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An Apple for the Teacher?

Choice and Technology in Learning

Report of the House of Representatives
Standing Committee on Employment, Education and Training

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MEMBERSHIP OF THE COMMITTEE

The House of Representatives Standiong Committee on Employment, Education and Training was established by sessional order on 24 September 1987.

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TERMS OF REFERENCE OF THE INQUIRY

That the Committee inquire into and report on:

> The potential of new technology, particularly satellite technology to improve educational access and outcomes in Australia.

CONTENTS

ABBREVIATIONS

ABC	Australian Broadcasting Corporation
ACIN	Australian Curriculum Information Network
AEC	Australian Education Council
AOLIN	Australian Open Learning Information Network
ASCIS	Australian Schools Catalogue Information Service
CAAMA	Central Australian Aboriginal Media Association
HACBSS	Homestead and Community Broadcasting Satellite Service
ISDN	Integrated Services Digital Network
OECD	Organisation for Economic Cooperation and Development
OTC	Overseas Telecommunications Commission
RSTV	Radiated Subscription Television
SBS	Special Broadcasting Service

Throughout the report, references to 'State' and 'States' include the Northern Territory and the Australian Capital Territory.

PREFACE

In Australia there is a growing demand – and an increasingly important requirement – for education to be made available on the student's terms. All sectors of education need to offer a greater range and diversity of learning opportunities, and technology can help make this possible. It depends not so much on what is happening at the cutting edge of new technological developments as on the capacity of governments, educational institutions and teachers to manage technology effectively for educational purposes.

There is also a crucial need to ensure that students are aware of, and able to use, new technology. Accordingly, exposure to appropriate technological developments should be an integral part of their learning activities.

A great deal of innovation in using technology in education has taken place, but to increase educational opportunities substantially and to enable economies of scale to be achieved, greater national cooperation is necessary. Sharing resources, fostering research and devleopment, setting technical standards and ensuring that teachers are familiar with the technology and skilled in its use are national issues requiring coordinated responses.

The Committee looks to the Australian Education Council as a key organisation to promote coordinated planning and cooperative endeavours. Several recommendations are made about the role and structure of the Council's Education and Technology Conference, and it is proposed that other national coordinating mechanisms be established.

Priority issues put forward for the Council's attention include the possibility of a national telecommunications network, the further development of educational television, a new research organisation, and a database of courseware and software for tertiary education.

The Committee gratefully acknowledges the assistance provided during the Inquiry by the individuals, institutions, and other organisations that provided written submissions, gave evidence and hosted inspections. The Committee is also grateful for the work of the Parliamentary Reporting Staff in documenting the Committee's public hearings, the research support provided by staff of the Parliamentary Library, and the assistance of Louise Carney, Anne Cronin, Laura Gillies and Allan Kelly of the Committee secretariat.

CHAPTER 1

OVERVIEW

Background

1.1 The major purpose of education is to help people to become socially capable citizens who understand, and are able to contribute to, their society and its values while living independently and cooperatively in it. The crucial influence that education has on personal development and economic advancement is reason enough to ensure that all individuals have access to a range and diversity of educational opportunities. Accordingly, this has been a consistent goal for governments. Moreover, presently there is a growing impetus Australia-wide to increase the level of participation in education and training not only for these reasons but also in order to upgrade and broaden the skills of the workforce.

1.2 A workforce that is well educated and trained is likely to be creative, and able to shape and respond to change. Its basic knowledge and skills have depth and diversity. These qualities are important factors in improving productivity, attracting investment and adapting to structural change. It is widely recognised that, unless major alterations are made to the performance and the shape of the Australian economy, Australia's competitiveness in international markets is at risk. The speed and ease with which these adjustments are made will depend to a significant extent on our education system as it affects both the level of skills and cultural attitudes of our society.

1.3 The Committee has been charged with examining the potential contribution of new technology to this process. Specifically, it was asked to examine how educational access and outcomes might be improved by use of technology. In examining access, the Committee has been concerned to see how more people, and especially the more disadvantaged groups, could be given by technological means more opportunities of education. This applies particularly to people cut off from access to conventional education by geographic isolation or by other circumstances of their employment or personal lives. In examining outcomes it has investigated how the quality of education can be broadened, enriched and stimulated by the application of technology to the educational process.

1.4 The Committee has looked at all sectors of education and training. Many government programs have been designed to foster learning. They have an impact on vocational activities, such as apprenticeships, traineeships and community-based programs, and on structured education at schools, TAFE colleges and higher education institutions. The Committee has focused more on

the systems of structured education than on work-based skills formation; however, it recognises that changes need to be made to both types of learning to strengthen the links between them.

1.5 In examining the potential for new technology to improve educational access and outcomes, the Committee has addressed the whole range of technological developments covered in Chapter 2 of this report. Some of these - for instance printing or the telephone - might not be considered new; but the latest developments in laser printing, desktop publishing, or telephone conferencing are new and they greatly extend the older technology. The Committee has examined the technological developments in the context of national endeavours to improve the knowledge and skills of the workforce in order better to prepare for, participate in and adjust to structural changes in the economy.

1.6 The starting point for this task is the school system. As future participants in a workforce and a society faced with advanced and changing forms of technology, students must feel comfortable with new technology and appreciate its potential. This necessary level of familiarity will depend in part on school curriculum, the availability of facilities and resources in schools, and the extent to which students have access to those resources. These factors will influence the extent to which students are encouraged to develop their interest and expertise in new technology. The Committee considers that these separate but connected matters are worthy of detailed analysis in their own right.

Access and Outcomes

1.7 Many factors affect both the range of educational opportunities that are available to an individual and the choice that the individual actually makes. Whether or not the learning programs attempted are successfully completed is also determined by a variety of influences.

1.8 A major task in improving educational access and outcomes is to develop within the individual the desire and the confidence to enrol in a course of study and to continue with it until it is completed. For this reason, it is often necessary to offer financial support and personal guidance before further education can be considered a realistic option. Technology can be used in education to make it easier to take up the option once a decision is made to do so, but the Committee recognises that it is not a panacea.

Schooling

1.9 In May 1988 the Minister for Employment, Education and Training released a paper entitled *Strengthening Australia's Schools: A consideration of the focus and content of schooling*. The paper calls for a national cooperative effort to improve the ability of Australia's schools to cope with current social and economic needs. It proposes that all governments pursue initiatives to

increase flexibility and equity and promote a common curriculum framework and a common approach to assessment. A prominent feature of the strategy is to encourage all students to complete a full 12 years of schooling.

1.10 The need to improve participation in post-compulsory schooling has been recognised by all governments. The Committee supports the principle of encouraging students to take up the opportunity of completing a full school education on which they can build a lifetime of learning. A sound educational base is a crucial factor in allowing individual aspirations, as well as national objectives, to be realised.

1.11 Retention rates to Year 12, or the proportion of students staying on at secondary school to Year 12, have increased in recent years. In 1980 the national rate was 34.5%. By 1987 it was 53%, an increase of 50%. All Australian governments are aiming to raise it to 65% by the early 1990s.[1]

1.12 The rates vary from region to region and they are not easily calculated with accuracy. Surveys consistently show, however, that students from non-metropolitan areas are less likely to complete Year 12 than their metropolitan counterparts. The subject is treated at some length and depth in the Commonwealth Schools Commission's 1988 report *Schooling in Rural Australia*.One source quoted in the Commission's report found that:

> In some cases the rural-urban differences in participation rates may be as much as ten percentage points, but in most instances four to five percent fewer rural students enter post-compulsory education.[2]

However, the report also quotes a Commonwealth Department of Employment, Education and Training study:

> There are marked variations between non-metropolitan regions in terms of their Year 12 completion rates ... Generalisations about participation in post-compulsory education in country as opposed to city areas, it is clear, can no longer be regarded as adequate.[3]

1.13 Studies also show that Aborigines have by far the lowest school participation rate at all levels to Year 12, and that those in small communities of less than 1000 people fare even worse than those in larger towns and cities. In 1986, for example, the national retention rate was 48.7% but the rate for Aboriginal secondary students was 17%.[4]

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[1] Minister for Employment, Education and Training, *Strengthening Australian Schools*, AGPS, Canberra, 1988, p 5.
[2] T Williams, *Participation in Education*, 1987, quoted in Commonwealth Schools Commission, *Schooling in Rural Australia*, Curriculum Development Centre, Canberra, 1988, p 185.
[3] Department of Employment, Education and Training, *Completing Secondary School in Australia*, 1987, quoted in Commonwealth Schools Commission, *Schooling in Rural Australia*, Curriculum Development Centre, Canberra, 1988, p 189.
[4] Aboriginal Education Policy Task Force, *Report*, Canberra, 1988, p 11.

1.14 A number of studies have tried to ascertain the reasons for variations in retention rates, and particularly the significance of home and community background. This Committee is currently conducting an inquiry into factors affecting Year 12 participation and expects to report its findings later this year.

1.15 Generally, the influences on school retention rates can be divided into three categories: the economic environment, the socio-psychological environment and the school environment.[5] Within the economic environment, the major factors are availability of jobs and the financial cost of continuing in school compared to other options. A characteristic commonly found in the socio-psychological environment of students who complete Year 12 is high socio-economic status. However, the most significant factor in the school environment is the type of curriculum: higher retention rates have been directly linked with broader curricula.[6]

1.16 Clearly, technology can be applied most successfully to raising participation and completion rates by improving the school environment. Strategies to influence the economic and the socio-psychological environments are more appropriately dealt with in the realm of social justice policy.

1.17 Access to primary and secondary education is available to all Australian children, but students in remote, rural and isolated areas are disadvantaged and discouraged where the range of subjects is limited, the material is not relevant to local lifestyles, and classroom-based tuition is not possible. Of course, some of these difficulties can be experienced in metropolitan schools as well. Technology can be - and has been - successfully applied to increasing the variety and number of subjects available, improving the quality of teaching materials, and facilitating communications between home-based students and their teachers. Use of technology for these purposes also facilitates the increase in flexibility and equity, and the introduction of a common curriculum framework and approach to assessment, recommended in *Strengthening Australia's Schools*.

Post-School Learning

1.18 More than 70,000 school leavers, about 20,000 of them graduates of Year 12, enrol in TAFE courses each year. The total TAFE enrolment in vocational and preparatory courses was more than 900,000 in 1988. The higher education sector caters for about 420,000 students and enrols approximately 60,000 Year 12 graduates each year. Mature age students comprise about half of the total enrolment and the proportion is growing.

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[5] M Hayden, 'Factors affecting participation by young people in tertiary education: A review of recent Australian literature and research'. In Commonwealth Tertiary Education Commission Commission, *Learning and Earning: A Study of Education and Employment Opportunities for Young People*, AGPS, Canberra, 1982 pp 79-165.

[6] J Ainley, 'Changing aspects of postcompulsory schooling', Draft of an article made available to the Committee.

1.19 Increasingly, it is being recognised that learning is and should be a lifetime activity. Industry restructuring and the introduction of new technology have meant that jobs are rapidly changing and the labour force must be better prepared to be retrained several times during a working life:

> On average, the next generation of workers will have to make no fewer than five complete job changes in a lifetime, not counting the multiple tasks (which will also be changing) associated with each respective job.[7]

This is reinforced by the fact that the population is ageing and therefore the workforce will not be able to rely solely on younger employees to bring new skills to the workplace.

1.20 As a response to the need for greater access to and participation in post-school learning, the Committee supports an increase in the diversity and flexibility of educational opportunities. It is also important that there be growth in the number of educational opportunities available. Unmet demand by qualified applicants for TAFE and higher education is significant, despite more places being created.

1.21 Access to courses, in terms both of academic prerequisites for enrolment and the proximity of a college to the student's home, is easier in the TAFE sector than it is for the higher education sector. In addition, the TAFE sector offers a greater variety in the content and delivery of its courses and its student population is more representative of the diverse Australian community.

1.22 Within the higher education sector, much of the innovation in making learning more accessible has been pursued by colleges of advanced education. Under the new Unified National System, however, all participating higher education institutions are being encouraged to take on a greater number of students and particularly those from under-represented groups: people from rural areas; Aborigines; people from a low socio-economic background; and people with disabilities.

1.23 Post-school institutions need to be able to cater for more students with a wider diversity of backgrounds, personal responsibilities and work-related commitments affecting their capacity and desire to attend classroom instruction. There should be more options and more flexibility in the availability and delivery of learning opportunities. In essence, there is a greater need for educational services to be provided on the learner's terms. Improving access is not only a matter of opening a door wider: it is a matter also of opening new doors.

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[7] M J Cetron, 'Class of 2000', *Futurist*, Nov-Dec 1988, p 13.

1.24 Students seeking the greatest flexibility in course delivery enrol in external courses. This is often the only means of access by many residents of rural and remote areas to the education they seek, but recent times have seen a marked increase in the number of people in metropolitan areas preferring to study externally rather than attending an institution nearby:

> A traditional view of the off-campus student is that of someone sitting in the outback of this big country listening to scratchy radio broadcasts, working patiently and monk-like on a mountain of books, and sending off assignments in the mail. This is often a myth, because off-campus study organisations usually get most of their clientele from the metropolitan areas, people who live only one to ten kilometres, rather than one thousand or ten thousand kilometres, from a campus.[8]

1.25 People who study externally now also include a diverse group of people who are unable or unwilling to participate in classroom-based learning, and especially mature age students. These are residents of newer outer urban areas; people whose family responsibilities and work commitments prevent regular study patterns; itinerant workers; people who fear or dislike educational institutions; and people with disabilities.

1.26 The flexibility sought by mature age students in the current system is also likely to be sought by adults who currently have no plans to further their education but who find retraining necessary when their workplace and range of duties change. Clearly, it is appropriate to move towards allowing the individual even more choice and autonomy than is often given to an 'external student' today.

1.27 The approach favoured by the Committee as a means of catering for both the existing and the anticipated levels of adult demand for learning is for post-secondary education to incorporate more of the principles of 'open learning'.

Open Learning

1.28 Open learning is most clearly perceived in contrast with conventional education. In the latter, a student must qualify by previous performance for admission to an institution, sometimes with specific subject-knowledge required for entry; the student follows a course of study set by the institution, over a period set by the institution, in a pattern of classes and attendance set by the institution, and is assessed at a time and place and in a manner set by the institution.

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[8] Box Hill College of TAFE, *Submission*, p 8.

1.29 Open learning attempts to give the student as much choice as possible: to determine what one would like to study; to determine how much one wants to study, considering one's own purposes in studying; to determine where and how one wants to study - on campus or at home, full-time or part-time, using various media, at one's own pace; to determine the level one wants to achieve and the ways in which and the times at which those assessments will be made.

1.30 Definitions of open learning vary, but the Committee accepts that used by the Manpower Services Commission of the United Kingdom:

> A term used to describe education and training schemes which are designed to meet the varied requirements of individuals - for example as to what, where, when and how they learn. Organisations make these freedoms of time, place and methods possible by providing a carefully planned, flexible learning package. This enables the learner to study, for much of the time if necessary, away from the direct supervision of the trainer.[9]

1.31 It should not be thought that open learning and external studies are the same thing. Courses of external study can be remarkably un-open except in their freedom from on-campus attendance; an external course following a curriculum determined by the institution, proceeding at a fixed pace, requiring attendance at telephone tutorials or radio or television broadcasts at fixed times and with a set time and manner of assessment cannot be called open learning.

1.32 An open learning approach would extend access to tertiary education to all Australians who want it. Through carefully-developed learning materials, using print, cassette, telephone, broadcast and computer media, people would be able to pursue their studies and training at home or in their work place as well as in libraries and classrooms. Through counselling, people would be advised of the appropriate level at which to commence study so that there would not be an influx of ill-prepared people into highly technical courses; but the path would be open to those who wished to equip themselves to master those fields of study.

1.33 With open learning, study and training packages would be developed by people or teams combining expertise in the subject with expertise in preparing self-study packages. The packages would be predominantly printed matter but with illustrative material and stimulus provided by television, radio or video and audio cassettes. There would be opportunity for contact between student and tutor either face-to-face or by telephone or by computer network.

1.34 Fields of study would be developed in comparatively small modules so that learners could access as much as they wanted without working through material irrelevant to their own purposes. These modules could be combined in different ways to produce sequences of courses relevant to each student's

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[9] W Hall, 'Open Learning', *Exhibit No. 25.*

interests. It should not be necessary to take all one's courses from a single institution; it should be possible to take relevant modules from wherever they are available and combine them into a course and a qualification defined by the needs of the learner, not by the rules of the institution.

1.35 Open learning made available in this way would extend educational access in the most economical possible way. There would be no need of extra buildings or other capital facilities. Agencies could provide open learning packages developed under contract by outstanding academics or practitioners in whatever organisation those people were employed. Similarly academics, practitioners and other suitably qualified people could be contracted to provide tutoring, counselling and assessment. Learning could be delivered into the home or the work place with great savings in time and convenience and often savings in costs of absence or travel. Well-developed packages are very likely to be more effective educationally than mediocre-to-poor classroom instruction.

Technology

1.36 An open learning approach can be encouraged or implemented by use of new communications and information technology, but it must be judiciously used. The introduction of new devices, each time heralded as a revolutionary innovation in learning and usually proving to be much less than that, has engendered a strong streak of scepticism among many educators towards the use of technology in education.

1.37 The essential issue is not whether technology should or should not be used in education. It is whether the technology used, be it a blackboard, tape recorder or the transmission of computer data via satellite, is appropriate in the circumstances. This is largely a management problem which involves identifying educational objectives and analysing the cost-effectiveness of the various means of meeting them.

1.38 New ideas in using technology in education usually have not been introduced and fostered in a planned way, particularly in the higher education sector. Often it has been due only to the enthusiasm and dedication of a few teaching staff that innovations have been tested. With limited funds, and limited support from their institution, their experiments ended when funding ceased or a report was written. In recent times, State governments have been developing longer term strategies, so a greater coherence in decisions concerning the use of technology within each State's education system can be expected.

1.39 Notwithstanding signs of improvement in how it is managed, the use of modern technology has been confined largely within individual institutions or States. There are very few examples of ventures which involve cooperation across State boundaries. State authorities and institutions make their own arrangements with insufficient interstate flow of information or attention to

what is going on elsewhere in trials, pilot studies or mainstream programs. As a consequence, different equipment, protocols and procedures are being used in different States with a real risk of incompatibility between them. It is as if we have learned nothing from the rail-gauge fiasco of the 19th century and are intent on repeating the same mistake in the use of modern technology.

1.40 Apart from the risk this poses to efficiency, it inhibits cost-effectiveness. Telecommunications are expensive and can be used economically in education only when they serve fairly large groups of students or other users. In many fields of education, groups of economical size cannot be achieved in a single institution or a single State, but only by linking people throughout the nation. The more specialised the field of study, the more this applies.

1.41 As the later chapters of this report will demonstrate, technology can conquer distance and other forms of isolation. It can bring educational materials to students in any place, at any level, in many forms - written, auditory or visual. It can put pairs or groups of people - students, teachers, administrators - into immediate touch with each other independent of distance and the postal system. These measures improve not only access but the quality of the education provided and the motivation of those involved in it.

1.42 Chapter 2 describes the technology available for educational use and Chapter 3 discusses its application to extending access, increasing participation and enhancing outcomes. These advances depend on teachers being able to make informed decisions about the circumstances when using technology is appropriate, the forms of technology to use, and how to use it to best effect. Chapter 4 discusses the implications of technology for the role and responsibilities of teachers and the measures which should be taken to help them to participate in and take advantage of the changes. Chapter 5 discusses the need for coordination of effort and the mechanisms by which this can be achieved.

Recommendations

1.43 The main recommendations in this report relate to mechanisms to achieve cooperation. The Committee looks especially to the Australian Education Council to achieve this. If the Ministers for Education on this Council can achieve common approaches and ensure that their officers act together in the use of technology, this Committee can see the prospect of considerable progress. The Committee's recommendations also focus on measures to promote planning in and between sectors and to assist particular educational activities including training. The recommendations are summarised below.

