls school so they are a bit luckier than the mix group; that's a tough one.

"The research suggests that where you have girls together that's not a problem but where there's girls and boys the social traditions tend to make them stand back and not out do the boys."

Just to go on, Yes, I think there's a problem there and Yes I think we have to address it. The girls have just got to more time to them.

"Career needs, do you think that having this sort of stuff readily available will assist the people in terms of what their career needs are?"

Well yes, I do because most of the jobs these people are going, remember we were talking before about the 2005-2010, you know, the next generation, you know I would hazard 50%-60% of the jobs not invented yet and unless we can get a handle on the

information and can show people no matter where they go, just like the telephone, every house, every home, every school, every office has got a telephone. That's exactly what it will be with the computer. It may even be integrated into the computer and the computer will happily keep time on each one of them. So, I mean you only need to pick up each Tuesday's copy of the Australian which is the only supplement which pays for itself by the way. The computer pages each Tuesday.

Let's take that particular supplement, have a look in there at the jobs. Programmers \$35,000-\$40,000, just programmers. The industry cannot get enough of certain types of people. They probably have enough of my sort of person. You know, I could be redundant shortly. The sales and marketing side will become increasingly less important as people buy them like a home. They simply must have one and that's the battle of the operating system we were talking about earlier. So just what were we talking on that question?

"Well I was just looking on the career needs. Whether in fact the computer enabled people to get a better picture of career needs such the sort of jobs available and skill themselves in a sense."

I think it will, but I'm not quite sure how. I could be tied up with the fact that a lot of jobs in the future will be information based anyway.

Also, when I've talked to children and said how do you feel about the computer industry they are quite ambivalent. It just strikes me as odd and the minute you say would you like a job that pays \$40,000 a year, they say yeh, and then you show them an advertisement for a programmer, wow, programming and then you've got their interest, so the dollar starts to get them, and then when you say you've got to do a little work to get here they say I like to polish cars. Too hard.

"There is another one which is very pertinent to education which a lot of people have not taken on board and that is, the curriculum is essentially fashioned out of what people believe to be the knowledge that's required. The question I keep asking people in education is what about the redundancy of current knowledge, do you think the current ways we learn, the information we are learning, the type of structure that's in the curriculum is even going to be relevant in the future, especially when you have knowledge readily available on computer bases of sorts."

Well my own views are that you will find, well let's take South Australia for example, we do very well with distance education. Have done, you know, School of the Air etc, a long way ahead of other folk.

Computers will follow it, satellite communications will follow it, but what you will find are places like Angle Park where they have a Nexus database. Do you know Nexus at all?

"Yes"

Magnificent. The boys have done a pretty good job out there and it's something this State can be proud of. All we need is a front end which is a little more friendly than the Unix based command like you have a knowledge centre there that every school can tap into for a very small fee. Unix just asked AOP Rueters to hook into their globe or internet to hook into theirs. You have all this information coming from those sources which can then be farmed out to schools with just a computer and modem and they can go almost anywhere in the world for a few cents and the computer happily tracks them as they come in and log on and log off.

So my view there is, you will face more and more of it and you will see more and more teachers come together in huddles so that they pool all the knowledge and they structure it and they access it. So I think that's close to that question.

"I suppose that as much as anything else one of the things I am looking at is that a lot of learning, learning we certainly did, was done on the bases of the need to know. Well, the question one has to ask is what do you need to know in society where need-to-know is as close as to a terminal which can give you that information?"

I think the answer is everything you need to know, everything. We all have a need to know. I mean what was it - the 3R's.

"It used to be the 3R's infatigably. Perhaps it's handling information, that's more important than the 3R's?"

Yes, I think you would get into a pretty wild argument with some folks. My own view is that you need a structured base as a youngster but again that's coming from my field of relevance and that's what I had, a structured base.

"Yes, most of us did but as we go up into the stream one wonders how much more use the structure is?"

Yes, what are the foundation stones? I don't have any firm answers to that one.

"You would be pleased to know that nobody seems to either."

"What about equity, do you think there is a problem in equity that is some people have the ability to get to the technology because they have the resources to buy it, others don't?"

I think this problem will face us for at least the next 10 years in Australia and I suppose you heard about the Coles Apples for students program. That was the most staggering promotion Coles have ever had. Schools went for it like you wouldn't believe. Now if that doesn't indicate there's a need out there for them to get their hands on the technology well I don't think anything else will. Matter of fact, that was a 9 million dollar buying spree. 9 million dollars worth of computers.

All the schools were mailed again this year and the tags have come down because their prices have come down so they don't need to get as many. I can not remember the exact number but say it was 10,000 schools mailed across Australia, 8,000 of them replied within a fortnight, 8,000. Now if that's not - we'll never know, we've been in this education business since the early eighties, we have never seen a response like it, never. So if you measure that against what they must have, you can see there's a crying need out there.

People say that's great for your company and it is, we're selling things the same as people sell books to schools. It's great for book makers it might not be for much longer.

"I heard that we have our own CD manufacturers now coming on stream?"

It's about time they did it because we can make a disc in Apple for about \$65.00

"Well apparently they are going to run Australian music rather than doing their test discs on garbage."

Well you can press one for about \$65 per master but generally by the time you put it all together it probably costs several thousand dollars and then every one you release costs about \$4.00 and they are also almost indestructible and they are very green.

"The last question talks about efficiency and effectiveness. In other words it says, we put all this stuff into schools and it gradually grows - we get more and more of it, are we getting a system which is more efficient and effective?"

Oh dear, one would like to say, yes. Years ago when computers first started going into schools it was the maths teacher, the poor old maths teacher - look these things are mathematical, you own it, it's your problem and the other teachers would avoid it at all

costs, even today I know teachers avoid it at all costs. I know many maths teachers who have gone out to make a fortune in the computing industry. They have gone out and opened up shops because they were first to see it, the first to adapt to it. I think there is a reticence still. I believe that it will be and I believe that it is inevitable.

"The other question this raises, is do we need so many teachers?"

Well I think if you look at the market, schools are closing. Schools are closing; one, because we are nuclear family orientated in this country, not enough children in schools; teachers leaving because of dissatisfaction; union problems, er, I, let's face it the old education industry like every other industry is in a state of upheaval. What the results of that will be, who knows? I think what they will be pushing them, more and more, to over the wire delivery from centres of knowledge, if you will. Again that cuts out whole levels of infrastructures.

"Are you suggesting that we could finish up with clusters of teachers who are knowledge specialists who put this stuff together and there will be another group of people we currently call teachers who look after the social development of the group."

Yes.

"And, ensure they are handling the learning appropriately."

COMPUTERS IN SCHOOLING

"How do you believe computing will effect the future of schooling?"

"Do any of the following descriptions meet your image?"

A place which conducts lessons as at present but which uses increasing amounts of computer technology for learning.

A place from where students' progress is managed, records kept and advice given but with much of the learning occurring out of the school in houses, libraries and other public institutions.

A place where students spend time on individual study programs monitored and recorded by computer.

A private company which manages computer learning programs for individuals for a fee in their homes or in small learning centres.

A place where students gather for group and social activities but specific knowledge is gained personally using computer technology.

A place which becomes irrelevant as technology removes the need for separate institutional education and replaces it with centralised data banks of learning material which can be used as required throughout life.

None of those described.

I think it will be a mixture. Well, we already have private schools haven't we. Look at Bond, he has a university, poor fellow, and we all wanted to be as rich as Bond and now we are.

I think it will be a mixture, I think we will have private companies, certainly. I think, yes, it will have to be individualised and yes, you cannot get away from some of the social development. I mean that's a real tough one, that's really tough and I don't think that schools will ever become irrelevant. If schools ever become irrelevant it won't be in my life time.

If schools are not looking ahead and not looking at change, yes they will become irrelevant.

THE ROLE OF THE TEACHER

"I think you picked this up before, the role of the teacher. You said that you saw the role of the teacher changing quite significantly."

Yes.

"Rather than being a fountain of all knowledge to being the point where effectively they are, -"

The knowledge navigators.

"They are assisting people, they are facilitators rather than people who have the knowledge themselves and so they are really more on about how people learn rather than knowledge itself."

Yes. Well Camden Park is a classic example. I mean he just didn't stand in front of the book and say class this is Africa and draw a map of Africa on the board, he got them to do their research, go to libraries, come back and actually put all their knowledge together into the computer and what they have is literally a new book on Africa created by the primary school students of Camden Park. Now he is a facilitator and they know more about Africa today than perhaps they need too because they all got stuck right into it. I mean even to the extent of putting little video clips and sound clips in of themselves dispensing the knowledge and on top of that he could not get them off it.

That's the interesting point. Now if you go to TAFE, here's the difference, and sit down and start teaching people the principles of computing, particularly in the DOS environment, they turn off in droves.

"The interesting thing about it is that those students are coming up and going into TAFE."

Yes

"If TAFE doesn't drastically change it's direction it's got a whole lot of disaffected students coming into it?"

Yes, it will.

CONTROL OF TECHNOLOGY IN EDUCATION

"Now this next block is about the control of education."

"Most people have already decided about where we're heading and the fact that we will be involved in this area. Do you think that that is the case or do you think that people are not really making a decision?"

I don't think there would be too many people not looking at it. I think that, I mean, just television, each time you see something like Beyond 2000 there's a computer in every shot. They're always there. I would be very surprised, I think those people who don't do it are in the outlying areas and the disadvantaged areas in the suburbs where there is no money, no budget, or that sort of thing and they have to press on with what they have.

"So are you saying therefore, that where we are and how we move in this field is inevitable?"

Yes, technology will drive us, if I can just go back to that, the times make the man, the person, not the person makes the times. I hold to that thought.

"Would you like to look at the future and say that it's going to be a more inhuman society?"

Jesus, let's hope it's no more inhuman that it is now. I would hope, a couple of classic examples, er, I think a blood bath in Manilla when Marcos and the other lady, what ever her name was, who turns out to be not much different anyway, when they confronted each other. The other reason that a bloodbath was avoided was **technology**; because the video cameras were there.

Now China did not make the same mistake. The minute they started getting the technology out we knew, in the western area, we knew that they were going to shoot people. People don't shoot people in front of people.

"Certainly not in front of cameras, where the world can see."

Correct. So there is coming a time where if you're planning a little massacre it's too late shooting the camera man because the picture is already up on the satellite.

Now, more and more, the nasty countries of the world do not have a free media, so I think in United Nations and Australia, we would have a media which is almost unfiltered, that can poke it's nose into any corner it pleases and run the stuff to air. Again, there would have to be certain controls but I wouldn't like to see too many. So those countries which don't have technology then good news services will continually fall further and further behind.

The days of dictatorships is rapidly coming to an end and thank goodness for technology in that respect. So if that's somewhat about answering that question. For instance, you don't get TV cameras in a row [argument].

"What about the question: do you think people are going to have much choice about where computers are used?"

No - they won't have a choice. Do you have a choice about where the phone is used?

"Not at all."

No, but it is accepted as a tool, look at the mobile phones. Now a few years ago \$5000. What is it worth now, \$1500. I've got one and I wonder how I got on without it. And that takes you back again, when the Bell invented the telephone and some chap ran up to tell the English postmaster general, listen this chap has invented a telephone, he shifted and said we've plenty of messenger boys here we don't need those sort of things. The mayor of New York on the other hand said that's a good idea, I can see the day when every city will have one. Neither of them had any idea, any idea at all. Find the home which doesn't have one.

"Schooling will be reshaped?"

Yes

"Exciting future?"

My word I do.

"Frightening future?"

I think it's a future full of hope.

"Teachers losing control of the curriculum?"

I think there are some positives and some negatives. I mean, you get back to the 3R's, is it necessary or should it be the 3C's for computing, charm, charisma and computing - who knows?

That's a very interesting one. You now get things like that silly women in NSW who put out that little green brochure the other day, that's ludicrous. What's she got to do with children's education. If she is going to put stuff out, I mean for Christ sake, check it for detail and check it for accuracy.

"Who besides teachers will be involved in the education process?"

Parents will be increasingly involved.

"In the paper some years ago the programmers were saying, look we clever people can do far better than that, we can run an education program of our games."

I think you have to be very careful. I think the Education Department and the teachers will be involved long into the future. What the Education Department has to decide what pain you're going through now you're going to do it and how you're going to do it but if you did away with it overnight, my God, we would be in diabolical trouble, I mean, half the people don't know where to get the information from.

"It's interesting that you say that because that's the general trend that I am getting. People are saying sure other people have got a say but teachers still are the preferred people to handle what's useful and what's not useful and they don't want to give others a free hand."

But at the same time we need to have forums where parents of those whose children are the responsibility of both groups have a say and when Rose Kelly trots out any more of that ridiculous dogma the parent has every right to say listen my children are going there to learn these three cities, right. For God sake, don't throw in any more issues than they can already stand and there's a warning. More and more government departments are throwing out educational kit's into schools and the educational content of them is highly questionable: get them out.

"With technology available, you have a better vehicle for delivery?"

And the left leaning boys in some of the Labor areas love it.

"Do you think there is any constraining of education because the technology is readily available?"