National Strategies

The Committee recommends that:

1 **the Australian Education Council**

(a) **be responsible for, and give priority to, the development of national strategies for the educational uses of technology.** *(Paragraph 5.22)*

(b) **promote and monitor the implementation of educational technology strategies approved by the Council.** *(Paragraph 5.22)*

(c) **encourage the adoption of guidelines and standards which ensure that new communications and information technology used in Australian education is compatible within and between sectors.** *(Paragraph 5.50)*

(d) **investigate the need for and feasibility of a national educational telecommunications network covering all of the education community.** *(Paragraph 5.61)*

(e) **ensure that adequate resources are provided to the Education and Technology Conference to allow it to perform the functions identified at (a), (b), (c) and (d) above.** *(Paragraph 5.22)*

2 **the membership of the Education and Technology Conference of the Australian Education Council be expanded to include representatives of the non-government school sector and higher education institutions.** *(Paragraph 5.24)*

Schools

The Committee recommends that:

3 **all students in all schools be provided with increased opportunities for 'hands on' computer experience; and further, that sufficient government funds be provided to enable schools to meet the OECD target of one microcomputer per ten students by the commencement of the 1992 school year.** *(Paragraph 3.23)*

4 **the Commonwealth Government encourage the wider adoption of the cluster approach in schools in its funding programs.** *(Paragraph 3.35)*

Post-school Learning

The Committee recommends that:

5 **the Department of Employment, Education and Training establish as a matter of urgency a national database of all Australian tertiary education courses. The information on the database should be widely available through TAFE computer networks and, in rural and remote areas, through Australia Post offices and agencies.** *(Paragraph 3.90)*

6 **the Higher Education Council of the National Board of Employment, Education and Training be given responsibility for ensuring cooperative and coordinated effort between higher education institutions in the use of educational technology, taking into account national strategies and policies developed by the Australian Education Council.** *(Paragraph 5.13)*

7 **the new organisation proposed by the Commonwealth Government to coordinate external higher education studies seek the establishment of a national database of courseware and software information which would be accessible to all tertiary institutions.** *(Paragraph 5.45)*

Aboriginal Education

The Committee recommends that:

8 **additional resources be made available by State governments and the Commonwealth Government for the production and broadcast of culturally appropriate educational material for Aboriginal people.** *(Paragraph 3.84)*

Teachers

The Committee recommends that:

9 **the Commonwealth Government allocate more funds to inservice training which deals with and uses new technology, provided that State and non-government systems match such Commonwealth expenditure with resources of their own.** *(Paragraph 4.72)*

Research and Development

The Committee recommends that:

10 **the Australian Education Council be urged to establish, on the model of ASCIS or the TAFE Research and Development Centre, a body to coordinate research into the use of technology in education and to**

facilitate exchange of information across State and sectoral boundaries on educational projects involving new technology and on equipment and processes. *(Paragraph 5.35)*

Television

The Committee recommends that:

11 by 1 January 1991 metropolitan and regional commercial television broadcasters be required to broadcast educational programs as a condition of their licences, similar to the arrangements applying to remote commercial television services. *(Paragraph 5.75)*

12 the Commonwealth and the State governments support and extend innovations in the use of 'narrowcast' television for educational purposes, particularly in the possibilities presented by the use of compressed video. *(Paragraph 5.80)*

13 in the event of pay television being widely introduced in Australia there be a requirement that a specified amount of broadcast capacity be made available free for educational purposes, and that the service operators provide assistance in producing the educational programs which are broadcast. *(Paragraph 5.86)*

Radio

The Committee recommends that:

14 licensing fees for narrowband area services not be levied on government educational institutions which operate the services exclusively to broadcast educational radio programs. *(Paragraph 2.55)*

CHAPTER 2

DEVELOPMENTS IN EDUCATIONAL TECHNOLOGY

Background

2.1 It was explained in Chapter 1 that, because education is a major component of the social, economic and cultural development of both the individual and the community, technology should be used to produce more diverse and flexible learning opportunities for people of all ages. The technology exists but the capacity to use it to best advantage often does not. This chapter canvasses the major technological developments that offer opportunities to improve the quality and availability of learning. The potential for these developments to help in meeting major educational goals is examined in Chapter 3.

Appropriate Technology

2.2 Most of the applications of new technology to education reflect advances in microelectronics and communications. The rapid changes in these areas have permeated many aspects of our everyday lives - at work and at home. We have witnessed in recent years exponential growth in the volume of information available to us and considerable improvements in the ease with which we can access, use, process, store and retrieve it. We also have an increasing ability to exercise quite sophisticated control, through computers, over mechanical devices. As a consequence, education systems have been called upon to teach the theory and skills necessary to master the new technology.

2.3 The focus of this report, however, is more on the use of technology as a means of improving and extending learning than on technology as a subject of study. Prime consideration is given to educational needs, and the challenge is to identify the appropriate technological solutions.

2.4 The appropriate technology for any educational task is not determined by technical features and specifications alone. Technology is more than equipment; it also embraces the way in which equipment and materials are used and the learning experience provided. The Australian Society of Educational Technology defines educational technology as 'the design, application, evaluation and development of systems, methods and materials to improve the

process of human learning'.[1] Accordingly, an appropriate technological solution must encompass consideration of the teaching and learning environment in which the techniques or equipment would be used.

2.5 To provide learning on the learner's terms involves ensuring that the student has a choice of equipment and techniques, and recognising that an appropriate technological solution might be a combination of 'old' and 'new' technology. Rarely can a single answer constitute the complete solution. The University of New England, for example, has used a range of technology to provide opportunities for external students both to study independently and to interact with other people:

> *Students have access to a range of independent learning tools: printed study* guides and other reading materials, audio cassettes, home study kits, assignments and library books. Opportunities for interaction (teacher/student; student/student) exist through residential schools, weekend schools, tutor-led or self-help discussion groups, visits by staff to various centres, communication by correspondence, telephone, audio cassette and electronic mail.[2]

2.6 Certainly it is unwise to invest scarce resources in new technological solutions if it is not clear that they are likely to solve the educational problems to which they are directed. Technology enthusiasts frequently are criticised for being unrealistic about costs and unable to provide conclusive proof of benefits. Analysis of cost-effectiveness should encompass both production and delivery costs. Major course production costs include the capital cost of equipment; the salaries of staff who are preparing the material; and the licensing fees for the use of any existing material. Costs associated with course delivery are those of training staff to use the appropriate technology to best effect; duplication and postage costs of material disseminated in hard copy form; and the transmission costs of material presented in electronic, audio and visual forms.

2.7 Savings are also part of the cost-effectiveness equation. Those most clearly established are found in teaching students externally, as expenditure on the production and delivery of course material can be offset by savings in staff salaries and the provision of buildings and facilities on campus. However, significant savings have been achieved by applying technology to on-campus teaching as well.

2.8 A major consideration in calculating and containing costs is the possibility of achieving economies of scale. It is common practice, for example, to offer students who ultimately will specialise in different disciplines a number of common core subjects, in which economies of scale are achieved. Economies

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[1] J Steele, 'EdTech and the review of efficiency and effectiveness in higher education', *Australian Journal of Educational Technology*, Vol 2, No 2, Summer 1986/87, p 130.
[2] University of New England, *Submission*, p 4.

can also be achieved over time, where individual study materials are designed to be used by a large number of students over several years, even if the annual enrolment in the subject is low.

2.9 Interstate and inter-institutional collaboration to achieve economies of scale also occurs but is not always an easy task. One disillusioned observer has described the difficulties of a cooperative venture as follows:

> ... this Project appears to have been almost stalled by inter and intra system financial bickering, by cross-crediting problems and by the lack of a networking secretariat which was recognised by all of the educational institutions and authorities involved. Thus, experience with a project which was seen by some as the proverbial light at the end of the tunnel has revealed that the light is really the headlight of the 'States' rights juggernaut coming relentlessly up the tunnel.[3]

2.10 Observations of this type have strengthened calls for all State governments, the Commonwealth Government and individual educational institutions to develop a better national sense of direction in applying technology to education. This issue is discussed more fully in Chapter 5.

2.11 Finally, not all costs are borne by governments or educational institutions. It is becoming common for students enrolled in post-secondary computing courses to be required to have their own computers, and students studying from home usually meet communications costs. Clearly, decisions about how costs are shared between the student and the institution affect access to education.

2.12 The technological developments canvassed in this chapter have been divided into two categories: those which affect the production of learning materials and those which facilitate their delivery. This distinction broadly corresponds to the distinction between technology which allows the student to study independently and that which facilitates direct interaction between students, teachers and institutions. However, some developments fall into both categories. Computer mediated communications, for example, can both allow, and overcome the need for, simultaneous interaction.

Production of Learning Materials

Print Media

2.13 Printed material is accessible, inexpensive, portable, easy to use and familiar to students and teachers alike. The Committee was advised repeatedly during the Inquiry that print, supplemented by other media, will remain the

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[3] A C Millar, *Submission*, p 6.

predominant form of learning material in the foreseeable future.[4] Moreover, a recent study has shown that external students in higher education prefer print-based media over all other media.[5]

2.14 Advances in desktop publishing and improvements in the cost-effectiveness and quality of photocopying and offset printing have made the production of high quality printed material more economically feasible for individual institutions. The use of personal computers, optical character readers, laser printers and word processing and desk top publishing software allows materials not only to be updated easily, but to be customised to reflect differences in regions, culture, educational development and teaching strategies. In addition, resources can be produced in a digitised form in one location and transmitted electronically, by disk, or by tape to other locations for printing.

2.15 The Western Australian Government pointed out to the Committee, however, that to convert and update the masters of old texts and learning programs that were not initially produced on computer would be a significant task, even with the use of the most sophisticated optical character readers currently available.[6]

Audio Tapes

2.16 Audio tapes increasingly are being used to supplement the learning materials in a wide range of subject areas. Cassette tapes are most frequently used because almost all Australians have access to audio cassette replay machines.

2.17 The tapes are inexpensive to purchase and the cost of making recordings is not high - even though it varies with the material recorded, the recording technology used, and the size of the audience. Moreover, improvements in high speed copiers can allow multiple audio tapes to be produced more quickly and cheaply. Audio tapes have the additional advantages of being easy to post and able to be reused.

2.18 The increase in popularity of this technology in Australia has also been experienced in the United Kingdom. Aside from print, the greatest growth in use of media at the Open University has been in audio tapes.

2.19 Apart from being a means of conveying pre-recorded lessons to external students, audio tapes are used to improve communication between these students and their teachers. Personal message tapes which they send to each

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[4] For example: B W Carss, *Evidence*, p 488; P G Skelton, *Evidence*, p 104; V J White, *Evidence*, p 432.

[5] Department of Employment, Education and Training, *Cost Effectiveness of Printed Study Material Supplemented by Other Media for External Learning*, by W K Timmins, 1988.

[6] WA Government, *Submission*, p 3.12.

other help to establish rapport and personalise interactions.[7] Furthermore, audio recordings of lectures and tutorials are being used by on-campus tertiary students who have missed a class or who wish to review the material.

2.20 Audio tapes cannot be regarded as 'new technology', but digital audio tapes have recently been introduced in Japan and Europe. These tapes reproduce a high quality sound without tape hiss and generation loss. The better quality of digitally recorded sound can be of great benefit in language and music instruction. However, it would not necessarily be required in the production of recordings for all courses, and certainly not for personal messages.

Video Tapes

2.21 Video tapes can make it possible to study externally subjects which otherwise could be offered only by face-to-face instruction, especially where practical skills and techniques are being taught. They can also improve the quality of learning materials generally. This can include materials for educators, other vocational groups, and the general community as well as for people enrolled in formal courses.

2.22 Compared to audio tapes, video tapes are more expensive to produce. This is particularly the case when they are produced to commercial television standard. The role of television in education is discussed further below; however, the educational use both of television and video tapes increased markedly once the video cassette recorder became a common household appliance.

2.23 Alternatively, video tapes of televised programs can be sent to students who cannot receive the broadcast. From 1982 to 1987, the Commonwealth Government's Loan Video Program enabled video tapes of ABC educational television broadcasts to be supplied by State governments to primary school children in remote and isolated areas. The children were also supplied with recorders and television receivers. Schemes of this type continue to exist in some States, under State government sponsorship.

2.24 Lesser standards of video production are often quite adequate for educational purposes, as the Victorian Government explained to the Committee:

> Broadcast standard equipment and facilities are required if video is to be broadcast on public television channels or to develop an interactive video disc. If video is to be used by many students in different institutions, high

[7] NSW Department of Education, *Submission*, Appendix 3.

standard non-broadcast quality is needed. If a one-off tape, which supplements other more significant learning strategies is required, domestic standard equipment could be used.[8]

2.25 Lower cost in-house recordings can be suitable if there are sufficient student numbers for broadcasting to be cost-effective. Video tapes of lectures, experiments and demonstrations, for example, can be produced more cheaply.

2.26 A specialised low-cost video application is the Individualised Video Console, or INVICON. This is a small, portable and individually operated video production console, about the size of a telephone booth, which allows teachers to produce their own video programs. It is being used in a number of States to supplement distance education materials. The Primary Correspondence School in Melbourne, for example, has used the INVICON for a wide range of purposes 'from [demonstrating] the dissection of a rat, to teaching music theory and practice, assisting with the remediation of errors, to comparing the work of pupils in the same grade'.[9]

Laser Optical Discs

2.27 The most widely available forms of laser optical disc are the audio compact disc and the video disc. Not only do they have almost all of the advantages of audio and video tapes, they produce a much higher quality sound or image, they have a greater capacity to store information, they have a longer life, and they allow the user much easier random access to the material. These features also make optical discs technically superior to floppy discs and magnetic tape used in computer storage and retrieval systems, so data is increasingly being stored on CD-ROM (compact disc read-only memory).

2.28 The main drawbacks of optical disc technology are the cost of producing them and the fact that material they contain cannot be erased or altered. In terms of contributing to the development of more diverse, flexible and better education, the greatest potential of optical disc technology can be found in applications where the disc is controlled by computer.

2.29 Controlling audio and video discs by computer allows the user to interact far more effectively with the material. Instructional aids for teachers, or forms of computer assisted learning for students, can be created in this way. Considerable realism can be given to instructional programs and, by using interactive video, students can perform experiments that they otherwise would be unable to experience. The New South Wales Conservatorium of Music, and the Adelaide College of TAFE, for example, have combined audio compact discs and video discs with personal computers to develop new music and language learning materials (see ***Panel 2.1***).

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[8] Vic Government, *Submission*, p 15.
[9] Primary Correspondence School, *Submission*, p 3.

Panel 2.1

Optical Discs

The Adelaide College of TAFE has developed a video disc 'Aussie Barbie' for adult learners of English as a second or foreign language.

The video disc provides conversational English in an informal Australian setting, enabling the learner to observe characters depicting guests at a BBQ. It can be used as an independent study aid or as a presentation resource for the classroom. In 1988 the Aussie Barbie' won a Computing Award presented by the Australian Society of Educational Technology.

B K Stanford, *Development of Non-Traditional Delivery Systems at Adelaide College of TAFE*

The NSW State Conservatorium of Music is using a Compact Disc Music Tutor, a teaching system utilising a domestic compact disc player interfaced to a personal computer. The system is an interactive audio-visual learning environment that introduces the notions of music through sequenced lessons that present text, scores and colour graphics synchronised with pertinent excerpts from the compact disc.

The system was developed by Dennis Patterson of the Conservatorium, Joseph Maccioni of MIDIWARE (Australia) and Alex Sardo of Compax Pty Ltd.

NSW State Conservatorium of Music, *Submission*

2.30 CD-ROMs can be operated only by personal computer. These discs hold vast amounts of data, usually as text files and numerical databases. Recently, they have also been able to store digitalised photographs and audio. One CD-ROM disc can hold about 600 megabytes of information, or several times the amount of data that can be held on a hard disc on a personal computer. Their mass storage capabilities and the ease with which the data they hold can be manipulated mean that CD-ROMs can be extremely useful research tools.

2.31 A number of important databases, including Australian Bureau of Statistics' published statistics, major subject literature indexes and encyclopaediae are already available in CD-ROM format. CD-ROMs are also replacing library index catalogues.

2.32 Laser optical technology can be expected to be adopted more widely in education as the cost of producing materials in this form decreases. Moreover, as new advances in this technology are made, so the cost-effectiveness of applying it to education should improve. Scientists at the Laser Physics Centre, at the Australian National University, for example, are developing a technique that potentially could increase the storage capacity of compact discs by a factor of up to a million. While the research is promising, developments are not expected to reach a commercial stage until the end of the 1990s and new methods of digital compression already are allowing much more information to be stored on disc.

2.33 Finally, from about 1990, it should be possible to purchase discs which can be erased, altered and copied onto other discs, and discs which produce text, audio, graphics, video and data using only a television set and disc player.[10]

Computer Aided Learning and Computer Managed Learning

2.34 While innovations in optical electronic technology have added new dimensions to the role of computers in education, computers have been used as research and instructional tools for some time. They are also being used increasingly as communications terminals, as discussed in the next section.

2.35 Computer aided learning is instruction by computer. The student sits at the machine and works through the learning materials stored on it. This method can be a very effective learning strategy and can allow the learner some flexibility as to when and at what pace to study. Recent work on artificial intelligence, combined with the capacity to produce better graphics and simulations by computer and to link computers with optical discs, have improved the quality of the learning programs produced. However, the quality of the learning experience and the applicability of the technology to other than branched yes/no learning approaches has been the subject of some scepticism.

2.36 Computer aided learning has been adapted by some tertiary institutions and used in workplace-based training. The rate of application to education has been hindered by cost considerations. The Committee was advised that:

> The compilation of a suite of worthwhile material, even using a sophisticated authoring system, is expensive, time consuming and still a reasonably specialised skill. Lower quality material can be produced much more cheaply but care needs to be taken here that the material could not just as effectively be given to students in paper form.[11]

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[10] R Fletcher, 'The implications of laser optical disc formats in formal and distance education'; N A Shaw, 'Interactive audio in education and training - applications of CD-ROM', *Proceedings of the National Conference for the Australian Society for Educational Technology, Designing for Learning in Industry and Education,* Canberra, 1988, pp 1-5 and pp 31-36.

[11] P J Smith, *Submission,* p 3.

The New South Wales Department of Education has estimated that about 100 hours of development time is required to produce one hour of delivery time.[12]

2.37 However, cost considerations have provided an incentive for computer aided learning to be used at the workplace because it can save the 'lost opportunity' costs associated with the employee's absence while training. Computer aided learning reportedly can be a faster way to learn effectively:

> One of the most consistent findings in evaluation studies is that technology based training reduces the time taken to complete the training. The Institute of Defence Analysis (US) has documented their findings that on average, technology based training can yield a 29% time saving over traditional methods. These findings go on to say that not only do the students learn faster, but also increase their comprehension by 18% (median).[13]

2.38 Computer managed learning is used more extensively than computer assisted learning in Australian education. The computer manages the student's learning by, for example, providing tests and assignments, directing the student through the stages of the learning program, and recording and analysing progress. While computer managed learning can incorporate computer aided learning, the course material is usually provided by a variety of other means such as printed guides, video tapes, audio tapes, lectures, practical work, tutorials and assignments.

2.39 Computer managed learning can be applied to almost every subject area. Moreover, projections by the Queensland Department of Employment, Vocational Education and Training indicate that this technology could reduce costs by up to 50% in some courses. The break-even point has been calculated as being about 300 students over the life of a course.[14] The University of Queensland, the Darling Downs Institute of Advanced Education and Curtin University of Technology are among the institutions that are successfully using computer managed learning technology. The Committee had the opportunity to view elements of each of these. ***Panel 2.2*** briefly describes a program at Curtin University which is used extensively in the training and retraining of nurses.

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[12] I Pirie, *Evidence*, p 968.
[13] Applied Learning, *Submission*, p 6.
[14] Qld Department of Employment, Vocational Education and Training, *Submission*, p 12.

Panel 2.2

Nurse Training with Computer Managed Learning

The School of Nursing within Curtin University of Technology uses computer managed learning extensively for the re-registration of nurses who are returning to the workforce after an extended absence.

The Computer Managed Learning nurse retraining course took its first students in September 1988. The course currently has 60 students 'on-line' using terminals on campus or in country learning centres in Derby and Geralton. A learning centre is soon to be established in Albany as well. Another 15 students will commence the course in the first quarter of 1989.

Students in country learning centres or metropolitan areas with access to terminals log on to the Computer Managed Learning Laboratory via the University's Computing Centre machine. Students in country areas who do not have access to terminals receive course materials in written form and take the course examinations in the presence of an approved supervisor.

The course takes approximately six to eight months to complete, but the length of time taken essentially depends on the student. The theoretical training provided in the computer managed learning course is followed by clinical training provided in a four week placement in an approved hospital.

Committee visit to Curtin University of Technology, August 1988

Delivery of Learning Materials

2.40 This section covers the use of technology to improve the interaction between teachers and students and to supplement and support the independent learning that the technology discussed in the previous section allows.

Post

2.41 Mail services were for a long time the only means of communication between the educational institution and external students but they now are being supplemented by newer communications technology.

2.42 The use of television, radio, telephones, electronic mail, facsimile and other telematic technology in education has been occasioned to some extent by irregular or unreliable mail services. For example, the Committee was advised that:

> ... many rural areas in Western Australia receive a mail service only on a weekly, fortnightly, or even monthly basis, and in some regions climatic extremes mean that even these services may be suspended for long periods.[15]

2.43 Nonetheless, where other communications methods have been used to overcome this problem, they tend to supplement printed material which has been delivered by mail. Moreover, mail services continue to be a cost-effective means of communication when interaction does not need to be immediate. If student numbers are low, for example, it is cheaper to post video tapes than it is to broadcast them on television, to post audio tapes than it is to broadcast them on radio, and to post computer discs rather than send the data via the telecommunications system.[16]

Radio

2.44 Radio is used as a means of broadcasting educational material to the general public and as a means of allowing interaction between students undertaking formal courses and their teachers. The advantages of using this technology are that it is relatively inexpensive, flexible, portable and almost every home has at least one radio, but probably more.

2.45 Broadcasting educational material has been a feature of ABC Radio for more than 50 years. At one stage, the ABC was broadcasting two hours per day for primary and secondary students. It now concentrates more on lifelong education while still retaining some preschool and primary school programs. By the end of the 1990s, all Australians will have access to three ABC radio stations, which represents a potentially greater capacity for radio to be used to reach large and dispersed groups of people.[17] A limitation on the use of broadcast radio for education, however, is that the extent to which specialised or complex learning material can be usefully transmitted. This is inversely proportional to the size and diversity of the audience. The ABC would not present an advanced accountancy course but is producing a very successful program on management because the latter is considered to be more interesting and topical for the majority of its audience.[18]

2.46 Educational public radio stations are operated by higher education institutions in every mainland State. They broadcast to much smaller audiences over much smaller distances and are better placed than major broadcasters to give higher priority to public services than to entertainment. They are also better placed to provide a means of allowing interaction between teachers and students.

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[15] Isolated Children's Parents' Association (WA), *Submission*, p 3.
[16] J F Marsh, *Submission*, p 2; University of New England, *Submission*, p 13.
[17] J B Patrick, *Evidence*, p 759.
[18] J B Patrick, *Evidence*, p 758.

2.47 Interactive educational programs can be offered on broadcast radio by means of talk-back via telephone. Where there is a large audience, of course, the chances of every listener attracting the attention of the presenter are minimal. However, where the audience can be targeted and identified, the program, or series of programs, can be structured more carefully and the progress of the learners better guided. Two projects which have explored the educational potential of talk-back radio, conducted by 2SER-FM, are outlined in ***Panel 2.3***. As a further development, the radio station has participated in a trial linking talk-back radio with televised educational programs.