Elucidate.

"Do you think that education is going to be constrained in any way?"

No, I think it will just keep opening doors and we don't know the door that we are going to open.

"Who do you think is really doing the promotion of computers in education?"

The media? No

Governments? To an extent

Employers? Certainly not

Education Departments? Yes

Parents? To a lesser extent, some yet.

Computer companies? Certainly

Teachers? Yes

Unions? Never

Certainly, the way I see it we push all the time.

EVALUATION OF SCHOOLING

"Whom do you believe has most promoted the use of computers in education?"

"Do you think schools are generally satisfactory as they are?"

No

"What about if I said they need radical change?"

I think they do, Yeh, from what I have seen.

"Do you think they will always be some what the same?"

No, they can't be because they will become irrelevant. If they remain the same they will become irrelevant. The same as our political parties, they are irrelevant. People will just vote out the sitter.

We've got a nice track record of that over the past three or four years. The sitter is out. It doesn't matter what shade Liberal or Labor in Hobart the By-election they put in a ringer God help us all. They put in a footballer for Christ sake. Watching Griener go, if anyone was clean Griener was clean. If you look at his predecessors they were as corrupt as buggery. They want responsible government. Likewise, they want responsible education. They children I want to be geniuses. Please turn that into a genius.

INTERVIEW THREE

COMPANY: IBM AUSTRALIA
POSITION: SALES CONSULTANT
DESCRIPTION: South Australia agent for the multinational computing company
IBM

IMAGES OF FUTURE

"What images do you hold about the future society and technology in which schools will operate?"

I think it will greatly change our lives. I think that you can see if you look back the way technology has changed our lives and the way we go about things whether it be the technology of the television, the video, the automatic teller machine. So you can see how technology enters our lives in everyday, and how it has changed the way we live.

"How will it change our lives in future?"

Well, are you talking about? Generally, it's technology. Well I, you may not need to get to places in the future, I think a lot of things will be done from home, I think that a lot of work can be done from home so that you may have a link through a computer to your office and be able to deal with people across the computer screen. There is no reason why the telephone will not be linked to your computer and you will be able to actually have conversations seeing and hearing both ends, as though you are meeting together. However, it will be across a distance whether it will be within the Adelaide district or Australia or across countries. You will be able to move information across those like you might do today, with a video conferencing facility you will be able to pass information between each computer set up, so there may be no need to meet face to face as such, or to move out of your house to go to work. The same with shopping, banking and one can see the beginning now with a teletex type system that is available on the television, I can see in the future that a lot more will be done, I suppose not by

mail order but by computer order, so that there may be no need to have supermarkets where you go to look around, you look around through your computer to see what you would like to purchase, and so again for banking or shopping, no need to go outside the home they will be, things are delivered, basically. As far as your social life, you will open up more time for social interaction on a social basis as opposed to force from a work or a, all those other things like shopping, banking etc, so it can have, I think, positives and negatives from that point of view. I think a lot of things will be speeded up that you do, like your shopping etc, so it may give you more time for your sport, but I think that the important thing is we obviously do not all sit on our bottoms in front of a computer screen for the rest of our lives or our children do not, that they need to, I suppose, balance their time between doing those sort of things maybe at home, you could look at school. I suppose a bit differently is what I would say that there still is a role for that social interaction, so as much as people may say that technology could now deliver what you are learning at a university, I think is still important to have tutorial type system where you do interact with others and as with work, you might work at home four days a week but go in on the fifth day for that interaction and meetings or you can meet across the computer screen. I think that it is still important to have the social interaction. I suppose from a school's point of view I think we will see technology used so that teachers become more of a consultant and any of the facts taught by, you know, CD-Rom across the computer or whatever technology is after CD-Rom so that there is a lot more depth and children can self pace themselves, but then join back into the class for general discussion. I think you will see people going a lot further in that way and that teachers, as I say, will have to be more like consultants than teachers because the facts will be taught by computer not by the teacher.

"Is privacy a concern?"

I do not see it as a real concern but I can imagine some people would, it's very easy for

information to be accessed because, you know, there will be some time whether it be in the social security number, here, something else so that there is a trigger that all information can be held, so, but then again I think that it can help society in some ways if you look at some of those credit problems people are having at the moment. If there was a better system for banks to understand what sort of debt some people are in we would not have people running up the credit problems that we have today. That is a minor positive versus some of the negative some people feel but I do not see it as a real issue. It is not a real issue for me.

"Will technology and in particular, computers control our lives?"

I do not see a problem probably because of how familiar I am with technology. I think that for those that are unfamiliar with technology they could be quite uncomfortable about how technology could change their lives but for me I think it is a positive move because I think if we use technology or if we utilise technology properly we can gain more. We can do things smarter, we can do things quicker and we can make more time available for things that we like doing, leisure time, sport, you know, social.

"Will technology stimulate a new series of cults?"

Yes, it is possible I think, I mean you could almost look at them now with the people that, what is the term for it, the computer hackers and it could become a cult. However, I think it is important for the technology companies to do a bit more work on the security side of things and also the telecommunications carriers. But it is possible, I think there are probably people in some universities that just about do that now.

COMPUTERS IN EDUCATION

"What impact do you believe computers will have on education? For example, relationships?"

I think the relationship will mature in that, as I said earlier, the computer will be teaching the facts, however, the students as a group and the students with the teacher will discuss the issues, probably at higher levels so that, I would say that, relationships will not disappear by any means, I think in some ways will strengthen because they will be built on more of a consulting style role from the teacher's point of view, and peer to peer it will be more of a discussion focus rather than a competition over, you know, whose going to be the first person to put up their hand to answer this question. that will all be held on a computer basis and people will be given equal, I suppose, hearing by computers which does not always happen in the classroom setting.

"Will learning abilities be enhanced?"

Absolutely, I do not think there is any question of that, I think that the difficulty of a teacher handling students of different abilities is already proven to be a problem in many schools where some children do not get the attention others do, just from the attention point of view some students get left behind or also the fact that leaning disabilities are often ignored and often not recognised and I think through a computer a lot of those will possibly even disappear in that a computer can represent topics to be learnt in a number of different ways, and I think that from my experience people are a little backward with computers, it is not impossible to enhance the learning abilities and also teach people at different levels.

"Will computers have a motivating effect?"

I think that it will motivate them to do more I think especially those who are gifted students they will be able to move further ahead without the constraints currently in a classroom environment. I think for them that are a little behind they will be able to motivate to spend a bit more time on the work to catch up with the general mass of students and that they will be able to actually revise work at home in a way that they can actually get some feedback which they cannot now because once the class is over the teacher is gone. When your using a computer you can revise your work with some input from an expert effectively.

"Will computers Improve creativity?"

I think that as long as it's managed it can enhance creativity but definitely not reduce creativity, however, it depends how the computers are implemented. If one, or if the school system chooses to use the computers to their utmost and they stay at the leading edge of technology, then I think creativity will be enhanced, students will be able to do a lot more than they could do today and, I mean, I think you can even just look at the way things are used to design equipment even to see how students can see how something that you could not necessarily do on a piece of paper or even with a lot of fancy tools can be done in an almost imaginary type format on a computer. So I think it can probably enhance creativity as long as, as I said, that we stay at the leading edge and we move with technology.

"Will computers have a detrimental effect on women?"

I think that the gender effects is probably something that comes from the parents of the students rather than the students themselves. I think it is something that may come from some backward teachers which I think there are plenty of around still, so, I do not think it is a gender effect or something that is inbuilt, I think it is society's push and society saying that science and maths is for boys and, you know, needlework is for girls still.

"Will computers help students career needs?"

Well, I think the way that the schooling system is going will make it possibly more difficult to move people back into the menial style jobs because you do see a lot of people then that would probably be more comfortable in the white collar area, however, as far as enhancing career needs, I think, I mean, this country, anyway to keep moving, if we are going to keep pace with other countries in the way that they utilise technology and how that does enhance people's careers so I think, yes it's quite possible that maybe we will see a change in the blue to white collar percentages because people will feel that they can strike further because of what they had learnt using the computers but I think that is a long way off still.

"Are computers more relevant to some subjects more than others?"

No, I really do not think that.

"Will computers constrain education in some way?"

I think that is possible but I think if the education system does that they are not educating the students, I think that it's important just like learning your times tables, a calculator can do that, but you do not always have, you know, it is important for your

now, I suppose, abilities, stretching your own brains, to be able to do some of these functions even though you know it does not mean because you can use a spell check on a computer, you should not learn to spell for example, and that, I mean, that is what could be said about the calculator and then, times tables and I am sure that there are some people who use that as a reason not to learn them.

"Will computers create a problem for equity?"

I do not think it will change the problem of equity, I think that the problem exists today and I think that will, well, just, you know, it will not change, those that are well off have better ability to go to tutors, or go to private schools and may be get better attention etc today, and I think it just may be spent in a different way but I do not think there will be any change, so yes, I think the problem will still exist.

"Will schooling be more or less effective and efficient if using computers?"

They will be huge, huge and like I said I think it will free up the teachers to, to do other, to perform other roles so that I think, not that we will not need the same number of teachers, they will need new skills.

FUTURE OF COMPUTERS AND SCHOOLING

"How do you believe computing will effect the future of schooling?"

"Do any of the following descriptions meet your image?"

A place which conducts lessons as at present but which uses increasing amounts of computer technology for learning.

A place from where students' progress is managed, records kept and advice given but with much of the learning occurring out of the school in houses, libraries and other public institutions.

A place where students spend time on individual study programs monitored and recorded by computer.

A private company which manages computer learning programs for individuals for a fee in their homes or in small learning centres.

A place where students gather for group and social activities but specific knowledge is gained personally using computer technology.

A place which becomes irrelevant as technology removes the need for separate institutional education and replaces it with centralised data banks of learning material which can be used as required throughout life.

None of those described."

I would say, management learning only, I think that teachers will be involved in the management of learning but like I said, also, this is a consulting process so they will manage the process so the computers can manage that almost as well. The computers will test and assess, the teachers will not. They would do, the fact based testing will be done on computers, the consulting will do more of the user style, how they may relate to people. It may not mean the same timeframes and the computers may be available at school or they may be available in another format, however, I think it is still very important to have the school facility for, whether it be, the discipline of students still having to spend some time doing this sort of thing, the social interaction with peers of the same age and abilities and different age different abilities, there is no reason why a class in this environment should not span different age groups as well. I think that, like I said, that the teacher will manage the learning process probably, but also act in this consulting style role and lead discussion within a class.

"Will the use of computers change the role of teachers?"

They have to do a massive relearning process and in some cases part of the problem is going to be the people that are teachers now are not going to be capable of this new role.

"Have most people made a decision about using computers in education?"

I think people think that their students will still go to school and that they will go in and they will use the computers to teach them typing. I think a lot of people do not understand how computers can be used. They can be used for learning to do a user word-processor, or learning to use a spreadsheet. They do not think about how you can apply that. 'Inevitable' - absolutely.

"Will society become more inhuman?"

If it is not managed well, if the opportunity is there to go without social interaction, it is possible that society could become inhuman.

"How much choice do we have about using computers?"

I think, if we do not we might as well, you know, shave ourselves off from the rest of the world because we are just getting so far behind.

"Do you believe that schools will be reshaped?"

Absolutely, I cannot imagine life without it now.

"Is the future exciting or frightening?"

I think for some people it could be very frightening, those that are currently illiterate, but I think it's good to see the number of people that are trying. People now that have

children or are going to be bringing children up in this new society are starting to try and learn with their children and they are the ones that are going to be the winners.

"Will teachers lose control of the curriculum?"

Teachers within schools I do not think have control of the curriculum now so I do not think that will change. I think curriculum is set by central departments or government, so it is being delivered through computing rather than through teachers.

"Constrain education"?

No

PROMOTING THE USE OF COMPUTERS IN EDUCATION

"Whom do you believe has most promoted the use of computers in education?"

Media? Not much

Government? Very little

Employers? Non computing company employers. Employers generally - no

Education Department? They have done what they can do with their constrained so called budget.

Parents? Uni, yes. I think parents have done quite a bit considering what they know, but then again I think that there are unfortunately a few parents in each school who think they know everything and maybe do not understand the full implications and the full abilities of using computers in education.

Computer companies? I think the computer companies, if you're talking about hardware and software, I think, yes they are the main, the main sponsors or the main people that are trying to promote it. I think that, the difficulties are that there is no

money in it for the computer companies and so they do what they can and I think that, you know, the thing is a prime example. However, what are they promoting? Apart from hardware, in my opinion, nothing. It is not the total concept it's one of the smallest portions.

Teachers? I do not think teachers are given enough education. I have spoken to a couple of sessions of teachers and they just blow their minds with the sort of things that I have been able to show them. They really have not got across to the technology.

Unions? I probably really do not have an opinion, no that I know of.

EVALUATION OF SCHOOLING

"Are schools currently satisfactory?"

Not really.

"Do they need radical change?"

Well, I do, I do think they need radical change because I do not think they are implementing the technology available today and if they are not doing that today, when the students get out there, they are going to be seeing something totally different in the work force.