Panel 2.3

Talk Back Radio

During 1986, Sydney radio station 2SER-FM, in association with the Outreach Program of New South Wales TAFE, conducted a project 'Opportunidades de Accesso a La Educacion'. The target audience was Spanish - speaking people in the wider Sydney metropolitan area. Eight 90 minute programs, comprising 30 minutes of pre-recorded material and 60 minutes of talk back, were broadcast. Topics included multicultural education, youth unemployment, leisure courses, and the educational needs of women, the aged and people with disabilities. A number of groups, of up to 15 people, gathered to listen to the programs, following which they were led in further discussion by tutors.

Another 2SER-FM project in 1986, 'Talking to New England', was designed to gauge the success of integrating radio broadcasting and external tertiary education. Two series of one-hour programs - 20 minutes of prerecorded lecture followed by 40 minutes of talk back - were broadcast. The producer/presenter of the program would function as the linking agent between the caller and the guest academic in Armidale. Thirty hours of course-based material was broadcast over a combined period of 18 weeks.

J Martin, 2SER-FM 107.5, *Submission*

2.48 The use of interactive radio to improve formal distance education was pioneered in Australia using the Royal Flying Doctor Services' High Frequency (HF) radio. While it is a useful form of communication between teachers and students, HF transmissions are regularly subject to fading, distortion or interference. However, a mobile communications service to be provided via the next generation of AUSSAT satellites has the potential to replace HF radio (see *Satellite Services* below). This issue is discussed further in Chapter 3.

2.49 The Committee was also told of a number of drawbacks associated with the use of radio, whether used for broadcasting only or for interaction. Studies overseas of external tertiary students have found that:

- students preferred radio/vision to radio;
- few students used broadcasts to pace their studies;
- radio was the first component omitted when a student was pressed for study time; and
- the use of audio/visual channels combined was superior to radio plus written notes.[19]

2.50 However, Australian projects have shown that radio is an effective medium for attracting new students who might not normally enrol in adult education, especially people from rural areas.[20] It has also been an efficient means of providing information to teachers and administrators about educational developments. The New South Wales Department of Education, for example, has been broadcasting radio programs for this purpose for more than six years as part of its INSERT (Insert Radio for Teachers and the Community) project.[21]

2.51 An idea gaining currency is to transmit interactive learning sessions via FM sub-carrier to students enrolled in formal courses. An additional audio or data signal, which is received only through decoder receivers that have been pre-tuned to a specific subcarrier frequency, can be 'piggy backed' onto FM radio broadcasts. Two messages can be transmitted simultaneously - one for the general audience and one for a specialised audience. The decoders cost about $250 each, but this cost could be expected to decrease significantly if the technology were used more extensively.

2.52 Murdoch University and 6UVS(FM) pioneered the use of FM subcarrier for educational purposes in 1985. Talk-back radio tutorials were transmitted to home-based and institutionally-confined students. Tutors and students alike appreciated the service and the University and radio station received a Pater Award from the Australian Academy of Broadcast Arts and Science for 'the Most Outstanding Radio Innovation of 1985'.

2.53 The service was discontinued pending determination by the Department of Transport and Communications of licensing conditions. Following a delay of more than two years, the Department decided that the service would be

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[19] University of New England, *Submission*, p 13.
[20] Western Regional Council for Adult Education, *Submission*, p 2.
[21] NSW Department of Education, *Submission*, p 13.

licensed as a Narrowband Area Service and radio stations would incur fees of $2,280 for transmission and $5 for each decoder used. This precluded future development.[22]

2.54 Some of the ambiguity surrounding the broadcasting regulations which apply to projects such as the FM sub-carrier trials has been overcome by the recent passage of new broadcasting legislation. Licences for diverse non-commercial television and radio services can now be provided more easily with the introduction of a special category of limited licences available for limited services. It is recognised that, while services such as local information services, special event coverage and broadcasting for remote Aboriginal and Islander communities require technical planning, they do not require the stringent programming conditions which are applied to major broadcasting services. Nonetheless, this legislation does not resolve the funding problems encountered by Murdoch University and the Committee believes that these fees should not apply to non-profit educational institutions using the technology.

2.55 The Committee recommends that:

> **licensing fees for narrowband area services not be levied on government educational institutions which operate the services exclusively to broadcast educational radio programs.** *(Recommendation 14)*

Television

2.56 Like radio, television is familiar to everyone and readily available to most. Its potential to deliver educational material to large audiences and, when supplemented by telephone technology, also to improve interaction between teachers and their students, has been recognised for some time. A major obstacle preventing its wider use for educational purposes is the cost of purchasing and producing programs:

> Good educational TV costs about $1000 per hour to produce, over and above the costs of staff and facilities. Broadcast quality TV can cost ten times that amount. Transmission costs are also high.[23]

2.57 The ABC has been broadcasting educational material since its inception and the SBS has been doing so since 1987. Apart from their own productions, both the ABC and the SBS have broadcast programs distributed by Learning Network Pty Ltd, a company which was established to utilise broadcast television to deliver adult education and information programs. It recently suspended operations. The SBS has also provided one hour of broadcast time per day to programs developed by TV Ed Australia, a cooperative project

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[22] P Guiton, *Submission*, p 6.
[23] J C Lange, 'New technology and distance education: the case of Australia', *Submission*, p 27.

supported by the Education Ministries of all of the States and Territories except Queensland. It is possible that the SBS educational window will be expanded to two hours per day in 1989. The project is described in more detail in ***Panel 2.4.*** Major country networks in Victoria take TV Ed 'off-air' via AUSSAT and retransmit the programs later.

Panel 2.4

TV Ed

TV Ed Australia is a national educational broadcast project involving Education Ministries and agencies such as colleges of advanced education, universities and TAFE colleges. TV Ed Australia developed from the Victorian TV Ed project, whereby educational broadcasts were made on HSV7 Melbourne and regional television stations in Victoria.

SBS now undertakes the broadcast function in place of HSV7 Melbourne, providing free broadcasts between 3.00 - 4.00pm on weekdays. HSV7 Melbourne still provides the Victorian Ministry of Education with one day per month free studio time and crew and equipment. Programs are provided by tertiary institutions and by government departments of all States and Territories apart from Queensland. The Victorian Ministry of Education undertakes the coordination and scheduling task and all States and Territories receive programs.

TV Ed Australia attempts to target audiences with its particular time slots. Accordingly, its programs concentrate on primary schools, TAFE colleges, or teacher professional development issues, for example, depending on the day.

Victorian Ministry of Education, *Submission*

2.58 Educational material is also broadcast by Golden West Network and Imparja as a condition of their licences. The licences require that:

> The licensee shall provide access for the following number of hours of aboriginal programs to meet the specific needs of the aboriginal population within the service area and educational programs based on or consistent with established curricula (including primary, secondary, tertiary and continuing education) to meet the specific educational needs and interests of the population within the service area: -
>
> (a) during the first and second year of operation - a minimum of 80 hours per year;

(b) during the third and fourth year of operation - a minimum of 280 hours per year;

(c) during the fifth year of operation - a minimum of 560 hours per year;

The licensee shall take all reasonable steps to ensure that the number of hours referred to above are transmitted using program material from independent, educational and its own resources.[24]

2.59 Golden West Network covers non-metropolitan areas of Western Australia. It provides up to 14 hours per week of free air time for educational broadcasts under the title 'Ed-TV'. Programs are produced by 10 participating institutions but they fall well short of 14 hours of transmission every week.

2.60 Imparja is licensed to provide a television service throughout the Northern Territory, South Australia and western New South Wales. The company's majority shareholder is the Central Australian Aboriginal Media Association (CAAMA), which aims eventually to produce all the educational programs that Imparja broadcasts. Currently, Imparja adapts and retransmits educational programs from the ABC and SBS.

2.61 The advent of satellite television in Australia technically gave broadcasters the ability to select their audience. The satellite signal is received by means of a decoder which is owned by the viewer but activated by the broadcaster. Programs can be 'narrowcast' in this way to specific locations. As they are seen by a limited audience, these programs are not subject to the same controls that apply to programs received by the general community. Low cost educational programs which could not otherwise be transmitted because they are of inadequate technical standard can now be transmitted to widely dispersed groups of students by direct arrangement with AUSSAT or by using the services of Sky Channel or TSN 11.

2.62 In 1987, for example, New South Wales TAFE hospitality industry courses were delivered via Club Superstation (later, Sky Channel) to satellite receiving stations located in registered clubs. The students attended the clubs to watch the classes and often undertook practical work using the clubs' facilities. New South Wales TAFE is now testing the delivery of courses directly via AUSSAT to receivers in colleges at Lismore, Gunnedah, Wagga and Hornsby.[25]

2.63 Perhaps more importantly, these transmissions can become interactive learning sessions. Two-way audio/visual interaction by satellite is possible, using mobile earth stations rather than the television receive-only equipment used by most people and organisations that receive satellite transmissions. However, the

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[24] AUSSAT, *Submission*, p 3.
[25] NSW Department of TAFE, *Submission*, p 2.

cost is prohibitive for the delivery of educational material. A mobile earth station costs at least $15,000, while a television receive-only satellite dish costs about $2,000-$3,000. A cheaper option is to introduce interaction to television broadcasts by adding terrestrial telephone links between the presenter and the audience. One-way video and two-way audio is then achieved.

2.64 TSN 11, which coordinates all Queensland Government satellite video transmissions, also produces and transmits 25-30 hours per week of interactive programs in this way for education, industry, commerce and professional groups. It transmits to a total of 60 educational institutions and centres and 1,500 privately owned satellite receiving facilities.

2.65 In recent times there has been a growing interest in using UHF channels to broadcast television programs. UHF-compatible television receivers are becoming common within the community, and the equipment needed is far less expensive than that required to receive satellite transmissions. A number of educational institutions have proposed that educational programs be broadcast via UHF to regionally defined groups of students. In November 1988, a consortium of tertiary institutions began broadcasting educational programs via UHF from the University of New South Wales to the eastern suburbs and inner-city areas of Sydney. Broadcasting ceased after a short time because of licensing regulations.

2.66 Another potential use of UHF television is to retransmit programs broadcast by satellite, to save students the greater expense of purchasing satellite receiving equipment. The New South Wales Government is currently seeking to have UHF channels allocated to it for this purpose.

2.67 The Commonwealth Government is actively considering the widespread introduction of cable television to Australia. Aspects of cable television are also being studied by the House of Representatives Standing Committee on Transport, Communications and Infrastructure, which is examining the possibile development and regulation of pay television.

2.68 Cable television is relayed to subscribers through underground cable either directly from the signal originator or via a microwave link. The cable has approximately one thousand times the information-carrying capacity of telephone cable and can be designed to allow not only one way broadcasts but also interactive services. These can include user-initiated access to special programs, systems, information banks, computer programs and library searching. The potential for cable television to be applied for educational purposes in Australia is discussed more fully in Chapter 5.

Slow Scan Television

2.69 Still diagrams, pictures, printed documents and other graphics can be transmitted by means of slow scan television. Slow scan television transmission is inexpensive because it can be operated using only one telephone or radio channel compared to the 600-1,000 channels required for normal television. This technology has proved to be a useful supplement to telephone conferencing.[26]

Compressed Video

2.70 As discussed above, two-way audio/visual interaction by satellite is not cost-effective for educational applications. Compressed video, or compressed television, could bring two-way audio/visual communications more within the financial reach of education authorities. The potential for this technology to improve interaction over a distance is being tested by the Adelaide College of TAFE, as outlined in ***Panel 2.5***.

Panel 2.5

TAFE Network using compressed digital television

Light College of TAFE, with three campuses north of Adelaide in Gawler, Nuriootpa and Clare, will commence a trial in 1989 to test the feasibility of constructing a compressed digital television network linking the three campuses with the Adelaide College of TAFE. If the trial is successful and the network is introduced, it will provide for fully interactive classes between the four locations at a cost of approximately $100,000. It is anticipated that a minimum of 650 hours of courses will be delivered each year, should all campuses be connected, as proposed.

It is envisaged that each location will have an encoder/decoder unit along with a camera and monitor. The unit will convert analog television pictures and sound into a compressed form as digital information for transmission over an established Telecom fibre optic telephone cable. The monitors in each location will display a split picture portraying the other three locations.

Light College has previously used compressed digital television to offer a Business Studies course from the Adelaide College of TAFE which it could not provide itself.

B K Stanford, *Development of Non-Traditional Delivery Systems at Adelaide College of TAFE*

[26] University of New England, *Submission*, p 16.

2.71 A compressed video signal is a signal which has been digitalised and the redundant information removed. Transmitted via fibre optic cable and a device at each end of the line known as a codec (coder-decoder), it uses very much less bandwidth than conventional transmission:

> You can compress to different extents. The further you compress, the cheaper it is to transmit that signal, but you reach a point at which the compression removes so much information from the signal that the image does not look natural. For example, if you are transmitting someone standing at a blackboard waving his arms, you will see his arms at different points but you will not see smooth motion. That may be inconsequential in an educational context. In a business context businesses would normally prefer to pay the higher cost of transmitting a less compressed signal.[27]

2.72 The Victorian Ministry of Education has the capacity to use compressed video on VISTEL, the Victorian Government telecommunications network. However it has cautioned against over-enthusiasm:

> ... if you are using two-way interactive video on VISTEL, you have to think carefully about it because even there you should not just use it because it is nice to use. It takes up a lot of the capacity of a fibre optic cable to do that and so you should make fairly careful judgements about when you should be using it.[28]

Computer Mediated Communications

2.73 Computers connected by cable or telephone line can be used for both direct and asynchronous communication. Cable connections provide permanent links that together form local area networks. Organisations often use local area networks for internal information management.

2.74 Telephone connections between computers via modem can create networks that extend wherever there are telephone links of ordinary voice quality. In addition, local area networks can be connected to other networks this way. Networking allows easy and quick access to information regardless of the location of the user or where the available data has been entered. Similarly, all users can add to the data on the network.

2.75 Data is transmitted and exchanged in different ways, depending on the flexibility required, the volume of the data to be transmitted, and the permanency of the link. The most widely-used system by which networks exchange data is 'packet switching', which involves transmitting data in discrete 'packets' or bundles to maximise the efficient use of the telecommunications system by directing data over spare capacity. The packet switching service provided by Telecom is Austpac.

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[27] D A Inglis, *Evidence*, p 646.
[28] J G Foks, *Evidence*, p 599.

2.76 Austpac caters particularly for users who desire a flexible network which can handle both synchronous and asynchronous data streams of various speeds and protocols. Any type of computer can communicate via Austpac. This has proved to be a useful feature for teachers wishing to communicate electronically with external students who own personal computers.

2.77 Using computer networks to access databases is fairly common. While for some time libraries have operated major networks for this purpose and have progressively computerised their own systems, it is becoming more prevalent for teachers and students to be able directly to gain access to a range of sophisticated data from home or work. Often all that is required is a standard personal computer and modem, linked to the Telecom network.

2.78 Electronic mail whereby messages are exchanged electronically by computer is also gaining in popularity. Electronic mail improves the ability of users to work collaboratively in developing and sharing ideas, advice and information, yet it frees them from the need to communicate simultaneously. One central computer functions as a clearing-house among users of the network. Messages that have been sent are stored in the central computer until the addressee 'logs on', at which time the message is presented on the addressee's screen.

2.79 Systems software used for electronic mail also permits users to send messages to a public 'bulletin board' where any other user can read and respond to them in the same way. Multiple bulletin boards can be set up and access to them can be restricted if desired. Computer conferencing, or meetings of geographically dispersed people, can readily be arranged by using bulletin boards but specialised software has also been developed for this purpose.

2.80 Telecom's electronic mail service is known as Keylink. Keylink provided the means for about 600 Australian schools to communicate with each other in 1988 as part of the Schools Across Australia program. Another educational application of Keylink is the Australian Open Learning Information Network. Aspects of these programs are discussed in Chapter 4.

2.81 Keylink cannot transmit graphics, but electronic blackboarding software provides an alternative. A graphic tablet at either end of a computer link can render the screen of each computer usable as an electronic blackboard. Teachers who are geographically remote from their students can find this technique useful.

2.82 Computer mediated communications have considerable potential to improve the quality, accessibility and flexibility of learning. The extent to which this potential is realised, however, depends in no small part on continued growth in the market penetration of personal computers. It has been observed, for example, that:

> A good rule of thumb for educational technologies is: don't use it unless 90% of your audience are familiar with it and have easy access to it ... for example, we can forget computers, unless we are teaching computer subjects or subjects that everyone already accepts must have computers to get the job done.[29]

Facsimile

2.83 Facsimile is a simple and speedy means of sending text and graphic material and can be an effective way of improving interaction between teachers and students in remote locations. Moreover, students are more frequently using facsimile, rather than mail services, to deliver assignments.

2.84 Facsimile systems are rarely purchased for the household because they are very expensive and limited in application compared to, for example, personal computers. They are therefore usually available to students only if provided at educational centres or the student's place of work, or if the student is prepared to pay the high cost of using the Australia Post public facsimile service. These factors have influenced the delivery decisions of some institutions. The New South Wales Correspondence School, for example, has decided not to use facsimile because of these drawbacks.

Videotex, Teletex and Teletext

2.85 Videotex is a two-way information service which provides access to large databases. Digitally encoded 'frames' are transmitted over the telephone line to a simple terminal, which can be a modified television set and a special keypad. A 'frame' is a standardised screenful of information, or 24 rows of 40 character positions. As the communication is two-way, videotex services can also offer such features as computation, computer program transfer, money transfer, and messages and mail.

2.86 The videotex service offered by Telecom, available only to subscribers, is Viatel. It has enjoyed strong growth due to the active involvement of the business community and some government sectors, but education accounts for only about 16% of the total usage.[30]

2.87 Indeed, little research has been done on the potential applications of videotex to education in Australia; similarly, the technology has been slow to be accepted and exploited for educational purposes overseas. [31] It is also possible that videotex is not as flexible as other technology being introduced to education. As the University of New England has observed:

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[29] J C Lange, 'Talk-back television: the Western Australian experience', *Submission*, p 3.
[30] F G Jones, *Evidence*, p 1569.
[31] Australian Open Learning Information Network, 'Knocking on the electronic door', *Submission*, p 7.

> The educational advantages of [videotex] are those of any simple-to-use mainframe-based computer system using relatively cheap terminals. Its menu approach, numerical branching technique and split rate access make it slow and cumbersome when compared with command-driven systems. It is therefore limited for large databases, mail and sophisticated information retrieval.[32]

2.88 It is interesting to note, then, that the Western Australian Government sees a significant role for videotex in education and especially in interactive learning. The Western Australian Office of TAFE uses three videotex services: Viatel, Elderlink and Infowest. Viatel and Elderlink are used to advertise all external courses to subscribers, as well as information on open learning materials, prices, and requests for order forms. Moreover, students can re-enrol on these systems. The Infowest service is a public system in the Perth metropolitan area. It provides more limited information about TAFE courses and gives users the opportunity to have additional material mailed to them.

2.89 Associated with Viatel is Teletex, a high-speed telex-type service. Anyone with a Viatel terminal can send a telex to another Viatel subscriber at less cost than an ordinary telex and without needing to have a telex machine. The message is stored until the addressee calls up the database. It then may be printed out and the electronically-stored signal erased or left in storage.

2.90 A service which is similar to videotex is teletext. However, whereas videotex frames are transmitted via telephone line, teletext frames are transmitted via the conventional television broadcast system. The teletext information is carried on the unused components, or lines, of the television signal and can be displayed alone on the screen or superimposed on the televised picture. A decoder and a keypad are used, as they are for videotex, but the teletext keypad is simpler. The display and coding techniques for teletext are compatible with videotex, so the two services may be combined on an adapted television set.

2.91 It was suggested to the Committee that teletext should be investigated because it 'could have as many advantages as Viatel, electronic mail, computer-assisted learning, graphics boards and most other electronic marvels put together'.[33] However, teletext allows access to a much smaller amount of data than does videotex, it cannot handle graphics, and the user cannot interact with the database. Teletext has had little impact on education to date and there are few teletext services available on Australian television networks.

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[32] University of New England, *Submission*, p 19.
[33] WA Government, *Submission*, p 3.6.

Telephones

2.92 While nowadays telephone lines are used to transmit far more than simple one-to-one conversations, the capacity for teachers and students to talk to each other when they cannot otherwise meet remains an important feature of distance learning. Communicating by telephone is a valuable means of exchanging ideas, information and advice about coursework and student progress, and it can complement and enhance course material presented in other forms.

2.93 New dimensions can be added to the use of printed material, recorded video and sound, computer aided learning packages and broadcast media by incorporating interactive learning through the use of the telephone. Talk-back television and talk-back radio, for example, provide a quite different learning experience from one-way broadcasts.

2.94 Technological advances have made it easier for one-to-one communications to be replaced by telephone conferencing. Also called teleconferencing, audio teleconferencing and telephone teleconferencing, it is the linking of three or more people by telephone in two or more locations. It has been fostered as a teaching and learning technique in recent years, although the concept was pioneered several decades ago on HF radio by the School of the Air.

2.95 Expansion of telephone conferencing has occurred particularly in South Australia, where the Education Department's Educational Technology Centre developed a loud speaking telephone with multiple microphones, called a DUCT (Diverse Use of Communications Technology). More than 300 schools in South Australia are now involved in some way with telephone conferencing. DUCT equipment is also being used in other States; for example, it has been adopted to provide the main audio link within and between clusters of rural secondary schools in Victoria. Moreover, the Brisbane College of Advanced Education has developed its own conference terminal, the Hybrid, which is also being marketed throughout Australia. Both the DUCT and the Hybrid are cheaper to purchase than the terminal marketed by Telecom and are more suited to educational applications.