"Are schools irrelevant at the moment?"

No, I do not think they are irrelevant because we still need to learn these facts however we learn them, but I do think that we need to move to, to teaching students, on, you, more about what they need to know when they get out of school rather than just the facts.

"Will schools in the future be the same?"

I think we need better teachers at the top, at the top of these education departments to move them into the, into the real time, and I think part of the problem is that people at the top of these organisations are just moving funds from the bucket to another and not looking at the total problem or concept of education.

"Anything Else?"

I think the teachers are going to need a massive reskilling or teachers will not be suitable as teachers and maybe industry will be the teachers. I do not think they are doing it now but I think in the future that they, that people from private industry, whether it be, I do not know, you know, people from computer companies or people from wherever any have better, consulting, discussion leading skills than the current teachers and may feel more comfortable in that role.

"People moving in and out?"

Absolutely I think, I mean, I think it would be a good development exercise from both sides of the camp.

Summary of Interviews with Computer Suppliers

TECHNOLOGICAL FUTURE		
CADDSMAN LTD (D)	IBM (E)	APPLE (F)
<p>I think educational institutions are teaching people how to use technology, how to actually use the instrument where as, there is a need for people to understand what technology is, how it can be harnessed and in fact, the key thing too, is to create.</p> <p>... if you don't build your industry on computing technology as a store you have not got any chance of competing on the world market anyway.</p> <p>... there are real problems I see in Australia that the government has no strategy in which to bring technology to bear through education and education is still teaching what, how to use the technology not how to create it.</p> <p>I think there's going to be a real surge in technology over the next decade - its going to get to the stage where human nature reacts against it.</p> <p>There is so much pressure on industry, particularly in Australia, to up-date and be competitive and it is going to be the strain that industry tries to grab hold of but I'm not sure it is the right answer.</p> <p>WORK [Computers] will really become, absolutely, the basis of operations for industry.</p>	<p>I think it will greatly change our lives.</p> <p>.. a lot of things will be done from home.</p> <p>.. a link through a computer to your office and be able to deal with people across the computer screen.</p> <p>I can see in the future that a lot more will be done I suppose not by mail order but by computer order.</p> <p>More time for social interaction on a social basis.</p> <p>We obviously do not all sit on our bottoms in front of a computer screen for the rest of our lives.</p> <p>You might work at home four days a week but go in on the fifth day for that interaction and meetings or you can meet across the computer screen.</p> <p>From a school's point of view I think we will see technology used so that teachers become more of a consultant and any of the facts taught by, you know, CD-Rom.</p> <p>Children can self pace themselves but then join back into the class for discussion.</p> <p>I think you will see people going a lot further in that way and that teachers, as I see, will have to be more like consultants than teachers because the facts will be taught by computer not by the teacher.</p>	<p>Technology itself will precipitate some of the greatest changes that we can have and it is precipitating them right under our nose.</p> <p>Start getting people working from home.</p> <p>Economically it is very attractive, ecologically the greensies will love it.</p> <p>Sociologically there's going to be a few changes.</p> <p>I think you would start to see job sharing.</p> <p>I guess there would be arguments then - oh we need to have them meeting once a week.</p> <p>The next thing people will say, well your cities will be dead but we have immediately solved our housing problem.</p> <p>I think technology can help us get out of the jam we're in.</p> <p>All those folks that work in our offices do nothing but play with information, the computer is a liberator contrary to other opinions.</p> <p>[Virtual Reality] To play a game in that vein is all consuming, the player literally is living the game and that's going to occupy a lot of folks.</p> <p>You need to be able to meet people in the work place but it could have a virtual workplace</p>

TECHNOLOGICAL FUTURE

CADDSMAN LTD (D)	IBM (E)	APPLE (F)
<p>There will be a replacement of a whole swag of human behaviour in terms of statistics and records and standards and that will be all computer based.</p> <p>I think the integration of the tools, the computer aided tools, it's the integration that's going to make the impact.</p>		
<p>LEISURE I think it's going to be opposite to what people expect. I do not think its going to be a computer generated industry it's going to force people further and further towards nature and sort of using your hands and things that they do not do otherwise.</p> <p>.. the more you stack in on computing for the work environment, the more you go the other direction for a leisure environment.</p>	<p>LEISURE</p>	<p>LEISURE It can teach me a language.</p> <p>I can have the computer repeat and repeat and repeat until I get it word perfect.</p> <p>If you look very closely at Nintendo and Sega that market is huge and rapidly approaching our own markets.</p> <p>They know that that's where entertainment lies.</p>
<p>PRIVACY Big issue!</p> <p>Privacy circumstances through finance is probably the most controlling factor in the whole of the human existence anyway ...</p> <p>I think that it's wide open to corruption and everything else.</p>	<p>PRIVACY It's very easy for information to be accessed.</p> <p>.. all information can be held I think that it can help society in some ways.</p> <p>I do not see it as a real issue.</p>	<p>PRIVACY If each house has a computer they should be allowed to log on to any database that has their particulars.</p> <p>I demand the right to enter my file and have a look around not to change it but to know what it is there and be given access to it.</p> <p>I believe that there should be legislation that every individual is able to go in electronically and have a look at that account here that account there, that record there, births and deaths etc.</p>

TECHNOLOGICAL FUTURE

CADDSMAN LTD (D)	IBM (E)	APPLE (F)
<p>CONTROL Less control because the more and more material that goes on to discs it's like books you know, they tried to stop books once, this is ten times more potent.</p> <p>Artificial realities are sort of high on the agenda but still a long way, still a long way out, but by hell you put a child in that environment and you could reap unbelievable damage I think.</p> <p>I'm sure that emotional problems and financial problems you could, I could see a day where you get the computer that sort of takes this set of criteria and nuts it out and says there is your best option.</p> <p>I think there is heaps of potential in the sort of direction that technology could go, it's all romance and day dreaming at the moment.</p>	<p>CONTROL I think it is a positive move [the use of technology] because I think if we use technology or if we utilise technology properly we can gain more, we can do things smarter, we can do things quicker and we can make more time available for things that we like doing - leisure time, sport, you know, social.</p>	<p>CONTROL Technology is moving along in some ways people are getting swept along with it.</p> <p>I think we've got limited control.</p> <p>If we are being swept along with it it's because we don't know.</p> <p>Most people are using computers and they don't even know it.</p> <p>They can be very invisible.</p> <p>I think you will have those [people] who adapt them and use them very quickly.</p> <p>You'll have the luddite of course who will say no I don't want any part of them and pull the power.</p> <p>Knowledge is expanding at such an exponential rate ... the only way you can store it and access it will be via a computer.</p> <p>If we have no trees to make books anymore it must come in the shape of CD or digital data.</p> <p>I don't think there is a huge Orwellian presence driving everything. Nor do I think humanity is clever enough to have a total global coverage telling you what to do.</p> <p>[undeveloped countries] I think they are pushed very quickly into the computer world.</p>

COMPUTING IN EDUCATION

<p align="center">CADDSMAN LTD (D)</p>	<p align="center">IBM (E)</p>	<p align="center">APPLE (F)</p>
<p>RELATIONSHIPS ... if it's taught as a, as a method of, similar to reading or mathematics or something, how to get into computing it's going to be fairly narrow field and people will tend to use it like a book whereas I really believe that the opportunity in computing is the reverse to that, to have them understand what computing is capable of providing, and being able to use it as a tool.</p>	<p>RELATIONSHIPS I think the relationship will mature in that, the computer will be teaching the facts, however, the students as a group and the students with the teacher will discuss the issues, probably at a higher level so that relationships will not disappear by any means, in some ways will strengthen because they will be built on more of a consulting style role from the teachers point of view, and peer to peer it will be more of a discussion focus rather than a competition.</p>	<p>RELATIONSHIPS I get to see a lot of children using computers in a lot of schools ... their concentration levels has to be seen to be believed. With the volume of information and with the turmoil that education is in right now, and it's under going radical stress, radical change, the teacher, I feel, will become, if I can use the term it's not my own, a knowledge navigator, a facilitator, a leader. The Education Department are now pushing and pulling him or her [the teacher] ... and its more information is landing on him. So more and more the computer will play the role to relieve him of some of that burden They too [the teachers] will be required to keep learning; it's now a lifetime process.</p>
<p>LEARNING ABILITY ... only if it's, if it's done in a way where the student understands the technology before they use it, such as, as a learning aid.</p>	<p>LEARNING ABILITY [Learning abilities enhanced] Absolutely, I do not think there is any question of that. The fact that learning abilities are often ignored and often not recognised and I think through a computer a lot of those will possibly even disappear. It is not impossible to enhance the learning.</p>	<p>LEARNING ABILITY [Learning abilities enhanced] My own view from what I see is yes!</p>

COMPUTING IN EDUCATION

<p align="center">CADDSMAN LTD (D)</p>	<p align="center">IBM (E)</p>	<p align="center">APPLE (F)</p>
<p>MOTIVATION I see it as a bit of a negative. I think it's a tool that needs a bit like television, control.</p> <p>If the computing is taught in the way that I suspect it's going to be, it will be reaction, reaction, reaction. Whereas to get the thing working properly it's got to be a pro-active, searching, enquiring arrangement from the students.</p> <p>... only those students that are taught well and get the principles and the, sort of handle on the computer they're going to come out with what I would say is effective knowledge to use in industry ...</p>	<p>MOTIVATION ... it will motivate them to do more, especially those who are gifted students, they will be able to move further ahead without the constraints currently in a class room environment.</p> <p>For them that are a little behind they will be able to motivate to spend a bit more time on the work.</p> <p>They will be able to actually revise work at home.</p>	<p>MOTIVATION [What you are also indicating is that computers are highly motivating] Oh yes, Oh yes.</p>
<p>CREATIVITY ... they [students] have got to understand how to control the technology and this is how the industries get built, jobs get built too ...</p> <p>... all we do is import the bloody stuff in here, sit it down in front of people and use it and that is why we have got such a huge import bill and no ability to create it ourselves.</p>	<p>CREATIVITY As long as it is managed it can enhance creativity but definitely not reduce creativity.</p> <p>If the school system choses to use the computers to their utmost and they stay at the leading edge of technology, then I think creativity will be enhanced.</p>	<p>CREATIVITY [Is there potential within the computer system to enhance creativity?] Um, yes</p>
<p>GENDER EFFECTS I think it (computer) will provide a bit of a common platform.</p> <p>Five years ago, computing was a man's domain, apart from sort of input data ...</p> <p>It's probably a great event for the female side of learning particularly to get into things traditionally, like engineering</p>	<p>GENDER EFFECTS I think it is something that may come from some backward teachers which I think there are plenty of around still.</p> <p>I think it is societies push and society saying that science and maths is for boys and, you know, needlework is for girls still.</p>	<p>GENDER EFFECTS Yes, I think there's a problem there and yes I think we have to address it. The girls have got to have more time to them.</p>

COMPUTING IN EDUCATION

<p align="center">CADDSMAN LTD (D)</p>	<p align="center">IBM (E)</p>	<p align="center">APPLE (F)</p>
<p>CAREER NEEDS</p>	<p>CAREER NEEDS I think the way that the schooling system is going will make it possibly more difficult to move people back into menial style jobs. If we are going to keep pace with other countries in the way that they utilise technology and how it does enhance people's careers.</p>	<p>CAREER NEEDS Most of the jobs these people are going, remember we were talking before about the year 2005-2010 you ... I would hazard 50%-60% of the jobs are not invented yet.</p>
<p>RELEVANCE [of computers to different subject] I think it will spread across everything. I do not think there is any limitation, I think it's just a matter of commercial possibility.</p>	<p>RELEVANCE [of computers to different subjects] No! I really do not think that.</p>	<p>RELEVANCE</p>
<p>REDUNDANCY [of learning] I, again think it will get back to knowing how to get the information and what are the principles of solving the problem. With all that information it's even more important to start teaching the way of resolving and getting solutions. So in grade one, in future, like straight out of kindergarten, ... what we have done is we have brought new technology and stuck it right at the end of the education stream ...</p>	<p>REDUNDANCY</p>	<p>REDUNDANCY [of knowledge] My own view is that you need a structured base as a youngster but again that's coming from my field of relevance. I don't have any firm answers to that one.</p>
<p>EQUITY I do not think it [computing] will have a major impact on learning but I think it will have a major impact on output.</p>	<p>EQUITY I do not think it [computers] will change the problem of equity - it will not change, those that are well off have better ability to go to tutors, or private schools and may be get better attention etc.</p>	<p>EQUITY I think this problem will face us for at least the next 10 years.</p>

COMPUTING IN EDUCATION

<p align="center">CADDSMAN LTD (D)</p>	<p align="center">IBM (E)</p>	<p align="center">APPLE (F)</p>
<p>EFFICIENCIES The way it's going now, no because ... those that can use computers at the moment do not necessarily have the skills in knowing how to adapt to it in industry.</p>	<p>EFFICIENCIES They will be huge ... I think it will free up teachers too not that we will not need the same number of teachers, they will need new skills.</p>	<p>EFFICIENCIES One would like to say yes. I believe that it will be and I believe that it is inevitable. [do we need so many teachers] The old education industry like every other industry is in a state of upheaval. I think what that will be pushing them more and more to over the wire delivery from centres of knowledge if you will. Again that cuts out whole levels of infrastructure.</p>
	<p>CONSTRAIN EDUCATION I think that it is possible but ... if the education system does that they are not educating the students.</p>	