2.96 A further development is the electronic bridge which allows multi-point conferencing to occur without requiring a Telecom operator to connect each party in turn. Each party can ring a particular number and automatically be connected to a conference call.

2.97 Telephone conferencing is not as widely used as it could be, even in distance education, because of 'design faults in the equipment and occasional breakdowns in coordination';[34] unreliability of Telecom service and lines;[35] the cost of calls;[36] and a lack of familiarity with the technology.[37]

Terrestrial Telecommunications Networks

2.98 The telephone network is the most extensive and accessible two-way communications available. New technological developments are enabling it to transmit increasingly versatile voice, data, video and graphic services. Apart from technological changes at either end of the telephone line, such as described in previous sections, the telecommunications system itself is being upgraded.

2.99 Most significantly, traditional analog transmission is being replaced by digital transmission. Digital transmission is more reliable, versatile and economical than analog, particularly because it allows different types of communications to be integrated and transmitted as one signal.

2.100 Presently, Telecom is digitalising all of the exchanges in Australia and all of the links between them, thereby creating an integrated digital network. From 1989, it plans to begin extending digital network services to customers through a scheme known as Integrated Services Digital Network (ISDN). At the completion of the ISDN project, residential customers will have two digital telephony channels and a data channel.

2.101 In the second half of the 1990s, Telecom intends to move towards introducing broadband ISDN, which would allow individual users to call up, as needed, the capacity they require from the system. Part of this development could involve the widespread use of optical fibre cable in residential services. A significant feature of optical fibre cable is the capacity to deliver a broadband analog channel which could be used for cable television.

2.102 Digital network services are being extended to non-metropolitan areas by the Rural and Remote Areas Program. The quality and reach of voice and data services available to permanent residents in these areas are being improved by the installation of Digital Radio Concentrator System services. This system uses digital transmission and radio repeaters to reach users up to 600km from an exchange. Instigated in 1984 and expected to be completed by 1992, the Program will cost about $500 million and will create or modernise 44,000 telephone services.

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[34] WA Government, *Submission*, p 3.6.
[35] A C Millar, *Submission*, p 3; A Hermann, *Submission*, p 1.
[36] Orange Agricultural College, *Submission*, Appendix A.
[37] J C Lange, 'Talk-back television: the Western Australian experience', *Submission*, p 5.

2.103 ISDN, optical fibre cables and other advances in telecommunications may not reach remote areas this century. The Committee received conflicting evidence as to the significance of the delay. According to the Department of Transport and Communications, this delay 'is not a significant consideration when most services required today are already available through existing means'.[38] The Committee was also informed, however, that some of the telephone systems being installed in rural and remote areas have insufficient capacity to handle the expected volume of data transmission.[39]

2.104 Another new feature being introduced is the intelligent network, an overlay on the existing network which enables users to create dedicated networks of the size and duration of their choosing; for example, a 008 service would be directed to different destinations at different times of day according to customer requirements. This could help control the costs of such educational activities as telephone tutorials and talk-back television and radio.

2.105 ISDN and other improvements to telecommunications could improve the quality and cost-effectiveness of different teaching and learning methods. The Committee was informed:

> The educational isolation of our teachers and students can be alleviated by improvement to our communications ... In this respect the faster we change over to the ISDN telephone system the better.[40]

Nonetheless, the Committee has also been advised that ISDN will be of limited use to education until everyone has access to it and charges are reduced.[41]

2.106 In order to take the greatest advantage of both terrestrial and satellite telecommunications services in the most economical way, a number of State governments are establishing, or are considering the establishment of, their own networks. The Victorian Government established VISTEL (Victorian State Telecommunications) as a public sector terrestrial and satellite telecommunications network provider in 1987. VISTEL is developing a State-wide integrated digital network, principally for use by the business area of government and the education sector. It will consist of enhanced facilities in the Melbourne offices and major regional centres; and a State-wide satellite network to link the Melbourne central business district regional centres with remote areas. The services provided will include the transmission of voice, data, one way television and two-way video.[42] The potential benefits for education are illustrated in ***Panel 2.6***, where the implications of VISTEL for the Sunraysia College of TAFE are shown.

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[38] Department of Transport and Communications, *Submission*, p 5.
[39] Qld Department of Employment, Vocational Education and Training, *Submission*, p 31; Isolated Children's Parents' Association (Federal Council), *Submission*,p 4.
[40] J E Tuovinen, *Submission*, p 1.
[41] R J Healey, *Evidence*, p 418.
[42] Vic Government, *Submission*, p 22.

Panel 2.6

Use of VISTEL by the Sunraysia College of TAFE

With an optical fibre link-up and satellite earth stations VISTEL will provide the Sunraysia College of TAFE with options in broadcasting ranging from receiving television transmissions to two way video conferencing throughout the Mildura/Swan Hill area.

It is intended that portable earth stations will enable satellite services to be received in areas not readily served by the College's study centres planned for towns including Swan Hill, Ouyen, Manangatang and Nangiloc and Pooncarie.

The College hopes to provide, and be part of, specialist lectures, teletutoring and national/satellite video link-ups. In this way the more remote parts of the region can have access to special educational materials and instruction previously not available to it.

Sunraysia College of TAFE, *Submission*

Satellite Services

2.107 The predominant supplier of satellite services in Australia is AUSSAT Pty Ltd. Under the *Satellite Communications Act 1984*, the primary objective of the company is to operate a satellite communications system for Australia in accordance with sound commercial principles. The Act also requires that priority be given to Department of Aviation services, Telecom's emergency remote area services and the ABC's Home and Community Broadcasting Satellite Service (HACBSS), which broadcasts ABC television and radio programs directly to domestic receivers.

2.108 Most of the services provided by satellite are available through Telecom's terrestrial networks, especially in metropolitan areas. However, the distinguishing feature of the AUSSAT system is its capacity to provide reliable and clear communications nationwide and, unlike terrestrial networks, satellite networks have the capacity to deliver television signals. The latter advantage could diminish over time as Telecom's optical fibre network grows. Indeed, one view put to the Committee was that:

> With the implementation of fibre optics in Australia, it would be an absolute nonsense to suggest the introduction of any educational services via satellite to metropolitan areas.[43]

2.109 Broadcasting represents more than 60% of AUSSAT's revenue base. Its largest customer is the ABC; the SBS, all major commercial television networks, the remote commercial television services, Sky Channel and Q-Net also use AUSSAT's services. Educational television broadcast by satellite is discussed above (see *Television).*

2.110 Satellite services provide an efficient way of communicating from a central point to a number of specific locations, known as point-to-multipoint communications. AUSSAT employs the B-MAC (Multiplexed Analog Component Type B) transmission system, by which means the satellite signal can be directed to selected receivers.

2.111 It is therefore not surprising that a service which is growing in importance for AUSSAT is video conferencing. As noted elsewhere in this chapter, the cheapest approach is to use one-way video via satellite and two-way audio via terrestrial telephone link. The South Australian Government advised that:

> The ability of satellite technology to achieve the combination of terrestrial audio teleconferencing and live television from the classroom, creating an electronic classroom, is its most powerful and useful characteristic.[44]

2.112 A service which AUSSAT recently introduced is Starnet, a network for two-way data and one-way video communications. Starnet was designed for networks where the main flow of communications is between a central point and several branches. Networks which employ this star configuration are not suitable for two-way video and voice applications.[45] Small two-way earth stations, known as VSATs (very small aperture terminals), are used. VSATs are located on the customer's premises at a capital cost of $20,000 and an operating cost of $1,000 - $1,500 per month. VISTEL is currently conducting a trial using Starnet to provide data communications between six schools in East Gippsland.

2.113 A difficulty associated with 'star' networks is that signals between earth stations in the network must travel via a central 'hub'. This is called 'double hopping'. Apart from problems with the time delay caused, the system is very expensive because a larger number of channels are required and the 'hub' must have the capacity to receive and transmit all concurrent traffic. A solution

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[43] S Paltridge, *Submission,* p 12.
[44] SA Government, *Submission,* (Response from Department of TAFE), p 17.
[45] D A Inglis, *Submission,* p 13.

where frequent cross-communication between the branches of the network is likely to occur is to install a full mesh network which allows each station to connect with any other. This technology is becoming more readily available in Australia.

2.114 The AUSSAT system comprises three satellites, known as the A-series satellites. They carry a total of 15 12-watt and 30-watt transponders which transmit signals via four spot beams - covering particular regions - and a national beam. One transponder can convey one full television signal of broadcast quality, or up to 1,000 simultaneous telephone conversations.

2.115 In 1991/92, the A-series satellites will begin to be replaced by two B-series satellites. These satellites will be three times more powerful than those they replace; they will have greater bandwidth, twice the operational life and far more operational flexibility. Each satellite will carry 15 50-watt transponders, some of which will be for a new mobile service. There will be national and spot beams over Australia, a special beam covering New Zealand and the capacity to target the major population areas of Australia with a high performance beam that can be used for pay television services.[46]

2.116 A major trial to demonstrate the capacity for a range of satellite services to be applied to education occurred at the Mt Isa School of the Air in 1986 and 1987. A class was formed from eight of the students from the school, and they were assigned a specially appointed teacher. An earth station capable of receiving television, and receiving and sending voice and data communications, was supplied to each student and the school. Each student was also given a microcomputer, printer and modem and was assisted in completing specially designed learning packages by regular voice contact with the teacher, one-way video and a computer communications link.

2.117 Evidence from the evaluation of the trial suggests that the students who participated became more motivated, diligent, and willing in their schoolwork. They found their studies easier and more interesting. The Queensland Department of Education concluded:

> The first year of the trial provided clear indications of the potential for distance education of open line teleconferencing, data transmission using microcomputers, and close coordination among learning opportunities. The trial experience provides solid justification for the costs of continuing to work towards communication systems capable of good quality multi-channel voice transmission. Systems based on one-way, one-to-many

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[46] R C Johnson, 'Satellite TV using Aussat B', Address, Sydney, 14 November 1988.

> communication, or on two-way, one-to-one communication have their uses in education, but the potency for teaching and learning of two-way, simultaneous communication among all members of a group have been graphically demonstrated by the trial experience.[47]

2.118 People in remote areas were expected to derive great benefits from the launch of the A-series satellites. AUSSAT certainly is able to deliver communications of a clarity and reliability that terrestrial networks are unable to provide. Despite these performance advantages 25% of the satellite capacity is unused and only about 4,000 - 5,000 HACBSS receivers have been installed, rather than the 100,000 that had been forecast.

2.119 There are continuing arguments about the technical adequacy of satellite networks *vis a vis* terrestrial networks, and it is possible that these have discouraged the wider use of AUSSAT services. One obstacle identified by all education authorities, however, is the cost.

2.120 The high capital cost of receiving satellite signals has also deterred people in remote areas from using AUSSAT services. A television receive-only satellite dish and decoder costs between $2,000 and $3,000 - to communicate two-way requires equipment which costs more than five times this amount.

2.121 It is possible that services provided by the B-series satellites might encounter less consumer resistance to the cost. The new mobile service will make two-way voice and low-speed data communications available to people whether in transit or in a fixed location. Rather than utilising 'Ku' Band, which is used for other satellite transmissions, the mobile service will operate on a more flexible 'L' Band and is expected to replace HF radio. The estimated 1991 cost of a terminal is close to $5,000, or about the cost of an HF radio transceiver.

2.122 If satellite-delivered pay television were available, a flat plate antenna, rather than a satellite dish, could be used to receive the new high performance beam in metropolitan areas. The antenna is about 50 centimetres square in size, easy to install, and currently costs approximately $500 without the decoder. By 1991, the cost including the decoder is expected to be about this amount.

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[47] Qld Department of Education, *The Queensland Distance Education by Satellite Trial: Evaluation Report, Year One*, 1987, p 35.

CHAPTER 3

TECHNOLOGY AND PARTICIPATION IN EDUCATION

Managing Technology

3.1 The essential role of technology in improving educational access and outcomes in Australia is to help make the idea of lifetime learning a reality for as many people as possible. For this to happen, the quality, quantity and diversity of educational opportunities must be increased. It also involves making further education a realistic option for people who currently are unable to participate, and an attractive option for people who currently are unwilling to take up educational opportunities that would improve their employment prospects.

3.2 This cannot be achieved without the application of communications and information technology. Certainly, schools and TAFE colleges are so well dispersed throughout the settled parts of Australia that most people live within reasonable distance of an educational institution. But without the benefits of technology, the quality, number and range of educational opportunities available at the local institution are limited by the size of the community. The student must either attend the classes offered or select subjects which can be taken by correspondence. However, computers, video and audio tapes, telephones, facsimile machines, television and radio can free learning from the constraints of distance and time.

3.3 As shown in the last chapter, governments and educational institutions Australia-wide have been examining the potential of a range of technological developments to be applied successfully to education, either singly or in combination. Current technology offers a myriad of options for improving educational access and outcomes, notwithstanding technical limitations of individual processes or pieces of equipment. Moreover, apart from those which are already available, there will always be further technological breakthroughs on the horizon promising new possibilities. In this environment it is easy to let the technological changes determine the educational changes. One observer advised the Committee, for example, that:

> In a rush to be seen to be using the new technology many educators have been caught up in, and overshadowed by the 'gee wizzery'.[1]

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[1] A Hermann, *Submission*, p 4.

3.4 The task of increasing the diversity and flexibility of educational services depends not so much on what is happening at the cutting edge of new technological developments as on the capacity of governments, educational institutions and teachers to manage technology effectively. This encompasses the ability to identify educational objectives; determine the strategies by which they will be achieved; select the technology that will support the strategies; and make any further changes necessary to the structure and delivery of education to ensure that the potential of the technology is realised.

3.5 In submissions and evidence many views were expressed about the obstacles to be overcome if technology is to be managed more effectively; however, they essentially reflect four broad problems:

- a lack of clear needs and objectives and a coordinated commitment by all governments and educational sectors to use technology in achieving them;

- the cost of developing new course materials and of purchasing and using new equipment;

- a lack of knowledge among administrators and teachers about the potential of new technological developments to improve education; and

- a lack of incentive for teachers to innovate.

3.6 The solution put forward time and again was to improve cooperation and coordination. National, cross-sectoral and inter-institutional cooperation and coordination are concepts which are almost inviolable. Indeed, there is no scarcity of cooperative arrangements at each of these levels already, yet what exists still is not enough.

3.7 The need to have a stronger sense of national direction in choosing and using technology in education is discussed in Chapter 5, as are the issues of improving research, facilitating the exchange of information, and reducing costs by achieving better economies of scale. The need to train teachers in using technology, and to encourage them to explore new teaching and learning techniques, is discussed in Chapter 4.

3.8 Even though it is widely acknowledged that there is scope for improvement, there nonetheless have been considerable achievements in applying technology to meet educational objectives in Australia. Moreover, there is much common ground already in the challenges being addressed by governments and educational institutions.

3.9 In this chapter, an overview is given of some of the achievements and directions in selecting appropriate technology for educational purposes. Improving the quality and diversity of education in schools and at the post-compulsory school levels is first discussed. This is followed by

consideration of the educational needs of people for whom technology represents special problems and promises. Finally, technological improvements to the administration and information management practices of educational institutions are discussed.

Schooling

3.10 All governments are aiming to improve retention rates to Year 12 in order to better prepare the individual for a lifetime of learning and to increase the level of skills of the labour force. Each year of schooling must provide a stronger and broader foundation from which the individual can develop skills, knowledge and personal qualities. The experience of compulsory schooling affects the individual's decision about whether to pursue post-compulsory education, and his or her capability successfully to complete further studies and to acquire new skills.

3.11 As retention rates are increasing, and measures are being taken to ensure that they continue to increase, secondary schools are finding that their student populations are more diverse and the students are demanding a wider selection of courses. Meeting the demand is a challenge, especially for small schools which do not have the necessary resources and expertise. Costs per student in the higher secondary grades are greater than at the lower because the curriculum is wider, the classes tend to be smaller, and the necessary equipment is more sophisticated. Accordingly, all States have been investigating the potential for technology to provide a cost-effective means of making learning more interesting to all students and broadening the range of courses available at any particular school.

3.12 Most children in Australia receive classroom-based instruction for all of their schooling years. Others, especially those who live too far away from a regular school to travel there daily, study at home through correspondence, distance education centres, or Schools of the Air. Distance education students also comprise children who are temporarily living outside their home State; those whose parents are itinerant workers; those who are unable to adapt to normal schools; and secondary school students studying subjects that their local institution does not offer.

3.13 Face-to-face teaching is considered to be the better way to teach children, largely because of the social and personal benefits to the student of direct, regular interaction with the teacher and with other students. This is one of the reasons that parents whose children have studied at home at the primary school level are reluctant to have them continue to do so at the secondary level. If their parents consider it desirable and are wealthy enough, children in rural areas who otherwise would have to continue their secondary studies at home move to larger communities to receive classroom-based instruction. As the Isolated Children's Parents' Association has observed 'Full-time study by Distance Education at Secondary level is regarded by the majority of isolated

families as a less desirable alternative to an educational environment enabling constant peer group interaction and group or team activities.'[2] Parents are also concerned about their capacity to provide adequate supervision and sufficient expertise to help secondary students master the more complex subject matter. [3]

3.14 For various reasons, technology has affected distance education more than classroom education. The emphasis in applying technology to education has been on reproducing for students at home the direct and immediate interaction found in the classroom. Furthermore, many teachers are sceptical or unaware of the benefits that using technology in the classroom can bring and have been slow to use it in normal face-to-face teaching situations.

3.15 While technology can be a useful teaching aid and can broaden the learning experience and increase the educational opportunities available to the student, it should not then be assumed that technology can or should replace teachers; nor should it be assumed that one form of technology which otherwise does not improve the flexibility and diversity of educational opportunities, or change the information being conveyed, is any better than another. Dr Hall, the Executive Director of the TAFE National Centre for Research and Development told the Committee about 'barrow loads of research' which show:

> ... first of all, there are no learning benefits to be gained from employing any specific medium to deliver instruction; secondly, media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition.[4]

3.16 Priority should be given to ensuring that teachers are able to make informed decisions about the circumstances where using technology is appropriate, the forms of technology to use, and how to use them to best effect. This is discussed further in Chapter 4.

Computers in the Classroom

3.17 Computer technology has been identified as having significant potential to change traditional approaches to classroom instruction. The Queensland Department of Education advised that:

> ... the microcomputer's greatest power and, as a consequence, its greatest potential for education is its ability to stimulate young learners to think and ask questions. Computers would best be used to encourage students to test ideas and explore alternatives. Computer technology offers easy access to

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[2] Isolated Children's Parents' Association (NSW Executive), *Submission*, p 4.
[3] Commonwealth Schools Commission, *Schooling in Rural Australia*, Curriculum Development Centre, Canberra, 1988, p 46.
[4] W Hall, *Evidence*, p 1420.

> such a great range of information that learners can be motivated to question and test the accuracy and validity of ideas, opinions and points of view. This is possible because computers are not simply passive technologies delivering information but are interactive technologies allowing learners to manipulate, test and, as a result, control information.[5]

3.18 Face-to-face education traditionally has used the same teaching processes regardless of the subject, the characteristics of the students, and the qualities of the teacher. Trials have indicated that using computer technology to change the teaching methods so as to reflect these variables can provide better results than is the case when traditional methods are used.[6]

3.19 A recent initiative in using computers to broaden learning experiences was the Schools Across Australia project. As mentioned in Chapter 2, this was a bicentennial project to encourage direct communication between schools. About 600 of the 1 150 participating Australian schools communicated via electronic mail. The coordinator of the project told the Committee that 'the whole learning experience is much more immediate and exciting' for the students who were able to use this technology:

> It is not mediated so much through textbooks that are out of date, that have certain methodological sort [sic] of structures. They can then create their own hypotheses and say that they have answered questions in this way, therefore they can deduce such and such, and such and such. Then they can make another set of questions to send back to those kids to test their hypotheses. So they ... are much more active in the learning process and they are not so much spoon-fed.[7]

3.20 Notwithstanding claims about the learning advantages of computers, it is widely accepted that school students should be exposed to computer technology in the classroom because it is becoming pervasive in everyday life:

> Students, as future members of a highly technological society, need to be empowered with the knowledge and skills which will enable them to function as technologically literate citizens. [8]

3.21 An important means of improving Australia's competitiveness on the international market is to increase the productivity of the workforce, not only by improving the skills base generally but by developing expertise in taking advantage of new technological developments. It is widely recognised that learning in this regard should begin at school and be supported throughout the school years.

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[5] Qld Department of Education, *Submission*, p 7.
[6] J C Lange, 'New technology and distance education: the case of Australia', *Submission*, p 29.
[7] J D Galligan, *Evidence*, p 527.
[8] T Beven, *Submission*, p 1.

3.22 Motivated by this need, a large number of schools have acquired computers, often with the assistance of parent associations and the encouragement of computer companies. An adequate ratio of computers to students for effective learning has been estimated by the OECD as one microcomputer per 10 students, or 30 minutes per pupil per day.[9] Australian school children with the greatest contact with computers appear to be in Tasmania, where the average ratio is one computer per 22 students.[10] It is the Committee's view that efforts to improve access by students to computer equipment, and of course to useful learning activities using that equipment, should receive high priority.

3.23 The Committee recommends that:

> **all students in all schools be provided with increased opportunities for 'hands on' computer experience; and further, that sufficient government funds be provided to enable schools to meet the OECD target of one microcomputer per ten students by the commencement of the 1992 school year.** *(Recommendation 3)*

3.24 It is possible that the incidence of computers being installed in classrooms would be lower if not for the National Computers in Education Program which the Commonwealth administered during the 1984-86 triennium. Under this program, $18 million was allocated via the States primarily to enable students, and particularly girls and disadvantaged groups, to develop an understanding of the uses and impact of new technology. Another major objective was to promote the professional development of teachers.

3.25 The Committee has heard favourable comments about the program from educators in all States and welcomes evidence that a number of State governments have continued similar programs. As teachers and administrators alike become more familiar with the technology, it is likely that acquisition decisions will improve. However, there is also a need to coordinate these decisions better than in the past if economies of scale are to be achieved and the full potential of the technology is to be realised.

3.26 Even though the National Computers in Education Program attempted to encourage compatibility of computers, for example, this has not always occurred. The Australian Schools Catalogue Information Service (ASCIS) liaises with all States in introducing technology-based services to schools and has experienced significant difficulties:

> Schools which elect to purchase low speed modems because they are cheap are denying themselves the opportunity to take full advantage of a national system which can support higher speed modems. Ill-chosen

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[9] Curtin University, *Submission*, p 5.
[10] Tas Government, *Submission*, p 1; p 3.

> telecommunications software, which is limited in its application, is not able to maximise the benefits to be derived from accessing a large mainframe computer system.
>
> Poor advice, or worse, no advice at all from State education authorities has resulted in schools acquiring a widely divergent assortment of hardware and software thus making it extremely difficult for a national information provider to offer the infrastructure needed to support such a disparity of equipment.[11]

This issue is discussed further in Chapter 5.

3.27 Aside from some scepticism by teachers and a paucity of hardware, the use of computers in the classroom has been hindered by a lack of suitable software and courseware. That which is available is often of poor quality and is expensive compared to the price of books. The high cost not only discourages teachers from using the technology: it invites software piracy.[12] A quality computer learning package can cost between $50,000 and $100,000 to produce, and it is often difficult to find this level of financial backing.

3.28 Because of the expense, it is important that unnecessary duplication is avoided. Better coordination among all States is required, both in curriculum development and software development, if the technology is to be used cost-effectively. It is also likely that, if Australia is without the capacity to produce quality material at a reasonable cost, overseas products will dominate the market. Funds for Australian developments would be even more scarce, and there would be a risk of cultural invasion of the education system. This issue is discussed further in Chapter 5.

3.29 Finally, the Committee welcomes the expansion of the ASCIS database of curriculum information to include computer software review records. This was achieved by the National Software Coordination Unit, a project established by the Commonwealth Department of Employment, Education and Training. The National Software Review Database that the Unit produced contains information about all of the computer software that is available for schools, along with reviews of that software by the education systems that have used it.

Educational Opportunities at Small Rural Schools

3.30 The difficulties, mentioned above, in meeting the demands of an increasingly diverse and growing secondary student population for a wider selection of courses are especially acute in small rural schools. For this reason,

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[11] Australian Schools Catalogue Information Service, *Submission*, p 5.
[12] Curtin University, *Submission*, p 5.

and because retention rates to Year 12 in rural areas have consistently been lower than those in metropolitan areas, State governments have given particular attention to applying technology to rural schooling.

3.31 Queensland, for example, began experimenting in 1985 with using technology to enable young people in rural areas to obtain their secondary education from local schools. In 1987, the Rural Secondary Schools Support Scheme commenced. This program allows students attending 17 rural secondary schools to study, under supervision, distance education courses that their schools otherwise could not provide. Using the technology of telephone, facsimile and electronic mail (Keylink), students are taught from the Secondary and Technical (TAFE) Correspondence Schools in Brisbane.

3.32 The results of this scheme are promising. Students, their parents, and teachers in Brisbane and in the regions, found that student concentration and motivation increased. After some exposure to a normal high school, student support for the program was still just as strong:

> ... they felt they achieved more both in quality and quantity in their lessons via correspondence teaching compared to what appeared to be achieved in a regular classroom. They were often amazed at the difference in the degree of correction and comment they received on their work compared with their peers in the regular classroom.[13]

3.33 An approach gaining acceptance Australia-wide but best developed to date in Victoria has been to form small schools into clusters to improve the quality and breadth of the curriculum that can be offered in rural areas. As a result of a negotiated resource agreement between Victoria and the Commonwealth, costing $3.5 million over two years, technology-enhanced learning is provided to students in 81 small secondary schools which have been organised into 17 clusters. Telecommunications links allowing audio, document and electronic blackboard links have been installed between schools in each cluster.

3.34 Students in one school within a cluster can be taught subjects at a distance from another. In addition, schools have collaborated in producing 'tekpaks', which are self-contained mobile loan kits of equipment, parts, manuals and exercises that enable schools to give their students hands-on experience in technology studies.

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[13] I B Wallace, *Rural Secondary Schools Support Scheme*, Brisbane, 1987, p 15.

3.35 The Committee received submissions from several of the clusters, all of which support the concept. The following benefits have been identified:

> This project has led to an enormous growth in both teachers' and pupils' understanding of the range of technology available to society in this day and age. Likewise it has engendered enormous growth in goodwill and cooperation between our rural schools among clusters and even across the State. As a flow on from the above teachers have been put in touch with others tackling similar issues and have developed professionally from the experience. School communities have been encouraged to see their needs and seek out ways of providing them at the local level without outside developed solutions being imposed. Due to dedicated attitudes, teachers have adapted to using technology or preparing new forms of lesson delivery most commendably.[14]

It has been mooted that the cluster approach will be applied to Victorian metropolitan schools in the future.[15] The Committee supports the wider adoption of the cluster approach in schools in all States and recommends that:

> **the Commonwealth Government encourage the wider adoption of the cluster approach in schools in its funding programs.**
> *(Recommendation 4)*

Distance Schooling

Schools of the Air

3.36 Communications technology has long been used to give students who are not able to attend a school the opportunity to interact directly and regularly with their teachers and with each other. The most celebrated example is the use of HF radio by Schools of the Air to supplement printed and other course material.

3.37 There are 12 Schools of the Air, catering for about 1 700 children at the primary school level. The problems experienced with the use of HF radio are well known and, even though technical improvements have been made, the operation of HF radio will always be affected by varying climatic and atmospheric conditions. Quality of transmission also depends on the extent to which the students' sets are well maintained. One witness told the Committee:

> Most families who operate these 12 regional schools of the air throughout Australia have been frustrated by the inherent transmission problems of high frequency radio which has led to their seeking a very simple

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[14] Vic Ministry of Education (Loddon Campaspe Mallee Region), 'A path to practical communications between cooperating schools', by N Elliott, p 12, *Submission*.
[15] Vic Ministry of Education (Loddon Campaspe Mallee Region), 'Future of telecommunications and education in Victoria', by N Elliott, p 5, *Submission*.

> requirement - namely, any communication system that is attempting to emulate a classroom situation must as a priority, provide a clear, fault-free voice channel that, firstly, enables every student in the class or network to hear the teacher. Secondly, it should enable the teacher to hear every student in the class, or the network; and thirdly, it should enable every student in the class or network to hear every other student.[16]

3.38 While acknowledging that the Isolated Children's Parents' Association finds HF radio to be 'less than satisfactory much of the time',[17] the Committee agrees with the assessment of the Commonwealth Department of Transport and Communications that it 'still has a lot to offer', if only because it is affordable and available.[18]

3.39 The number of people who rely on HF radio transmission is small and decreasing as Telecom progressively provides telephone services to remote pastoral properties through its Rural and Remote Areas Program. Telephones provide much better quality communication, but the cost to the user is higher, especially if STD rates are charged, and the Program will not be completed for four years.

3.40 Rather than either upgrading HF services for the small audiences that need them, or using telecommunications services as they become available, the mobile satellite service, to be offered once the next generation of AUSSAT satellites is operational, has been put forward as the most appropriate technology to replace existing HF services.

3.41 When the first generation AUSSAT satellites were launched, one of the main benefits expected was cheaper and more reliable communications for people in rural and remote areas. School of the Air services in particular were to be improved. Technically, providing satellite communications for Schools of the Air is feasible, and the Mt Isa School of the Air trial showed that it would be educationally desirable, but the cost is prohibitive and far higher than initially estimated. The Committee was informed that:

> ... the cost of using AUSSAT for School of the Air ... would make it less expensive for the Australian Government to provide a personal professor to each student for their entire educational career.[19]

3.42 However, there is reason to be optimistic about the mobile service to be provided by the next generation of satellites. It could improve the quality of education received by students of Schools of the Air, and it could extend the reach of these schools to students who currently cannot enrol because they are itinerant or live out of range of the HF transmissions. In addition, it could

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[16] H R MacKinnon, *Evidence*, p 233.
[17] WA Isolated Children's Parents' Association, *Submission*, p 1.
[18] Department of Transport and Communications, *Submission*, p 5.
[19] S Paltridge, *Submission*, p 1.

allow interactive communications to be established for more secondary school students and people pursuing post-school education. Nonetheless, costs of applying the existing satellite services to education were badly under-estimated and the Committee is not confident about the cost-effectiveness of the new services. These will need to be determined in view of other new telecommunications services which are becoming available.

Other Distance Schooling

3.43 Schools of the Air cater for almost half of the primary level students who study at home. There is a much larger number of students at both primary and secondary level who study through the correspondence schools of the various States but do not receive School of the Air services. Increasingly, the printed course materials and mail-based communications of these students are being supplemented through the use of new technology. Audio and video programs and telephone tutorials are becoming common features of distance education.

3.44 The former Commonwealth Loan Video Program was greatly appreciated by education authorities and distance pupils alike. Educational video material could be supplied directly to illustrate scientific or technical processes. Material of less direct application but general interest enriched the curriculum and the awareness of pupils and their families.

3.45 Audio tapes provide a cheap and easy way of communicating more personally than written correspondence. For many isolated pupils it is more satisfying to communicate with a human voice than with marks on a page. These tapes have the added advantage that tape players are extremely widespread and almost universally accessible throughout Australia.

3.46 At a more elaborate level, the INVICON (see Chapter 2) is used to enhance the experience of genuine human communication for distance pupils. The effect of this is increased interaction, clearer understanding of course materials, and greater commitment and persistence in studies.

3.47 In addition, such developments in information technology are freeing students from externally imposed demands on their time, since these materials can be played at the times of the student's choosing. This helps to make education more accessible, whereas the demands of a job, responsibilities on the family property, attendance at other classes, an itinerant lifestyle or physical disability can make participation in regularly scheduled interactive sessions, such as telephone tutorials or talk-back radio, very difficult.

3.48 For access to education to be improved, learning opportunities need to be available to individuals with a variety of preferences and lifestyles. Regardless of its merits, if the application of one particular type of technology excludes certain groups or otherwise places them at a disadvantage, it still needs

to be supplemented by other measures. Making opportunities for immediate and direct interaction between distance students and their teachers, whether in the form of structured learning or informal counselling, is clearly desirable. But this is not to say that it is always necessary.

3.49 High priority should be given to the further development of learning packages of the type produced for the Mt Isa experiment. These packages were central to the learning process. Each package contained a booklet of readings and learning tasks which were linked to video tapes, audio tapes, computer software and graphic materials such as posters, charts, maps, pictures and diagrams. They were designed to be used without external guidance, but their effectiveness was enhanced by the satellite communications employed during the trial. Similar packages could be used both by other students studying at home, with or without direct communication with their teacher, and by students studying by distance education methods at school.

Post-School Learning

3.50 The increased incidence of students remaining at school beyond the compulsory years has been accompanied by a growth in demand among school leavers for further education. Moreover, structural changes to the economy and technological changes at the workplace are increasing the likelihood that, in addition to their basic education and prevocational training, members of the labour force will need to undertake some form of further post-school learning during their working lives. Accordingly, tertiary education institutions are being asked to find cost-effective means of providing educational services to a larger number of students with a greater variety of learning needs.

3.51 External studies programs have given students far more independence in controlling when and how they study than on-campus programs offer, and technology is being used to enhance the learning experience and broaden the range of courses that can be completed off-campus. Tutorials conducted via telephone, computer, radio and television, for example, ensure that external students no longer need to forgo the immediate interaction that face-to-face teaching allows. As shown in *Panel 3.1*, students have been found to respond well to such learning methods.

Panel 3.1

Electronic Tutorials

Macquarie University recently conducted a pilot project to trial an electronic tutorial system. Seven external students from a senior law course used computers to communicate with each other and with their tutor. Each student was provided with an intelligent terminal which was connected through telephone lines to a central computer that controlled the tutorial.

All participants found that electronic tutorials had proved worthwhile. Difficulties were experienced in developing technical competence; having to use the system in addition to a traditional external studies framework; coping with technical problems with the equipment; and having to adjust to each other's pace of study. The advantages included: ease of contacting other students and lecturers; availability of information; feeling part of a group; and being able to make comments and receive replies.

V X Gledhill, *Submission*

3.52 Furthermore, while the printed book is likely to continue to be the learning resource which gives independent learners the greatest control over when, where and how to study, computers can give external students access to large databases of information - including catalogues of books that can be borrowed. Audio tapes, video tapes and laser optical discs also can make other forms of information available for reference when convenient. Audio and video materials, whether they are pre-recorded, broadcast, or recordings of broadcasts, have permitted students to study off-campus subjects and skills which cannot be learned from a book alone. Nursing education, trades skills and languages for example, can now be taught outside the classroom. By way of further example, the potential use of video tapes for recording physics demonstrations is outlined at *Panel 3.2*.

Panel 3.2

Video Tapes

Staff of the School of Physics at the University of New South Wales put the view to the Committee that: We should never underestimate the effect of role models and to see Australian scientists doing interesting experiments with Australian equipment has a powerful motivating effect in encouraging Australian students to see science as a fascinating, relevant and creative subject and helps direct them into a scientific or technological career. We propose ... to produce video tapes of experiments and demonstrations which are not specifically tied to a particular syllabus, but which are central to the understanding of a particular concept. They will be useful at both a school and first year university level. They will be of such a quality, in both content and presentation, that they will be used even in institutions which have adequate demonstration equipment and they will inspire all institutions to perform more live demonstrations. They will be invaluable for students in remote areas. They could in fact use them on their home videos or record them from air if an original tape were not available. Such material could be broadcast outside normal television hours and recorded for isolated communities.

J C Kelly, *Submission*

3.53 Educational institutions providing external study programs have made further education possible not only for people who are geographically distant from campus but for adults whose employment, family and social responsibilities otherwise prevent their attendance at classes. External study also provides educational opportunities to people with disabilities, the institutionalised, and those who find the prospect of face-to-face instruction too daunting or otherwise disagreeable.

3.54 In the higher education sector alone, the proportion of students who choose to study externally has almost doubled since 1975.[20] It is very likely that these students have chosen to study off-campus for reasons other than the distance between their homes and an educational institution. In fact, the majority of external students live in metropolitan areas within reasonable distance of an institution.

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[20] Minister for Employment, Education and Training, *Higher Education: A policy statement*, AGPS, Canberra, p 49.

3.55 Despite improvements in the flexibility given to students by external study options, education will not be on the learner's terms until Australia adopts more of the principles of open learning. Open learning is often equated with external study but, beyond the fact that open learning encompasses the opportunity of studying off-campus, they are quite different.

3.56 In an open learning system, students would have far greater capacity to select the subjects of their choice and to combine them into courses determined by their learning needs. An important feature of open learning is the development of subjects as modules, or packages, which can be taken at home, at work, at a study centre or at an educational institution. The subjects so selected could be from one institution or they could be drawn from a number of institutions. TAFE institutions in particular have aimed to develop individual learning modules of this type. Those produced by Western Australia TAFE are described in ***Panel 3.3***.

Panel 3.3

Open Learning Materials

TAFE in Western Australia is committed to the continued development of Open Learning packages. These packages can be used for a variety of purposes and cover subjects ranging from the trades to computers, from business communication skills to the arts. A package consists of printed study booklets, which may be supplemented by audio tapes, videos, computer discs, broadsheets, and TAFE texts. If commercial texts are necessary, these are made available separately. The materials are designed with independent learning in mind, and offer self-assessment exercises as well as advice on how to study. In fact, everything needed to complete the course of study is available.

Western Australian Government, *Submission*

3.57 As noted above, much of the impetus for increased educational opportunities arises from the need to develop and continually upgrade the skills of the labour force. Open learning packages, using technology as appropriate, could be important in bringing educational programs into the workplace. They would be carefully developed materials combining printed documents, video illustration and computer-aided learning, while instructors provided support at the workplace or by telephone or electronic mail. Disruptions to work patterns, caused by the need to leave the workplace to pursue training programs in an

educational institution, would be avoided. Moreover, an open learning system could offer more scope for vocational work-based learning to be recognised for the purpose of gaining formal qualifications.

3.58 Features of open learning systems are becoming more commonly adopted in Australia. How far they develop depends upon how willing tertiary institutions are to collaborate more closely with each other and with industry.

3.59 The judicious application of technology can help develop open learning, but care must be taken to ensure that the technology used facilitates access to education rather than adds another barrier. To help overcome disadvantages encountered by students who do not have access to the necessary equipment to undertake their coursework, some institutions have established study centres. The Darling Downs Institute of Advanced Education, for example, has a network of study centres from which students can participate in telephone tutorials and use facsimile machines and personal computers.

3.60 The Queensland Department of Employment, Vocational Education and Training has established a number of Electronic Learning Centres in TAFE colleges throughout the State. The Centres provide the necessary materials to allow independent learning in areas such as literacy, numeracy and computer applications:

> After a simple registration procedure, people can book a time for the learning resources they wish to access. The Centres operate over extended hours. They offer learning through computer-assisted learning, interactive video disc, video tapes, audio tapes and printed learning guides. The Centres are also equipped with computing systems to allow students to practise computer-related skills and to allow potential purchasers to evaluate hardware and software. These Centres can easily be placed in small towns to service rural populations.[21]

3.61 In establishing study centres in rural areas, or otherwise installing new technology which is intended to enhance the learning opportunities available to rural people, it is important to seek the views of the local community. The technology must be flexible enough to adapt to regional needs and to support regional social and economic development. In Western Australia, for example, it has been found that:

> ... the involvement of people at the local and regional level in developing the software or the content of programs using new technology will maximise the impact of new technology on the quality of life of non-metropolitan residents.[22]

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[21] Qld Department of Employment, Vocational Education and Training, *Submission*, p 1.
[22] WA Government, *Evidence*, p 94.

The need for local community consultation is most clear in developing educational programs for Aborigines in remote areas. This is discussed further in the next section.

3.62 In supporting open learning, the Committee is not suggesting that institutionalised teaching and learning should not remain the predominant mode of education. As the Education and Technology Conference of the Australian Education Council has pointed out:

> Educational institutions remain dynamic centres for advance in the Australian national social fabric. They remain centres of teaching, learning and research and no vision of open education should be allowed to undermine that.[23]

3.63 The dynamism of educational institutions will in part depend on the way they use technology to support teaching and learning in a changing social environment. The extent to which technology can support diversity and choice in on-campus studies depends on the preparedness of institutions to change their structure and routine, and on the willingness of students to study more independently.

3.64 At the Darling Downs Institute of Advanced Education, for example, there has been a demand among on-campus students for the course material which is given to students studying off-campus. The Institute is now beginning to reduce the number of formal lectures delivered in some subjects and to increase the availability of small workshops, but it is not intended that face-to-face teaching hours be reduced. The students will work through the prepared course materials, attend lectures that highlight the important aspects of the topics covered in the material, and participate in workshops. The Institute expects that other tertiary institutions eventually will adopt a similar approach.[24]

People with Special Learning Needs

3.65 Not only can technology assist in overcoming the educational difficulties of people in rural and remote areas, it also can contribute to overcoming other disadvantages: those associated with having a non-English speaking background or with being poor, disabled, female or Aboriginal. In addition, technology can help meet the special needs of the intellectually gifted.

3.66 Computers are especially powerful in this regard. They can give the student more control over the learning process and provide a degree of anonymity which many students appreciate. Gifted and slow learners alike can use computers to progress at their own pace, largely unaffected by the

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[23] Education and Technology Conference, Australian Education Council, *Submission*, p 6.
[24] V J White, *Evidence*, p 438.

performance of their classmates. In addition, students working with computer aided learning programs, aware that their failures will not be witnessed, are often more willing to risk making mistakes than they would be in face-to-face learning. In this way, they extend themselves intellectually and develop confidence in their own abilities.[25]

3.67 Another significant feature of computer technology is that it can give people with disabilities new opportunities to learn, express themselves and gain independence. Those who cannot speak or write are learning to communicate via computer; the visually impaired are gaining greater access to information by using computers linked to speech synthesisers and braille printers; and the hearing impaired are developing their language skills by using computers linked to videodiscs. One innovation that the Committee was shown, invented by staff of the Warrnambool Institute of Advanced Education, is explained in ***Panel 3.4.***

3.68 As it is for the general population, providing technological solutions is not sufficient in itself to improve educational access and outcomes for people with special learning needs. The Committee concurs with the findings of the Australian Education Council Task Force on Education and Technology in 1986 that:

> Acquisition by all young people of basic skills will depend on thoughtful deployment of a range of resources, including computers, in ways that meet the different needs of individuals, the obviously gifted ones as well as the slow learners. "Battery hen" arrangements in which all students have equal access to computer assisted drill and practice will not guarantee appropriate learning situations, even where the software allows students to progress at their own rate.[26]

3.69 There is no lack of the essential technology which can be used to meet special learning needs. Three things are required: teachers who are aware of the difficulties, sympathetic to the students, and accepting a responsibility to assist; technologists (who may be the teachers) willing to spend time and effort to identify suitable technology and modify it as required; and administrative authorities in institutions or government agencies who are willing to support these efforts with resources and release time.

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[25] Commonwealth Schools Commission, *Computers and the Realm of Ideas,* Interim Report on the Involvement of Disadvantaged Children with Computers, Commonwealth Schools Commission, Canberra, 1988.

[26] Australian Education Council Task Force on Education and Technology, *Education and Technology,* Australian Education Council, Melbourne, 1985, p 9.