FUTURE OF SCHOOLING

CADDSMAN LTD (D)	IBM (E)	APPLE (F)
<p>I think a bit of each.</p> <p>There is a lot to be gained from a computer oriented learning system that forces them [students] to be creative that sort of has them use a whole range of other skills like the library or doing exercises.</p> <p>If it pushes people out to doing different, varying exercises using a whole range of centres, that is the way to go and they get the social environment as well.</p> <p>The majority of people have not given it a great deal of thought where I believe the lead should come from is not education but industry.</p> <p>Industry has got to say this is what we have to achieve and really drag the sort of the education into that.</p>	<p>Teachers will be involved in the management of learning.</p> <p>The computers will test and assess, the teachers will not.</p> <p>Computers may be available at school or they may be available in another format.</p> <p>It is still very important to have the school facility for ... the social interaction with peers of the same age and abilities and different age, different abilities.</p> <p>There is no reason why a class in this environment should not span different age groups as well.</p>	<p>I think it will be a mixture. I think we will have private companies certainly.</p> <p>I think, yes, it will have to be individualised and, yes, you cannot get away from some of the social development.</p> <p>I don't think that schools will ever become irrelevant.</p> <p>If schools are not looking ahead and not looking at change, yes, they will become irrelevant.</p>
<p>ROLE OF TEACHER</p>	<p>ROLE OF TEACHER</p> <p>They have to do a massive relearning process.</p> <p>In some cases ... the people that are teachers now are not going to be capable of this new role.</p>	<p>ROLE OF TEACHER</p> <p>[They will become] the knowledge navigators.</p>

CONTROL OF EDUCATION

CADDSMAN LTD (D)	IBM (E)	APPLE (F)
	<p>{Have people already decided where we are heading?}</p> <p>I think a lot of people do not understand how computers can be used.</p>	<p>{Have people already decided where we are heading?}</p> <p>I don't think there would be too many people not looking at it.</p>
		<p>{So are you saying therefore that where we are and how we move in this field is inevitable?}</p> <p>Yes, technology will drive us</p>
<p>{Will society be more inhuman in future?}</p> <p>Yes, society will to an extent.</p> <p>... it's success{society's} it's not going to be the computing power or anything else that is there it's going to be the human interaction.</p>	<p>{Will society be more inhuman in future?}</p> <p>... if the opportunity is there to go without social interaction it is possible that society could become inhuman.</p>	<p>{Will society be more inhuman in future?}</p> <p>Let's hope it's no more inhuman than it is now.</p> <p>Marcos ... the only reason that a bloodbath was avoided was technology, because the video camera was there.</p>
<p>{Do you think people are going to have much choice about where computers will be used?}</p> <p>... there will not be any choice for industry and economics and therefore that will dominate education.</p> <p>I would definitely use computers in education but I'd use them differently</p>	<p>{Do you think people are going to have much choice about where computers will be used?}</p> <p>... if we do not we might as well ... shave ourselves off from the rest of the world because we are getting so far behind.</p>	<p>{Do you think people are going to have much choice about where computers will be used?}</p> <p>No they won't have a choice!</p> <p>Do you have a choice about where the phone is used? ... it will be accepted as a tool.</p>
<p>{Schooling be reshaped?}</p> <p>Yes! ... industry has to do it though</p>	<p>{Schooling be reshaped?}</p> <p>Absolutely, I cannot imagine life without it now</p>	<p>{Schooling be reshaped?}</p> <p>Yes.</p>
		<p>{An exciting future?}</p> <p>My word I do</p>

CONTROL OF EDUCATION

<p align="center">CADDSMAN LTD (D)</p>	<p align="center">IBM (E)</p>	<p align="center">APPLE (F)</p>
<p>[Frightening future]</p> <p>I see it as hugely exciting on one hand but devastatingly frightening at the moment with Australian government policies the way they are and the education system going in the direction that it is.</p>	<p>[Frightening future]</p> <p>For some people it could be very frightening.</p> <p>... it's good to see the number of people that are trying [to] learn with their children.</p>	<p>[Frightening future]</p> <p>I think it's a future full of hope.</p>
<p>[Will teachers lose control of curriculum?]</p> <p>Yeh, definitely I think you've got to break up the education system.</p>	<p>[Will teachers lose control of curriculum?]</p> <p>I do not think [teachers] have control of the curriculum now so I do not think that will change.</p>	<p>[Will teachers lose control of curriculum?]</p> <p>I mean you get back to the three R's, is it necessary or should it be the 3C's for computing, charm and charisma.</p>
		<p>[Who besides teachers will be involved in schooling?]</p> <p>Parents will be increasingly involved.</p>
		<p>[Is schooling redundant?]</p> <p>If you did away with it over night, my god, we would be in diabolical trouble, I mean, half the people don't know where to get the information from.</p>
<p>[Will education be constrained?]</p> <p>I think it will flounder simply because unless the government has the right policies in conjunction with industry ... education cannot hope to do it all on their own.</p>	<p>[Will education be constrained?]</p> <p>No</p>	<p>[Will education be constrained?]</p> <p>I think it will just keep opening doors and we don't that we are going to open.</p>

CONTROL OF EDUCATION

CADDSMAN LTD (D)	IBM (E)	APPLE (F)
<p>[Who do you think is really doing the promotion of computers in education?]</p> <p>"The media" No</p> <p>"The government" No</p> <p>"Employers" A little</p> <p>"Education Departments" A little</p> <p>"Parents" A little</p> <p>"Computer companies" Dominant, absolutely dominant and for the wrong reasons</p> <p>"Teachers" A little</p> <p>"Unions" I think that is changing, actually the perception there would be that at least starting to change.</p>	<p>[Who do you think is really doing the promotion of computers in education?]</p> <p>"The media" Not much</p> <p>"The government" Very little</p> <p>"Employers" Generally no</p> <p>"Education Departments" They have done what they can do with their constrained, so called, budgets</p> <p>"Parents" Parents have done quite a bit consider what they know.</p> <p>"Computer companies" I think computer companies are the main sponsors or the main people that are trying to promote it.</p> <p>"Teachers" I do not think teachers are given enough education.</p> <p>"Unions" Do not have an opinion</p>	<p>[Who do you think is really doing the promotion of computers in education?]</p> <p>"The media" No</p> <p>"The government" To an extent</p> <p>"Employers" Certainly not</p> <p>"Education Departments" Yes</p> <p>"Parents" To a lesser extent, some yes.</p> <p>"Computer companies" Certainly</p> <p>"Teachers" Yes</p> <p>"Unions" Never</p>