Panel 3.4

Study materials for visually and physically impaired people

Warrnambool Institute of Advanced Education has a project which provides fully supported external study opportunities for print-handicapped people and people lacking manual dexterity.

Study materials written by lecturers are prepared using a desktop publishing system involving the preparation of computer files, and printed for the majority of external students. For the print-handicapped students, these computer files are processed by a conversion program which prepares them for conversion to an audio version using an appropriate speech synthesiser. The audio version is made available on four-track, half speed audio cassettes. Prescribed texts and supplementary readings are voice recorded using volunteers in the local community.

To provide access for people lacking manual dexterity to the audio cassettes produced for visually impaired people, staff at Warrnambool Institute of Advanced Education have patented a non-manual remote control unit which is used with a Luxman K106 stereo cassette deck. This unit, incorporating a switch appropriate to the needs of the individual, a puffer, skin sensor or pressure device, for example, provides them with almost total control of the unit - only the cassette must be loaded for them. When using four-track half speed audio cassettes, a C-90 cassette provides six hours of listening/recording.

Not only will this equipment enable people who are quadriplegics, or who are suffering from MS or cerebral palsy, for example, to enrol in the Institute's external studies program, but it will also provide a large measure of independence for them in using recreational or leisure audio materials recorded for visually impaired students.

Warrnambool Institute of Advanced Education, *Submission*

Aborigines

3.70 Educational disadvantage is at once a symptom and a cause of the social, economic and cultural problems faced by Aboriginal people. More so than for any others with special learning needs, the solutions for Aboriginal people are elusive and complex. Nonetheless, technology can be used to make important gains.

3.71 There have been numerous studies, reports and recommendations concerning Aboriginal education. Despite these, and although participation rates are growing, Aboriginal people are still the most educationally disadvantaged group of people in Australia: 13% of Aboriginal children of compulsory school age do not participate in schooling, only 17% of Aboriginal youth continue to Year 12, and about 2% of the total Aboriginal population proceed to tertiary education.[27]

3.72 It has been apparent for many years that services provided to Aboriginal people are unlikely to be successful unless they have been developed in consultation with the community that they affect, and are controlled as much as possible by that community. Simply to extend mainstream education systems to Aboriginal communities is insufficient, and often inappropriate. The challenge for governments is to achieve equity of participation by Aboriginal people at all levels of education while at the same time ensuring that Aboriginal values, cultures and lifestyles are retained.

3.73 Technology can be used in overcoming learning difficulties encountered by Aborigines in formal education. The flexibility permitted by technology in the content and delivery of course material can also help Aboriginal communities who control the use of technology to preserve their cultural identities.

3.74 The computer, for example, is a particularly useful learning tool for Aboriginal people. Aborigines are often found to have well developed skills in observation and imitation, which they can use to advantage in learning with computers.[28] During an inspection of the school at Yuendumu in the Northern Territory, the Committee was told that the introduction of computers has had a profound effect on the Aboriginal students, particularly the 12- and 13- year olds. The Committee was also told that the students are always eager to visit the computer room and using the computers has helped to develop their literacy skills simply because they need to know how to read and spell to operate them.

3.75 Of crucial importance, however, is the production of learning materials that are relevant and culturally appropriate. Better dissemination of details about suitable learning materials could be useful for teachers and communities in identifying appropriate resources and could give added impetus to the incorporation of such materials into school curricula Australia-wide. The Aboriginal Education Policy Task Force raised this matter in its August 1988 report to the Ministers for Aboriginal Affairs and Employment, Education and Training. The Committee supports the Task Force's recommendations that funds be provided, from the allocations made by the Commonwealth Government for curriculum development, to enable a feasibility and planning

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[27] Aboriginal Education Policy Task Force, *Report*, Canberra, 1988, p 7; pp 11-12.
[28] Commonwealth Schools Commission, *Computers and the Realm of Ideas*, pp 64-65.

study on a national Aboriginal curriculum information service to be undertaken. The Task Force recommended that the funds be allocated in 1989, with a view to establishing the service in 1990. The study should explore the advantages of linking the service to established national curriculum information networks.[29]

3.76 One third of the Aboriginal population lives in small towns, remote Aboriginal townships and homeland communities. Students who are required to leave their communities in order to study often suffer distress, as do their families. As a result, they commonly discontinue their studies. There is a clear need to offer as many learning opportunities as possible within Aboriginal communities. Again, this problem was explained to the Committee by members of the Yuendumu community (see ***Panel 3.5***).

Panel 3.5

Problems of Aboriginal Students in remote areas

A teacher at Yuendemu School pointed out that one of the main problems facing secondary and tertiary students was that of distance from the appropriate colleges and the resulting homesickness. It was an old problem which had been with the community as long as she could remember but nothing constructive had been done to ameliorate it even though the community had been complaining about it for at least 10 years. At present tertiary students had to go to Batchelor College near Darwin for adult education, management training, teacher training and broadcasting courses and most regarded this as too far away. They could not get home at weekends and got very homesick. As a result they usually dropped out of the course.

The Headmaster of Yuendumu School told the Committee that in the past 15 years only two students from Yuendumu had succeeded in graduating from Batchelor. Both of these had been members of the same family and seemed better able to handle the isolation difficulties. Every year Yuendumu sent students to Batchelor but every year the story was the same - they were dropping out. 'It has nothing to do with lack of intelligence, but everything to do with being put in a completely different environment' ... very often whole families were traumatised' by the absence of one of their members who was studying at Batchelor College. You must remember that family ties and a sense of community are very strong among Aboriginal people'.

Committee visit to Yuendumu, August 1988, *Evidence*

[29] Aboriginal Education Policy Task Force, *Report*, p 28.

3.77 A number of educational institutions are providing external courses for Aboriginal people. The School of Aboriginal Education at the Adelaide College of TAFE, for example, conducts an extensive number of courses supported by telephone tutorials for Aboriginal people in remote areas of South Australia. It has also been developing, in conjunction with Imparja, a proposal to televise 10 one-hour programs on Aboriginal community management in May 1989.

3.78 Furthermore, remote area teacher programs, which enable people to qualify as teachers without needing to move from their traditionally-oriented communities, have existed for some time. The Committee would support measures to increase the range of external study opportunities available to Aboriginal people and to expand the remote area teacher programs to communities other than those in traditionally-oriented areas.

3.79 An important element in improving access to external study opportunities is the provision of reliable and affordable telecommunications services. Telephone conferences, for example, have proven to be a very successful means of enhancing the learning experience by giving students immediate feedback and personal contact with each other and their teachers. The School of Aboriginal Education at the Adelaide College of TAFE told the Committee that students often prefer communicating by telephone to face-to-face instruction because they feel more free to express themselves.

3.80 Technology can help Aboriginal communities preserve their identity and culture, provided that they have control over both the message and the medium. By publishing material in their own languages, and broadcasting their own television and radio programs, Aboriginal communities are reinforcing their languages and sense of cohesion, as well as conveying information and news. Equipment to support the development of community-controlled broadcasting has been provided by the Department of Aboriginal Affairs under the Broadcasting for Remote Aboriginal Communities scheme, but the program has attracted strong criticism from Aboriginal communities for being inflexible.

3.81 The Central Australian Aboriginal Media Association (CAAMA), which has produced an award-winning educational radio series, 'Bushfire', and is the majority shareholder in Imparja television, wishes to establish an Education Media Unit to produce educational programs for broadcast to remote communities by radio and television. The concept offers much promise, particularly for general community programs. As with all broadcasting media, however, and especially commercial enterprises such as Imparja, the programs must be entertaining and interesting to a majority of the audience. Given the commercial need to attract a reasonably-sized audience for a broadcast, programs associated with courses where the enrolment is small and the subject matter specialised would be better delivered via video tape.

3.82 Moreover, few outstations are able to receive Imparja television directly. In some cases this isolation is by choice. Indeed, television has not penetrated remote Aboriginal communities as much as video tape machines have; and video tapes have the additional advantage of being easily vetted by the local community before being widely distributed. Finally, communities may wish to develop their own expertise in producing and broadcasting educational material and this should not be discouraged.

3.83 With regard to the role of the proposed Education Media Unit, the Committee fully supports the development of expertise within CAAMA in modifying existing programs in view of cultural considerations; producing educational programs at the request of individual communities and educational institutions; and advising educational institutions about how to produce appropriate material. The Committee does not support measures which would give CAAMA a monopoly over the production of educational material for communities within the region covered by Imparja. Expertise in Aboriginal education is developing in a number of centres around Australia, and remote communities should have access to that expertise if they so wish. While this is a reasonable goal from the viewpoint of continuing CAAMA's viability, the Aboriginal communities suffer if the alternative is to forfeit the educational opportunity altogether.

3.84 The Committee recommends that:

> **additional resources be made available by State governments and the Commonwealth Government for the production and broadcast of culturally appropriate educational material for Aboriginal people.** *(Recommendation 8)*

3.85 The Committee does not see a requirement to establish a committee, as proposed by CAAMA, to plan the establishment of long-distance educational services. It would be preferable for existing consultative bodies to consider this issue on a regional basis.

Administration and Information Management

3.86 An increase in the range, diversity and flexibility of learning opportunities is possible only if educational services are underpinned by comprehensive and reliable information management systems. Every aspect of the administrative infrastructure is affected: details about courses, enrolment procedures and student services must be readily available to the public; learning materials, including library collections, must be kept up to date and accessible; more detailed student records must be held, and their confidentiality protected; more teachers need to monitor the progress of students they rarely meet, as well as those in the classroom; more complex timetables need to be developed; and the learning activities of institutions and industry must be better coordinated.

3.87 The scope for communications and information technology to be applied to these and other information management tasks is considerable. All governments and educational institutions are examining the many options that new technological developments allow to encourage greater access and improved educational experience through administrative changes; some examples are discussed below.

3.88 An essential feature of any strategy to improve access to education is a set of initiatives designed to ensure that a wider range of potential students is aware of available courses, eligibility requirements and enrolment procedures. Several institutions have established systems using new technology to disseminate information of this type.

3.89 As mentioned in Chapter 2, the Western Australian office of TAFE uses videotex services to advertise all external TAFE courses and open learning materials, and to enable students to re-enrol. The Royal Melbourne Institute of Technology similarly used videotex to establish COURSEFINDER, a database of external studies courses available through higher education institutions. Currently, consideration is being given to expanding this service. The South Australian Career Information System gives users access via personal computer to a database containing integrated information about career opportunities, self-employment options, and learning programs. In Victoria, Job and Course Explorer, a computerised data base established by the Ministry of Education and the Department of Labor, provides access to information about jobs and courses. The University of Queensland has explored the use of interactive video disc as a means of providing information about higher education opportunities.

3.90 The Committee is of the view that information about tertiary educational opportunities Australia-wide should be available to Australians wherever they live. Perhaps existing State-based and sector-based innovations could be expanded or used for this purpose. The Committee recommends that:

> **the Department of Employment, Education and Training establish as a matter of urgency a national database of all Australian tertiary educational courses. The information on the database should be widely available through TAFE computer networks and, in rural and remote areas, through Australia Post offices and agencies.** *(Recommendation 5)*

3.91 Technology can also help institutions keep track of the course material and assignments which flow between students and teachers. The Darling Downs Institute of Advanced Education has devised a computer program and bar code system to record and monitor the movement of assignments from receipt by the Institute to their return to students after marking. According to the Institute:

> It has been found universally that such action to ensure rapid turn-around has a significant impact on the retention of distance education students.[30]

3.92 On a smaller scale, computer managed learning systems can be established and monitored by teachers for particular subjects and groups of students. Their usefulness can be hampered, however, if they do not link in with other systems used by the organisation. In one case an institution would not accept in electronic form the final results of students who had completed one of its courses using a computer managed learning program. The results had to be given to the administration area in handwritten form so that they then could be entered into a computer again.

3.93 Communications technology has also modified management procedures. Electronic mail has become a popular means of conveying administrative information and advice between educational institutions. Facsimile machines have also provided an alternative to mail services and lengthy telephone calls. Meetings of staff who are dispersed over a wide area can be achieved by telephone conference more efficiently than by face-to-face discussion. Similarly, staff development seminars can be held by video conference to save the expense, in terms of time and travel, of bringing everyone to a central point.

3.94 Developments in the electronic storage and transfer of data have made the greatest impact on the ways that educational organisations manage information and communicate internally, with each other and with their clients. Information entered on a computer can be produced as words on a screen; as a printed document; or as data on a floppy disc, laser optical disc, laser card or magnetic tape. It can be transmitted electronically to other computer terminals, and it can be transformed into sound by a speech synthesiser or into braille by a braille printer. While technology has transformed the management of educational services, and although new applications are being discovered at a rapid rate, a long-established need for information is still not being met as well as it could: access to reference and research material.

3.95 There are about 200 publicly available databases in Australia, as well as in-house databases used by closed groups in universities, government departments and business organisations. Within the education area, a number of networks provide access to bibliographic and research databases and to information about educational resources. Many permit electronic mail services between users.

3.96 These networks variously link subject specialists, institutions within regions, and institutions within sectors. Linkages with overseas databases are also possible through gateways' established by the networks. The usefulness of database access through computer networks is proven, and new possibilities

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[30] Darling Downs Institute of Advanced Education, *Submission*, p 4.

continue to be explored. Bond University, for example, will be relying on technology and the cooperation of other institutions to provide extensive information resources within a limited timeframe:

> ... it is ... both physically and humanly impossible to create in the short period of time that Bond University has been in existence a quality library collection .... How do you cope with demand for journal articles that have been published in obscure titles that are no longer even alive? ... We have put together a project that does not really create anything new, but rather integrates what is now off-the-shelf equipment, and we are developing some software to glue it all together .... [Y]ou put the journal article on the copier [in North America] and it appears, through digital technology, 10,000 miles away in Australia.[31]

3.97 Many educational institutions, particularly primary schools and schools in rural and remote areas, are not 'on-line'. They commonly rely on microfiche versions of databases. However, CD-ROM technology offers a more flexible and useful, albeit expensive, alternative. Another alternative to microfiche is the Hudson Card, which is produced by a new optical digital information storage technique based on conventional microfiche technology.

3.98 The proliferation of databases can either make each less useful, or each less well used. A recent study of school use of 'on-line' information services in Australia revealed that the proliferation of networks has not necessarily led to better access to information:

> ... in half the schools in that sample of 50, the work was not, in fact, being done in the school library and ... the students were involved in things like the Australaskan writing project, Computer Pals across the World. They would be in their classrooms dialling Anchorage to get information and then coming to the school library to use a five-year-old atlas when "on-line" services could have been available in that library.[32]

3.99 The need to rationalise the use and development of databases over State boundaries and sectors of education has been recognised for some time. Even so, the Australian Bibliographic Network, for example, which was established by the National Library as a national database, is not used by the Queensland State Library, parliamentary libraries, and at least five major universities. [33]

3.100 A significant achievement, on which further cooperative projects can be built, is the national electronic database provided by ASCIS. ASCIS is a private company owned by the Ministers for Education of the six States, two Territories and Commonwealth, together with the senior officers of the

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[31] E B Brownrigg, *Evidence,* pp 501-502.
[32] L A Clyde, *Evidence,* p 266.
[33] H W Groenewegen, 'Australian bibliographic network', *Discussion Papers,* Australian Libraries Summit, National Library of Australia, 1988, p 2.

National Catholic Education Commission and the National Council of Independent Schools. It was established in 1984, after 10 years of planning, as a cooperative venture to pool catalogue information, minimise duplication of effort and provide schools with affordable products and services generated from the nationally built database.

3.101 Apart from providing details about more than 240,000 catalogue items, the service provides access to information about curriculum documents, computer software used in schools, specialised subject areas and projects. The information is available through 'on-line' access, in microfiche form, as catalogue cards, on floppy disc and on magnetic tape. Consideration is being given to using CD-ROM, producing book catalogues for small libraries, and providing gateway services to external databases.

3.102 The Committee was told repeatedly of the need to improve the dissemination of information about developments in educational technology and the production of appropriate learning materials. ASCIS provides the means of meeting the requirement, or at least the model for doing so. This is discussed, along with other issues requiring nationally coordinated action, in Chapter 5.

CHAPTER 4

TEACHERS AND TECHNOLOGY

Introduction

4.1 One of the main themes which emerges in this report is that the successful application of technology to achieve educational objectives depends not so much on the features of the technology as on how well it is managed.

4.2 Choice of technology is influenced by cultural attitudes about the most appropriate way to socially organise learning. That social organisation of learning is manifest, for example, in the way teachers and students interact; the emphasis on cooperative or group learning and the extent to which students have some responsibility for teaching each other in the classroom. For example, in Japanese secondary schools where there is considerable emphasis on independent learning, the computer hardware configuration chosen is consistent with the goal of one microcomputer station per student. In contrast, in Australia and the United States of America where the group learning philosophy is stronger, there does not appear to be the same priority attached to allocating a machine to each pupil.[1]

4.3 The educational management task is one shared between teachers, administrators and policy makers. Each group can exert a positive or negative influence on the effectiveness of the educational system and on the way in which technology is used; clearly, they should work closely with each other. This is evident in the story of a satellite link trial in a school in Canberra:

> A private group came in, a satellite link was made with some overseas schools, the keyboard clicked away and the cameras whirred. One got the impression that it was more for the benefit of the Minister and others who could bask in the publicity, rather than for the students themselves. Within a week it was all over. The private company disappeared. The teachers, who hadn't been informed what was going to happen anyway, were left wondering what DID happen and why. The students just forgot about it.[2]

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[1] M Vickers, 'Microcomputers and secondary teaching: implications for teacher education', *Report on a Scottish Education Department - OECD Seminar,* Scottish Education Department, Glasgow, 1987, pp 9-10.

[2] T Beven, *Submission,* p 2.

4.4 Of the three groups listed in the previous paragraph, teachers have the most direct influence on the management of technology in education. Moreover, they are the group whose role will be most directly changed by the use of technology. Here the term 'teachers' describes individuals formally and informally delivering classes or lectures as well as people involved in developing curriculum and preparing instructional materials.

4.5 The relationship between teachers and technology can be a mutually beneficial one in that technology can improve the teaching and learning processes and these improved processes can increase the effectiveness of the application of technology. Professional development and training are among the many ways in which these joint objectives can be achieved. The latter part of this chapter explores the requisite features of such a training and development regime - a regime which encourages teachers to manage technology so that it provides diverse and flexible opportunities to learners with various aptitudes and experience.

4.6 One witness submitted that:

> To interface adequately with technology, teachers, like many other groups in society, require a number of facilitating factors to exist. These factors include, an enthusiasm to use technology, adequate preservice and inservice education, informed and supportive specialist advisory staff, adequate and compatible hardware, and educational software that is not only technically compatible, but compatible with teachers' educational philosophies.[3]

4.7 Factors other than teacher training influence how well teachers are able to use technology. Some of those factors, including that of instructional design and the incentives within the teaching profession, are also considered in this chapter.

Learning, Teaching and Technology

4.8 The Committee received varying opinions as to whether a particular technology can improve learning. Some commentators enthusiastically commended features of a particular approach or device for a specific purpose. Other commentators argued that technology is less important than the nature of the learner and the expertise of the teacher in determining educational success.[4] Another group of commentators took the intermediate view. One witness from the Darling Downs Institute of Advanced Education suggested, for example, that:

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[3] A C Millar, *Submission*, p 2.
[4] University of New England, *Submission*, p 6.

> ... the technology will be used to enhance education, to make education more enjoyable. Why should students not enjoy their education? I for one have been prone to preach to people in less developed countries that any teaching technique will suffice. And it will, provided the student is sufficiently motivated. But by using a range of techniques we can obtain better motivation and better retention.[5]

4.9 While it may be inappropriate to specify a particular type of device or method as optimal for a category of learning task in all circumstances, new technology can certainly improve the learning experience. Consider the case of pupils previously relying almost entirely on printed material dispatched by post: their learning experiences can be enhanced significantly by radio link with telephone talk-back, face-to-face teaching via a video or television broadcast, or other opportunities for personal contact with their teachers or peers.

4.10 Educational radio stations are a case in point. These stations are closely associated with tertiary institutions and provide an excellent talk-back facility to allow interaction between the teacher and the learner.[6] As noted in Chapter 2 radio 2SER-FM in Sydney, for instance, has broadcast educational programs and talk-back segments to complement television programs produced by the University of New England.[7]

4.11 The benefits of clear communication provided by new technology were discovered in the Queensland satellite trial in which it was found that:

> ... it made the teaching-learning system clearly something new. Teacher and students were alive to each other. Voices carried emotion as well as information. Coughs, sighs, groans, pauses, inflexions all assumed significance ... As the students donned their headsets, they entered an "audio environment" with their teacher and classmates. They could sense the presence of the others, and they knew why they were there.[8]

4.12 As to improvements in teaching, the training provided in new educational technology not only can remove some of the suspicion in which unfamiliar technology is held among teachers, but it also can improve teachers' face-to-face instruction. Teachers have been found to be applying in their other teaching activities the particular instructional design and presentational skills acquired and honed through experience with broadcast, teleconference and computer technology.[9]

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[5] V J White, *Evidence*, p 430.
[6] J Martin, *Evidence*, p 1091.
[7] J Gelonesi, *Evidence*, p 1098.
[8] Qld Department of Education, *Queensland Distance Education by Satellite Trial: Evaluation Report, Year One*, 1987, p 19.
[9] J C Lange, New technology and distance education: the case of Australia, *Submission*, p 35.

4.13 Technology can benefit teachers directly by improving the quality of their duties and responsibilities. The introduction of computer managed learning at the University of Queensland, for example, has allowed the staff more free time to prepare classes and undertake research since many students' queries are resolved by the program itself.[10]

Technology and the Role of Teachers

4.14 It is likely that new educational technology will lead to changes in teachers' roles just by the very rapidity and magnitude of technological change and its associated social and economic effects. Teachers must be given training and support that will help them participate in, and take best advantage of, these changes.

4.15 The University of Queensland's computer managed learning program, mentioned above, illustrates the way in which new technology has changed the role of the Economics teaching staff. Whereas staff were previously required to undertake considerable repetitive work answering individual students' questions and marking the practical tests, the computer managed learning program has meant that the staff are now more a source of guidance and clarification for persistent and/or higher order problems. ***Panel 4.1*** illustrates this case and the positive way staff and students have accepted the innovation.

Panel 4.1

The changed role of teachers

The four staff members at the University of Queensland running an economics subject using a computer managed learning system like it. The 21 staff involved in conducting the subject previously were continuously answering individual inquiries from the 730 students.

Most of those individual queries are answered by the program itself and staff now have time to get on with their own work or to spend more time with a student who has a particular problem. The program has increased staff satisfaction in that regard and at the same time has consolidated the lecture and practical sessions thereby providing students with a great deal more discretionary time. They can do their practical sessions anytime the facilities are open (between 8.00am and 11.00pm).

B Carss, *Evidence*

[10] B W Carss, *Evidence*, pp 488-489.

4.16 The relationship between teachers and students in a new technological environment was described by a representative of the Queensland Department of Education as having changed from one in which teachers are seen as the source of information for students to one in which they become the managers of access to information by students. Another commentator described the teacher's new role as that of a facilitator of learning as distinct from that previously of a subject expert.[11]

4.17 The teacher working in an environment of considerable technological change must apply a positive and dynamic approach to these changes if the potential of new technology to improve teaching and learning is to be realised. Teachers too must encourage their students to be active and innovative in their learning. Queensland's electronic learning centres are designed to foster independent learning using technology. These centres similarly support the new role of teachers by changing the emphasis in that educational environment from teaching to learning.[12] It would be unrealistic to expect such attitudinal changes to occur overnight and for the transition to be without cost. Queensland has devoted two staff to the three centres established so far and staff in the centres have found that teachers have required several months to adjust to the technology and to start to appreciate its impact on their programs and the curriculum.[13]

4.18 Queensland's experience provides a valuable lesson for the way in which teachers should be introduced to the new technology to minimise their uncertainty and likely resistance. The strategy of 'selective saturation' of a few schools with equipment and training has the advantage that it encourages those schools selected to be fully technologically oriented and viable. This is a more appropriate approach than spreading technological resources thinly across the school population in an attempt to achieve mass acceptance. The strategy requires, of course, continuing efforts to enlarge the number of schools which are very well resourced.

Teachers' Attitudes to Technology

4.19 The Committee has been impressed by the professionalism and enthusiasm of many teachers and educationalists developing and applying technology in innovative ways. The Committee was impressed with the Schools Across Australia Project, the school and TAFE clusters in Victoria and South Australia and the activities of educational radio stations.

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[11] P J Hosie, 'Realistic uses of AUSSAT for distance education in Western Australian primary and secondary schools', *Submission*, p 16.
[12] L A Lacey, *Evidence*, pp 354-355.
[13] L A Lacey, *Evidence*, pp 355-356.

4.20 However, it would be unrealistic to expect that new technology would be uniformly and warmly embraced by teachers. It is quite reasonable to expect teachers to display a certain degree of resistance to technological innovation, partly because of fear of the unfamiliar and partly because of scepticism borne out of the failure of other innovations to perform as well as promised. It has also been argued that teachers often see technology as a threat to personal contact with students, thereby undermining much of their job satisfaction.[14]

4.21 Teacher resistance can be a potent barrier to the application of technology in education.[15] One witness mentioned a case whereby:

> ... at one local Brisbane school they had a parent who was willing to donate the equipment and a P and C ready to pay for it, but the teachers had no experience of the technology, and they knew it had something to do with the telephone and their total response was "we do not want it. We do not want to be standing guard over a telephone all the time to stop the kids ringing up". They did not have the understanding and that is a real barrier.[16]

4.22 The description of the pace of technological change as 'revolutionary' is a cliche. However, the term is no less true for its familiarity. Such rapid change provides challenges for those who need to keep their knowledge up to date. The challenge is much greater for those teachers who were trained 15 or 20 years ago and who have had no previous training in new forms of technology. Indeed, the pace of change means that specific training in a process or on a machine soon becomes irrelevant as those lines disappear from the market. One witness estimated that teachers who received preservice training on any one line of equipment or software would be out-of-date by the time they began teaching.[17] Clearly the need for teachers to have thorough training and exposure to new technology represents a large but necessary task.

4.23 Another aspect of the uncertainty which engenders teacher resistance to the new technological environment is concern that technology may limit their career prospects. Such concerns are founded, for example, on forecasts that telecommunications-based teaching and learning will result in reductions in the number and seniority of staff required in certain fields.[18]

4.24 While there may be some growth in employment in the education sector overall, this growth is unlikely to occur at an even rate in all areas. Technological change will make some teaching jobs unnecessary, but will create new and different teaching tasks as well. Training for teachers is thus important

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[14] Qld Department of Employment, Vocational Education and Training, *Submission*, p 27.
[15] J C Lange, 'New technology and distance education: the case of Australia', *Submission*, p 34; M Grant, *Evidence*, p 212.
[16] J D Galligan, *Evidence*, p 523.
[17] J A Tainton, *Evidence*, p 354.
[18] A C Knight, *Evidence*, p 171.

to equip them with the skills to secure these jobs, to enable them to adjust to, and possibly even to anticipate, the structural changes which their profession faces.

4.25 Training can help overcome teacher resistance resulting from unfamiliarity with the technology. Teacher scepticism, too, can be reduced with training and communication to ensure that teachers know that successful projects involving teachers and technology have taken place and are taking place. Training will also support the efforts of the dedicated enthusiasts who are currently carrying much of the burden of innovation, advocacy and training themselves.

Training

Reasons for Training

4.26 Training is necessary not only for overcoming uncertainty about technology but also to ensure that new technology is used to best effect. Only when users are educated in both the features of technology and the educational context in which it should be applied can the equipment and techniques be used appropriately.

4.27 When discussing the training of teachers, and commenting on the training task necessary to use educational technology properly, the overwhelming weight of evidence received was directed to inservice training, and to the inadequacies there in current practice. Very little complaint was made about the training received at the preservice level. In part this may be due to the fact that the number of new teachers being trained and entering the profession at any one time is small compared to the number already in the field, so the inservice training could reflect a general perception that the inservice training task is the greater one.

4.28 One witness, while speaking specifically of rural schools in Australia, cited a national study which found that:

> ... provisions for inservice teacher training, and even preservice teacher training, are quite inadequate, and much is left to the goodwill of those motivated teachers who put in extra time, but in a bit of an ad hoc fashion. They do their best to use what the technology has to offer, but it is not good enough for the nation.[19]

4.29 The needs of rural teachers for training in technology are particularly pressing and support the more general case for improved inservice training for teachers. Teachers in rural and remote areas face special difficulties because of their physical isolation. Isolation has tended to mean that teachers in rural

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[19] C Fasano, *Evidence*, p 1007.

areas are less well off than their metropolitan or provincial colleagues: they are less experienced, but paradoxically are more often required to teach subjects in which they have had little or no training. It is not really surprising that turnover rates among rural teachers are higher than among teachers in metropolitan areas.

4.30 As was evident from the discussion in Chapter 3, new technology can do much to mitigate these problems of remoteness and inexperience. The feeling of isolation can be reduced, for example, by using technology to facilitate communication. Technology can be used to support clusters of schools and links between teachers so that schools and teachers can specialise, consult with, and help each other. In a similar way, training in technology could improve communications between teachers in metropolitan areas and improve the courses offered by their schools. ***Panel 4.2*** highlights the way in which technology can sustain links between teachers for formal and informal contact and support.

Panel 4.2

Teacher Support

The teacher support which often flows from the establishment of clusters of schools can be facilitated by the use of new technological devices.

When, for example, an English teacher in one of the well established clusters in the Mallee region of Victoria was having early problems developing lessons for her class, other teachers in the cluster learnt of her difficulties and undertook to help. One of the more experienced teachers from another school sent down a computer disc of actual lessons and course material. Not only was this information able to be compiled and sent quickly and conveniently, it was also readily usable by the teacher in need.

N Elliott, *Evidence*

4.31 The Committee was frequently told that inadequate professional development was constraining the use of new technology. For example, one witness said:

> I think one of the highest obstacles preventing the spread of the use of technologies is the lack of experienced practitioners, of high level people. You see this at the tertiary institutions; you see it right down to the school level. There are very few people, in my view, who really know what it is all

about and have the expertise and the experience to implement programs, conduct the research and so on. ... To me the bottom line of the whole issue, of all the issues of information technologies in education, is professional development and training ...[20]

4.32 It was emphasised in both written and oral evidence to the Committee that the need for skilled teachers and trainers must be addressed if the potential of new technology is to be realised. For instance, one witness from the Western Australian Department of Employment and Training explained that:

> From the perspective of my Department, there is within the State now a massive need for retraining and skills upgrading within the workforce. The present structures cannot cater for this new demand for skills training. The need for more skilled trainers will become acute as the industrial restructuring process and the new industrial relations and wage negotiations under the structural efficiency principle develop and become a reality.[21]

4.33 The need for professional development and inservice training to be well planned and widely available is a perennial issue in the education sector. Considerable attention is currently being directed by the Commonwealth and State education authorities to the training and retraining of mathematics teachers to address the shortage of skilled staff. The Education Department of Victoria, for example, has a small team of professionals skilled in the subject area, and the processes of professional development, assisting consultants in school support centres who work on seeding projects with teachers.[22]

4.34 The Committee will be interested to observe the progress and achievements of such inservice training efforts since the training effort for maths and science teachers may well increase numbers of teachers familiar with new technology. Even more importantly, the inservice training strategy being developed and applied by the States for the training of maths teachers should provide guidance as to the most appropriate strategy to deliver inservice training on aspects of new technology and using new technology.

4.35 Telephone conferencing and educational television have done much to improve the delivery and content of inservice training materials. The Committee learnt of diverse programs being undertaken to support inservice activities. One of the inservice applications to which new technology could be applied was described by representatives of the Queensland Non-Government Boarding Schools. That organisation has undertaken programs to assist

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[20] J Winship, *Evidence*, p 165.
[21] Y Gosselink, *Evidence*, p 97.
[22] E P Atkinson, *Evidence*, pp 604-605.

boarding school staff in remote areas.[23] ***Panel 4.3*** provides an insight into the convenience of using telecourses to train a language teacher in a language in demand in her school.

Panel 4.3

The Convenience of using Technology in Inservice Training

In Tasmania one teacher trained in French and German was required to teach Indonesian. She sat in on about 30 teleclasses from La Trobe High School and at the end of the year attended a one-month intensive summer school in Indonesian at the Australian National University.

She then, after one year's inservice by teleteaching and an intensive summer school, was able to teach introductory Indonesian on a face-to-face basis in her school, all without having been removed from her normal school.

M Walker, *Evidence*

4.36 Often because new technology can support distance learning, inservice and professional development programs cause far less disruption to teachers' and schools' work schedules than would previously have been the case if teachers had to travel to attend classes in person. They are also often cheaper to organise. The experience of one academic frequently involved in inservice training is outlined in ***Panel 4.4.***

[23] R M White, *Evidence*, pp 547-555.

Panel 4.4

Savings in Training Costs with Technology

A recent two day inservice training exercise involved 150 resource teachers from throughout Queensland including teachers from Thursday Island.

The entire course of 12 hours was all done by audio-teleconferencing with groups of experts from the Brisbane College of Advanced Education. Outlays for the course were $475. There were no travel, transport or accommodation costs and staff were not absent from classes except during the sessions themselves.

J Deshon, *Evidence*

4.37 The Committee was also impressed with the New South Wales Department of Education's use of technology to extend and enhance staff development. Its projects include the School-based Support Course in which attendance at residential sessions is supported by regional seminars conducted by telephone conference. The Department estimates these courses cost approximately half that of traditional staff development courses.[24]

4.38 The Department also prepares 30 minutes of original television material per week for staff development. The 'Education Today' segment which presents discrete staff development topics is transmitted weekly on the SBS television network.[25] Schools are encouraged to tape programs and to use them when it suits. The Department also prepares courses on staff development themes using video tapes either broadcast by SBS or distributed on cassette, supported by print material and face-to-face instruction.[26]

4.39 The Department has been broadcasting on radio to teachers and the general community for over five years as part of its staff development project, INSERT. Programs on issues and developments in education are broadcast six times a term on 10 community broadcasting stations in the State. The Department also prepares tapes of these programs for staff. [27]

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[24] NSW Department of Education, *Submission*, p 10.
[25] NSW Department of Education, *Submission*, p 11-12.
[26] NSW Department of Education, *Submission*, p 12-13.
[27] NSW Department of Education, *Submission*, p 13-14.

4.40 Staff development programs clearly can be delivered via many modes of new technology. The Committee was interested to learn that, overseas, technology is also providing services like those of an electronic staff-room, whereby teachers have access to an electronic mail facility for general social interaction and even counselling when under stress.[28]

4.41 Within Australia, AOLIN (Australian Open Learning Information Network) provides training and support for educationalists using information technology. As a national on-line network linking educators in tertiary institutions, schools and government education departments, AOLIN allows experienced users to provide assistance on technical and educational matters to those who are less experienced and provides a more general forum for discussion and social contact.[29] A human dimension was evident in AOLIN's activities and the Committee was interested to see that recipes and snippets on colleagues were also being exchanged on the network. [30]

4.42 The Australian Schools Catalogue Information Service (ASCIS) mentioned in the Chapter 3 also provides a network which links educationalists and institutions. Such activities are vital if teachers are to be kept informed of technological possibilities and, since the network is so extensive, the Committee also considers that it would be ideal for the dissemination of material relating to inservice training and professional development.

Features of the Appropriate Training Scheme

4.43 Broad agreement as to the need for teacher training and professional development does not provide guidance as to the nature of the training required. Most teacher training courses now include training in new technology. While this is a start, rapid technological change can make specific training obsolete. A balance must be struck between providing a conceptual appreciation of the role and potential of new forms of technology and providing detailed training sufficient to provide a working knowledge of the technology.

4.44 Inservice training both overseas and in Australia has very much favoured short courses designed to familiarise teachers with the equipment. This has probably been as much for cost and administrative reasons as for those of following what is perceived to be an appropriate learning approach. Under the National Plan in France, over 157,000 teachers (one quarter of their teaching force) had received a 50-hour initiation course in computing by the end of 1985.[31]

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[28] J D Galligan, *Evidence*, pp 524-525.
[29] Australian Open Learning Information Network, 'Knocking on the electronic door', *Submission*, p 3.
[30] Australian Open Learning Information Network, 'AOLIN - a meeting place', *Submission*.
[31] M Vickers, p 4.

4.45 By way of contrast, France also introduced training programs of a much longer duration in response to teachers' complaints that short courses were too superficial. French training courses have also provided instruction and practice in the application of computers in the classroom in response to teachers' concerns that earlier courses did not have an adequate pedagogical base.[32]

4.46 The appropriate training system must take both technological and pedagogical issues into account. The appropriate form of teacher training and professional development in new technology must be comprehensive and have a solid pedagogical base. An appropriate training regime must be adequately supported administratively if it is to be successful.

4.47 In this way, administrative factors also contribute to an appropriate training system. For example, the ability of teachers to undertake inservice programs successfully depends on their ability to take time off and then have the confidence and support to apply the lessons learnt.[33] Without such a supportive environment there will be a tendency to revert to the old and familiar and the inservice training opportunity will have had no practical effect.

4.48 One way in which this support can be provided is by having teachers who work together undertake training together so that they can help one another when it comes to applying the new techniques in the class or lecture, back in their school.

4.49 One of the most important techniques to be learnt in the training program is how to design lessons and materials to maximise the learning impact. The matter of instructional and materials design is discussed in the next section.

Instructional Design

4.50 Course design and materials development is an issue of on-going importance to teachers; the issue is not one which emerges only when new technology is being considered since the topic embraces the fundamental educational challenge of ordering and conveying information in a manner which best delivers the desired message.

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[32] M Vickers, p 4.
[33] J E Tuovinen, *Submission*, p 2.

4.51 Materials design has been a topic of increased interest in recent years, particularly within the field of external education. The Committee is aware of the work of the External Course Development Unit of the New South Wales Department of TAFE, for instance, which has researched the topic of instructional design and has attempted to prepare courseware, which is largely print-based, guided by strategies of learning, rather than by strategies of teaching.[34]

4.52 While the concepts of instructional design are of relevance whether the instructional materials are technically advanced or not, successful instructional design assumes a more economically important role when the new technologly to be used well is costly and changing.

4.53 The Victorian Chapter of the Australian Society for Educational Technology describes instructional designers as 'people specialising in finding solutions to learning problems, such as the use of new technology solutions, if these can be shown to be the most appropriate, the cheapest, the most efficient' and identifies them as one of the key personnel groups which should be supported if technology is to be used to improve education.[35]

4.54 The importance of instructional design skills in ensuring that technology and learning work optimally together was underlined by the Queensland Department of Employment, Vocational Education and Training. The Department submits that, in contrast to the United States of America, Canada and the United Kingdom, very few higher education courses on instructional materials design exist in Australia, and the shortage of people skilled in this area is a major factor inhibiting the use of new technology. The Department suggests that the Commonwealth could assist by encouraging such courses and possibly funding trials.[36]

4.55 A concomitant to the introduction of new technology in education is change in the structure and content of courses. One of the strengths of the microcomputer, for instance, is its capacity to facilitate exploratory group and self-paced learning. In some instances, it may be appropriate to modify the structure of courses to use this capability. Evidence from OECD countries suggests that the introduction of microcomputers in secondary schools has changed the content of courses and the way subjects are taught.[37]

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[34] A Wilson, 'The development of external course material', *Proceedings of the National Conference for the Australian Society for Educational Technology, Designing for Learning in Industry and Education,* Canberra, 1988, pp 167-177.
[35] Australian Society for Educational Technology (Victorian Chapter), *Submission,* p 1.
[36] Qld Department of Employment, Vocational Education and Training, *Submission,* p 29.
[37] M Vickers, p 2; p 7.

4.56 The Committee also learnt of trials and programs in Australia which illustrate the way in which technology and instructional design principles have interacted. For example, in Queensland's satellite trial in distance education, the learning materials packages were on trial as much as were the satellites or the micro computers.[38] The learning packages were novel in their design and presentation: they organised material by topic rather than by subject; emphasised skill development through activity and inquiry; and were closely related to the audio/visual elements of the trial.

4.57 Despite some initial concern about the organisation of materials by topic and concept rather than by subject, and the consequent need to work out new timetables to use the learning packages, home tutors became comfortable with the new structure. They also saw improvements in their students' interest and performance. The audio lessons and interactive video programs were important in introducing activity and inquiry into the learning process. The audio and video parts of the material were also reported to have been keenly used and favourably evaluated by students and their home tutors.[39]

4.58 On perhaps a less grand scale, the Rural Secondary Schools Support Scheme in Queensland also provides evidence that technology in Australia has modified teaching method. The scheme commenced in 1987 to provide students in rural schools opportunities for secondary education and to provide a range of curriculum support services for teachers and students in those locations using telecommunications technology, including the loudspeaker telephone, facsimile machine, Keylink and Q-Net facilities.[40]

4.59 The use of loudspeaker telephones has required teachers to modify their teaching delivery somewhat. Teachers have been required to pay particular attention to the clarity of expression, the organisation of ideas and the manner in which interaction is encouraged and managed. It was found that teachers using these media should use longer phrases and complete sentences interspersed with pauses to allow time for a response.[41]

Incentives to Innovate

4.60 Another practical consideration affecting the uptake of technology by teachers is that of the current teaching ethos. At present there is no recognition or reward included in the system to encourage teachers to innovate. The issue of the lack of appropriate performance measures was variously expressed:

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[38] Qld Department of Education, *Queensland Distance Education by Satellite Trial: Evaluation Report, Year One*, 1987, p 25.
[39] Qld Department of Education, *Queensland Distance Education by Satellite Trial: Evaluation Report, Year One*, 1987, p 26-28.
[40] I Wallace, *Rural Secondary Schools Support Scheme*, Brisbane, 1987, p 11.
[41] I Wallace, *Rural Secondary Schools Support Scheme*, Brisbane, 1987, p 21.

> The new technology will require significant funds to establish, but the purchase of hardware will not guarantee that any use is made of it, as the numerous under-used educational television and radio studios around the country indicate. They are not idle because they are not effective, nor because they are too costly. They are idle because use of them simply does not count in the performance measures by which academics are judged.[42]

> Unless academics and administrators are given training in new educational technologies, they will remain a source of opposition and possible sabotage. Without incentives and rewards for participation, most academics will not use technological solutions regardless of how much they might cut institutional costs or improve the quality of teaching and research.[43]

4.61 One university academic who is a self taught user of a computer for word processing observed that:

> ... the system of rewards that operate in tertiary institutions do not encourage teachers to take the initiative [to use new technology]. It is scholarship, reflected in contributions to knowledge in the discipline of the academic, that is the primary basis for judgements about merit ... I have never been asked (nor heard anyone else asked) whether I (or they) had made any use of technology in teaching or indeed had any interest in doing so.[44]

4.62 Consistent with this evidence on the lack of appropriate rewards for use of technology in education was information from Curtin University, which offers post graduate diploma and master's degree courses in educational instructional technology:

> A number of graduates from the program have found better opportunities outside the public or private teaching (school) sector where their skills and applications are of increasing relevance to major employers involved in the retraining and updating of skills within industry.[45]

4.63 The Committee urges educational authorities to consider a proposal to require teachers to undertake training in new technology over, say, the next five years and that proficiency be a specific criterion for promotion. The Committee also urges the authorities to ensure that the necessary administrative arrangements by way of time off and relief teachers are instituted to support such training schemes.