EVALUATION OF SCHOOLS

CADDSMAN LTD (D)	IBM (E)	APPLE (F)
<p>[Are schools generally satisfactory?]</p> <p>It's, it's not irrelevant but that scenario it's getting towards it sort of.</p> <p>I think what I am really saying that perhaps the whole of the education system is fairly adequate for what it does but it lacks ... a third dimension that are all leading to something in the end ... perhaps an elevation which is your job at the end of it.</p> <p>The vocational selection sort of has to happen a hell of a lot earlier.</p> <p>The sort of thing that is a tragedy in Australia right now is you get a whole lot of people that are highly educated doing things that they do not really enjoy ... the whole system is whacked.</p>	<p>[Are schools generally satisfactory?]</p> <p>Not really</p> <p>I do think they need radical change I do not think they are implementing the technology available today.</p> <p>[Are schools irrelevant at the moment?]</p> <p>... need to move to teaching students ... more about what they need to know when they get out of school rather than just the facts.</p> <p>[Schools in the future the same]</p> <p>I think we need better teachers at the top of these education departments to move into the real time.</p> <p>Teachers are going to need a massive reskilling or teachers will not be suitable as teachers and may be industry will be the teachers.</p>	<p>[Are schools generally satisfactory?]</p> <p>No</p> <p>[Do they need radical change?]</p> <p>I think they do.</p> <p>[Will they always be the same?]</p> <p>No, they can't be because they will become irrelevant.</p> <p>They want responsible education ... my children, I want to be geniuses please turn that into a genius.</p>

Summary of the Theorising by Computer Suppliers

TECHNOLOGICAL FUTURE	
ISSUE	THEORETICAL PROPOSITION
Technological and Work Impact	<ul style="list-style-type: none"> - Computer technology will precipitate great change. - Some people will react against technology. - Most homes will have computer technology. - Computers will be used to link homes to offices, shops, businesses etc. - Computers will be used to link people directly. - Some aspects of life may involve virtual reality (simulated reality). - People will use computers to teach themselves (ie languages, crafts, leisure activities). - Teachers will become consultants to learning rather than dispensers of information.
Economic and Organisational Impact	<ul style="list-style-type: none"> - Computer technology can assist in solving the world's problems. - Computers will become the basis for operations in industry. - Industry must build on computer technology; national development and competitiveness depend upon adopting technology. - All functions within the work environment will be integrated through computer technology. - People who work in information systems will be able to work from anywhere including home. - Working from home solves ecological problems of pollution and assists in conserving resources (ie oil) - Government policies and educational policies are not supporting appropriate development.
Sociological Impact	<ul style="list-style-type: none"> - Computer technology will greatly change people's lives - Many people will work from home. - Many work tasks will be replaced by computer. - Job sharing is likely to develop. - Greater flexibility of work and other activities (time of work etc). - More time for social activities. - Computers will be liberating. - Direct interaction is needed and would be for social reasons only.

COMPUTING IN EDUCATION

ISSUE	THEORETICAL PROPOSITION
Relationships	<ul style="list-style-type: none"> - Computers will teach facts. - Relationships will mature and teachers and students would discuss issues at a higher level than at present. - Teachers will become knowledge navigators, facilitators. - Computer will relieve teacher of the burden of information giving.
Learning Ability	<ul style="list-style-type: none"> - Learning ability will be enhanced.
Motivation	<ul style="list-style-type: none"> - It will motivate students especially those who are gifted or slow. - Only those students who are taught well.
Creativity	<ul style="list-style-type: none"> - If managed well can enhance creativity, especially if schools stay at the leading edge of technology.
Gender Effect	<ul style="list-style-type: none"> - Will provide a common platform. - A problem that has to be addressed. Girls have to have more time on them (computers). - I think society is still saying that science is for boys and needlework is for girls.
Career needs	<ul style="list-style-type: none"> - The way the school system is going it will be more difficult to move people into menial jobs. - Technology enhances people's careers. - 50-60% of jobs not invented yet.
Redundancy of Knowledge	<ul style="list-style-type: none"> - With access to information important to teach way of resolving problem. - Technology needs to be introduced at Grade 1.
Equity	<ul style="list-style-type: none"> - Computing will not have any impact on equity issues.
Efficiencies	<ul style="list-style-type: none"> - Will free up teachers, not necessarily reduce the number but they will need new skills. - New delivery systems will cut out whole levels of infrastructure.
Future of Schooling	<ul style="list-style-type: none"> - Schools will be a mixture of private companies, public schools. - Learning will have to be individualised. - Schools will have to provide some of the social development - Schools will not become irrelevant - Teachers will manage learning - Computers will test and assess. - Access to computers will be at schools but may be available in other formats. - Classes should span different age groups - A lot to be gained from a computer orientated learning system - Computer learning which directs students to varying exercises in various centres - The lead should be provided by industry. - Industry has to set the goals.

FUTURE OF SCHOOLING	
ISSUE	THEORETICAL PROPOSITION
Future of Schooling	<ul style="list-style-type: none"> - Schools will be a mixture of private companies, public schools. - Learning will have to be individualised - Schools will have to provide some of the social development. - Schools will not become irrelevant. - Teachers will manage learning. - Computers will test and assess. - Access to computers will be at schools but may be available in other formats. - Classes should span different age groups. - A lot to be gained from a computer orientated learning system. - Computer learning which directs students to varying exercises in various centres. - The lead should be provided by industry. - Industry has to set the goals.
Role of Teachers	<ul style="list-style-type: none"> - Teachers will have to do a massive relearning process - some teachers are not going to be capable of this new role - Teachers will become the knowledge navigators

CONTROL OF EDUCATION	
ISSUE	THEORETICAL PROPOSITION
Future directions	<ul style="list-style-type: none"> - People do not understand how the computer can be used although many are concerned
In-human Society	<ul style="list-style-type: none"> - There is the potential for society to be more in-human
Choice	<ul style="list-style-type: none"> - No choice, it will be accepted as a tool.
Schooling Reshaped	<ul style="list-style-type: none"> - Yes (Industry has to do it)
Frightening Future	<ul style="list-style-type: none"> - Future full of hope on the one hand but for some people very frightening
Teachers Lose Control Curriculum	<ul style="list-style-type: none"> - Yes. They do not have control now
Education Constrained	<ul style="list-style-type: none"> - No, technologies will provide more opportunities. - Education will flounder unless government and industry develop the policies