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[42] J C Lange, 'Talk-back television: the Western Australian experience', *Submission,* p 2.
[43] J C Lange, 'New Technology and Distance education: the case of Australia', *Submission,* pp 16-17.
[44] P Bayne, *Submission* pp 1-2.
[45] Curtin University of Technology, *Submission,* p 3.

Conclusions and Recommendations

4.64 The Committee appreciates the dilemma educational authorities face in allocating limited funds over the complementary human and equipment teaching resources. Nonetheless it is disappointed with some of the evidence it has received suggesting declines in States' commitment to inservice training and professional development irrespective of the level of Commonwealth support.

4.65 When the Commonwealth Government reduced its funding to this area, so too did the States. In the words of one witness:

> I have noticed that in the last two years there has been a decline in the level of professional development offered at the State level with the cessation of Commonwealth funding for professional development.[46]

In contrast, the Committee was also informed that:

> ... as a member of the State committee [for the Professional Development Program] I was very disappointed that as the Commonwealth program had been introduced and expanded, in many respects as a seeding program to initiate new activities and new directions in professional inservice education, the State progressively withdrew its own funding support for professional development. It had lapsed into an almost substitution program ...[47]

4.66 The Commonwealth Department of Employment, Education and Training is undertaking work on trends in teacher training. The Committee is hopeful that the information obtained as part of that exercise, in conjunction with consultations with the Australian Education Council, will be a satisfactory basis on which to develop training strategies and priorities.

4.67 The Committee considers that a greater degree of strategic planning is required if the somewhat dispersed efforts at professional development are to be used to better effect. The Committee notes that it is supported in this opinion by the Victorian Education Department.[48] One possible consequence of such planning is the greater likelihood that States share the effort and costs of developing training programs, and that these be implemented on a shared basis across States whenever possible.

4.68 The Commonwealth is not a provider of inservice teacher training and development in schools. It has nonetheless quite a long history of involvement in this area, by way of targetted funding or, since 1986, through the program of real resource betterments provided under Commonwealth General Recurrent

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[46] G G Cane, *Evidence*, p 671.
[47] R D Linke, *Evidence*, p 1628.
[48] E Atkinson, *Evidence*, p 606.

Grants. In addition, the Commonwealth also provides funding for some specific programs of teacher development and funds for higher education institutions at which teachers may take upgrading courses.

4.69 Since 1986 expenditure by the States on inservice developmen and training which has been funded from the Commonwealth's betterment funds has averaged over $18 million per annum.[49]

4.70 Some universities and colleges of advanced education funded by the Commonwealth provide courses designed to improve the teaching and academic performance of their staff. The effectiveness of these courses is heavily influenced by the attitude of senior academic staff and the quality of course instructors. A study undertaken in 1982 suggested there was scope for improvement in both these aspects.[50] The training of academic staff remains an uncoordinated activity dependent on institutions' individual priorities.

4.71 The Committee considers that inservice training, as a matter of fundamental importance to the effective use of technology in education, should be regarded by the Commonwealth as a priority area complementary to that of equipment.

4.72 Accordingly the Committee recommends:

> **the Commonwealth Government allocate more funds to inservice training which deals with and uses new technology, provided that State and non-government systems match such Commonwealth expenditure with resources of their own.** *(Recommendation 9)*

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[49] Department of Employment, Education and Training, *Teachers Learning,* Report of the Inservice Teacher Education Project, AGPS, Canberra, 1988, pp 9-10; p 67.

[50] Commonwealth Tertiary Education Commission, *Academic Development Units in Australian Universities and Colleges of Advanced Education,* by R Johnson, Commonwealth Tertiary Education Commission, Canberra, 1982.

CHAPTER 5

NATIONAL POLICIES FOR THE FUTURE

The Need for Coordination

5.1 The common thread throughout the many submissions, hearings, inspections and discussions which have contributed to this Inquiry is the need for improved national coordination. Increasing the range and diversity of educational opportunities available to all Australians in a cost-effective way depends upon the barrriers between governments, educational institutions, and sectors being lowered.

5.2 This is not a novel idea. Coordination will always be both a stumbling block and a goal for Australian governments simply because of the operation of our federal system. In the education arena, the dislocation caused by the division of powers among governments is exacerbated by the existence of the various sectors.

5.3 One after another for almost a decade and a half, national inquiries into education have pointed to the need for better coordination: the Karmel Report on Open Tertiary Education (1974), the Australian Education Council's Task Force on Education and Technology (1985), and the advice to the Commonwealth Tertiary Education Commission from its Standing Committee on External Studies (1986).

5.4 Good liaison is not enough: a sense of national direction is also needed. While a number of national education and training strategies have been identified and are being pursued Australia-wide, the use of technology in learning and teaching is not nationally guided. Until it is, it will be harder to achieve national goals such as developing the skills of the workforce and raising Year 12 retention rates.

5.5 The need for a national approach to using technology in education was brought to the Committee's attention many times. For example:

> What presently can be observed across the nation is fragmented development, application and experiment stemming from the lack of common objectives, structure or network.[1]

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[1] Brisbane College of Advanced Education, *Submission*, p 1.

> The problem we have is that there is a great deal of will and goodwill from people working in the area of education technology, but we are not getting anywhere. There is not a major focus, there is not a major push.[2]

5.6 A national approach would ensure that all parties were working in a consistent context and knew what developments might be expected in the short-to-medium term. A plan - or series of plans - worked out by proper consultation between States, institutions and the Commonwealth would assist progress and minimise waste of time, money and effort through conflict and duplication.

National Issues

National Strategies

5.7 In calling for coordinated national action, many contributors to the Inquiry looked to the Commonwealth Government to take the lead. The Victorian Ministry of Education told the Committee that:

> ... we do believe quite strongly that the Commonwealth has a significant role in facilitating the development of broad national guidelines together with a significant and adequate investment in, for example, equipment, course materials, print, videos and staff development.[3]

Others pointed to the need for the Commonwealth to coordinate software and computer education policies and to encourage cooperation in resource sharing, research and development.

5.8 Despite this, the submission from the Department of Employment, Education and Training indicates that the Department does not see its role in developing the application of educational technology in Australia as a significant one. The Department sees this as the responsibility of those authorities and institutions which are themselves urging that the Commonwealth take the lead:

> The States, the Commonwealth, the Australian Education Council, schools, TAFE institutions, higher education institutions and industry all have a role to play in the implementation of educational technologies. The schools and TAFE sectors are principally the responsibility of the States, and the Commonwealth's major role is in the higher education sector. However, responsibility for implementing programs in that sector lies with the individual institutions, and the Commonwealth is not directly involved in the delivery of educational services. There is general agreement that cost-effective, quality applications of new technologies are dependent on a

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[2] P J Hosie, *Evidence*, p 242.
[3] E P Atkinson, *Evidence*, pp 539-594.

large clientele and good coordination at a system level. The unified national system of higher education proposed in the Government's recent paper *Higher Education: A Policy Statement*should provide more scope for this.[4]

5.9 The Committee acknowledges the Constitutional constraints on the role of the Commonwealth in education. It is also aware that it is difficult to forge cooperation - let alone coordination or compromise - among the various States, Territories and institutions. Nevertheless, the Committee was struck by the apparent lack of a coherent approach within the Department of Employment, Education and Training itself to the use of technology in education. While affirming the importance of 'equity considerations' in its submission, for example, the Department does not seem to have a policy on the use of technology for improving the educational opportunities for Aborigines.[5]

5.10 The Department sees the Australian Education Council as the 'most appropriate body to have the continuing role of promoting overall coordination and cooperation' and also suggests that the proposed external studies coordinating body in the higher education sector 'might assess the appropriateness of various technologies for various educational purposes and evaluate cost benefits of course development, hardware, software and delivery options'.[6]

5.11 The Commonwealth should not attempt to usurp the discretion of State governments to act autonomously, but this does not mean that it should be complacent. The Commonwealth has sponsored some major initiatives in the application of technology to education, such as the Computers in Education Program and the resource agreement with Victoria which has improved rural schooling through the use of technology, and is aware of the issues associated with this area. However, it does not appear to have clear policies about these issues in the context of which it can negotiate with the other governments and educational institutions.

5.12 Apart from actions within the Department of Employment, Education and Training to strengthen its capacity to provide well-developed policy advice in this area, a constructive role can be played by the National Board of Employment, Education and Training. This is the senior policy advisory body to the Commonwealth Minister. It has responsibility across all sectors of education including training in the workplace outside institutions. It is in touch with all of the institutions of higher education through its Higher Education Council. It has representation from all States and has in place mechanisms for consultation with appropriate State authorities. While it lacks executive power, it could still be a strong source of continuing policy advice on the best use of educational technology.

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[4] Department of Employment, Education and Training, *Submission*, p 1.
[5] B A Corish, *Evidence*, pp 1629-1630.
[6] Department of Employment, Education and Training, *Submission*, pp 5-8.

5.13 The Committee recommends that:

> **the Higher Education Council of the National Board of Employment, Education and Training be given responsibility for ensuring cooperative and coordinated effort between higher education institutions in the use of educational technology, taking into account national strategies and policies developed by the Australian Education Council.** *(Recommendation 6)*

5.14 Alongside calls for greater Commonwealth involvement in encouraging national cooperation, the Committee was told that national cooperation should be fostered by a coordinating body.

5.15 Such an organisation already exists: the Australian Education Council (AEC), the council of all State, Territory and Commonwealth Ministers of Education at all levels. Since major policy decisions are ultimately Ministerial or government decisions, no body could have higher authority than this one. Since Ministers have executive power within their portfolios, no body has more chance of ensuring that decisions are implemented. Since the Council comprises all Ministers on equal terms it is not dominated by any one Minister or group and is a forum well suited to consultation. When it makes decisions, however, it has as a Council no power to carry them out: the implementation is left to the several Ministers in their own portfolios. The secretariat of the Council is small and designed to service meetings of the Council and its committees, not to take any executive role.

5.16 In 1985, the AEC commissioned a study into education and technology. The task force that undertook the review recommended, among other things, that the Council:

> ... investigate the establishment of an Education and Technology Centre to improve cooperation in the use of technology among education authorities across all States and sectors.[7]

5.17 Rather than establishing a permanent organisation the Council created a standing committee called the Education and Technology Conference. The Conference consists of representatives from each State and the Northern Territory and reports to every AEC meeting. Its current responsibilities are shown at ***Panel 5.1***.

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[7] Australian Education Council Task Force on Education and Technology, *Education and Technology*, Australian Education Council, Melbourne, 1985, p 126.

Panel 5.1

The Role and Activities of the Education and Technology Conference

The role of the Education and Technology Conference is to ensure the maximum exchange of information between government systems and the greatest possible cooperation between them. It covers all levels of education including primary, secondary and tertiary levels. The Education and Technology Conference also seeks to involve other organisations such as those in broadcast and telecommunications and organisations selling computer equipment and services.

The Education and Technology Conference is directing its attention in 1988-89 to:

- coordination and cooperation in the use of technology in tertiary education to foster open learning;
- improved teacher education to improve the effectiveness of technology;
- development of school curricula to stimulate innovation and entrepreneurship;
- documentation and communication of educational initiatives between government systems; and
- use of technology to assist the disabled.

Education and Technology Conference, Australian Education Council *Submission*

5.18 Members of the AEC Education and Technology Conference have found that their work is hampered by a lack of continuity and resources:

> The Conference is supported by a limited secretariat, the AEC secretariat, and therefore it is not capable of doing a great deal of work in this area. It comes together maybe three or four times a year to exchange views and opinions and to exchange some papers on things that are happening State-to-State. At the moment it has no capacity to undertake research, in effect, on its own.[8]

5.19 The solution sought by the Conference is the creation of an Education and Technology Council similar to the organisation which was recommended in 1985. The body would foster research and development and coordination. Apparently, it would also replace the Conference.

5.20 The need for the AEC to be given sound policy advice about the use of technology for educational purposes should be distinguished from the need for research and development. One organisation cannot perform both roles without the risk of confusing what is desirable in education with what is made possible by technology. Accordingly, it is the view of the Committee that the AEC Education and Technology Conference is the appropriate body to provide advice on national directions in the use of technology in education.

5.21 A task which the Education and Technology Conference should have been pursuing is the implementation of the 24 recommendations made by the Task Force in 1985. The recommendations were generally endorsed by the AEC, and it was left to the member authorities to follow them up individually. Clearly, the fact that the decisions of the AEC are not binding on the members indicates that it is necessary to monitor what actually happens. The Education and Technology Conference does exchange information about issues and policies at its meetings. However, a more formal mechanism should be introduced.

5.22 The Committee recommends that:

> **the Australian Education Council be responsible for, and give priority to, the development of national strategies for the educational uses of technology.** *(Recommendation 1a)*
>
> **promote and monitor the implementation of educational technology strategies approved by the Council.** *(Recommendation 1b)*

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[8] A Abrahart, *Evidence*, p 1462.

ensure that adequate resources are provided to the Education and Technology Conference to allow it to perform the functions identified at Recommendations 1a and 1b above and Recommendations 1c and 1d below. *(Recommendation 1e)*

5.23 The capacity of the Education and Technology Conference to provide policy advice has been limited in that there has been no involvement by non-government schools or by higher education institutions.

5.24 The Committee recommends that:

the membership of the Education and Technology Conference of the Australian Education Council be expanded to include representatives of the non-government school sector and higher education institutions. *(Recommendation 2)*

5.25 Industry is not represented on the Conference either. The Committee does not consider that membership is necessary or appropriate, given the structure and operation of the AEC, but recognises that consultation between the Conference and industry is desirable and has sometimes occurred.

Research and Development

5.26 National strategies are futile unless they are based on sound and up-to-date information and investigation. Not only must Australia be aware of, and contribute to, new developments in technology, there are many nationally significant aspects of the use of technology in education that need to be investigated.

5.27 Many possible areas of national interest were identified as requiring research and development and it is widely believed that this should be coordinated nationally. The subjects mentioned include:

- the development of better ways to use computers in education;
- the pedagogical issues of instructional television;
- studies on specific forms of technology and the optimum conditions for their deployment;
- the content and style of courseware suitable for people with special learning needs;
- artificial intelligence and the use of computers in learning;
- the ways in which technology can expand the scope of learning;

the nature of the attitudes of teachers towards the extensive use of technology in their teaching, and the reasons underlying those attitudes; and

the benefits/costs involved in retraining appropriate teachers in areas of teacher surplus, for work as technology support staff.

Associated with the need to coordinate research is the need to disseminate information about new developments.

5.28 The Committee was impressed with the large number and range of initiatives in the use of new technology in all parts of Australia and in all sectors of education. Much of the energy and innovation that has been demonstrated, however, has been expended on trials, pilot programs or short-term ventures that must end when the period of funding expires. Pilot programs may have succeeded but no-one except their proponents and participants knows about it, so that the pilot may be repeated in other places by people unaware it has been done before.

5.29 Around Australia at present proponents of educational technology are reinventing the wheel, producing courseware and software already devised by others of whom they were unaware: 'Trial and error is very expensive when we are all making the same mistakes'.[9] There is a clear need for a national information exchange about equipment, processes, projects and workers in the field.

5.30 The Education and Technology Council proposed by the AEC Education and Technology Conference would perform both the research and the information dissemination roles. It is envisaged that it would undertake some research of its own, but would more often fund and coordinate the efforts of others. It could also market courseware in Australia and overseas. Rather than being a single large centre, it could encompass a number of centres in different States, including research groups within State governments or academic institutions operating as centres of excellence.[10]

5.31 Much expertise has been developed, for example, in organisations such as the Bendigo Resources Centre and the University of New England's recently established Centre for Research on Educational Technology. Furthermore, the Western Australian College of Advanced Education has proposed the establishment in that State of a Key Centre in Telecommunications-based Distance Education. The Education and Technology Council would coordinate and foster research and development by such bodies.

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[9] A Whyte, *Evidence*, p 723.
[10] Education and Technology Conference, Australian Education Council, *Submission*, pp 19-20.

5.32 Another proposal put forward is the establishment of a 'Centre for Educational Innovation'. This would be an independent organisation which had staff of its own but would also have staff working with it on secondment from educational institutions.[11] A Centre for Research into Distance Education was also proposed.[12]

5.33 The Committee supports the concept of a decentralised but coordinated mechanism which can draw upon and foster the expertise of as many people as possible and considers that the proposed Education and Technology Council could perform this role.

5.34 The AEC has sponsored two successful ventures in response to national priorities in education: the national TAFE Research and Development Centre, itself the source of a great deal of expertise in education and technology, and the Australian Schools Catalogue Information Service. Both are funded by contributions from all parties to the AEC as well as by earnings. The Education and Technology Council could be established in a similar way, possibly with the assistance and continuing involvement of industry.

5.35 The Committee recommends that:

> **the Australian Education Council be urged to establish, on the model of ASCIS or the TAFE Research and Development Centre, a body to coordinate research into the use of technology in education and to facilitate exchange of information across State and sectoral boundaries on educational projects involving new technology and on equipment and processes.** *(Recommendation 10)*

Software and Courseware

5.36 By operating a clearinghouse on the availability, application and potential of technology, the proposed AEC research and development organisation would help to overcome much of the duplication, and associated diversion of resources, in testing new ideas. However, a significant amount of duplication has also occurred in producing appropriate software and courseware (the range of learning and teaching materials which can support the delivery of a course).

5.37 A number of State governments have been responding to the problem. The Victorian Government, for example, established Knowledge Victoria, a non-profit company which facilitates the development and delivery of technology-based open learning programs in Australia and overseas. Among its functions is the survey, analysis and establishment of databases of knowledge

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[11] D A Inglis, *Submission*, p 15.
[12] J Lockwood, *Submission*, p 1.

resources. Moreover, Curriculum Development Centres have been established in all States. Their functions include the coordination, and dissemination of information about, courseware.

5.38 Without doubt the major achievements in this regard are those sponsored by all governments through the AEC, particularly through ASCIS. Contributing to the ASCIS database is the Australian Curriculum Information Network (ACIN), a project developed by the Curriculum Development Centre of the Department of Employment, Education and Training. ACIN records consist of materials which have not been formally published, such as syllabuses, curriculum documents and project reports, as well as reviews of the content, usefulness and availability of the material. Another project of the Curriculum Development Centre was the collation of information and reviews about computer software used in schools. All States can contribute to the ASCIS database records and can establish their own information networks within it; for example, a number have added State-based curriculum information networks to the system.

5.39 The Commonwealth will be proposing to the next meeting of the AEC, in April 1989, that a new company responsible for national curriculum development in schools be formed. Essentially, the company would be an amalgamation of the Curriculum Development Centre and ASCIS. The Committee supports this proposal as it would underpin efforts to promote similarities in curricula and thereby reduce the disadvantages encountered by the 500,000 children who change schools during the academic year, often because they have moved interstate.

5.40 Cooperative arrangements in the use of technology in presenting TAFE courses have also been fostered by the AEC. The Conference of TAFE Directors, which is a sub-committee of the AEC, has established a national steering committee to pursue this task. The TAFE Research and Development Centre also has an important information dissemination role.

5.41 In the higher education sector, however, there appears to be a need for far better exchange of information about available software and courseware. Some commentators have supported the establishment of a clearinghouse, others referred to a database.

5.42 Demands for easier common access to information about course material will increase as higher education institutions begin to work more closely together. Impetus is being given to this trend by the establishment of the Unified National System and the identification of Distance Education Centres as the producers of external studies materials.

5.43 The new external studies coordinating organisation proposed by the Commonwealth Government and comprising Distance Education Centres, a number of teaching institutions and Commonwealth representatives, could perform the information exchange function. However, care would need to be taken to ensure that technology is not equated only with external study.

5.44 ASCIS provides a model on which a higher education database could be built. The database could be available on the new computer network which is being developed within the higher education sector, but the Committee would not support this if it reinforced the division between higher education and TAFE institutions. Access should be given to the TAFE sector, as should information on TAFE course material and software be available to higher education institutions. Because of its accessibility, AOLIN has proposed that it take on this function.

5.45 The Committee recommends that:

> **the new organisation proposed by the Commonwealth Government to coordinate external higher education studies seek the establishment of a national database of courseware and software information which would be accessible to all tertiary institutions.** *(Recommendation 7)*

Technical Standards

5.46 An important aspect of using technology in developing and pursuing greater coordination in education is to ensure compatibility of communications protocols, systems, hardware and software. As was noted in Chapter 3, ASCIS has found it very difficult to provide national on-line services to all schools because of differences in hardware and software. Moreover, the development of private telecommunications networks, operating on different protocols, can hinder efforts to promote national communications:

> The ability of telecommunications networks to connect with each other and hence enable people working within separate networks to communicate is a function of the communication protocols that are adopted. In the case of data communications international standards define protocols of many different types. This multiplicity of protocols creates a problem for connectivity. In the case of voice communications few standards exist and no standards yet exist for compressed video transmission. Where no standards exist, individual companies develop proprietary protocols and promote them actively in the marketplace in order to attain a more competitive position.[13]

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[13] D A Inglis, Royal Melbourne Institute of Technology, *Submission*, p 8.

5.47 The satellite communications technology being used by Queensland for Q-Net, for example, uses an analog protocol which is incompatible with the digital technology that was subsequently chosen by Victoria for VISTEL.

5.48 ASCIS has told the Committee that the Commonwealth should 'take a lead in ... coordinating the development of a national specification - some clear guidelines on telecommunications and hardware that schools can follow ...'[14] Similarly, the Victorian Government sees the Commonwealth developing standards for computer aided design and manufacturing.[15] Others, including the South Australian Government, have suggested that the development of standards and guidelines should be a function of a Key Centre of expertise in educational technology.[16]

5.49 Some progress has been made in developing standards under the International Standards Organisation's seven-layer network architecture known as open systems interconnection (OSI). The process is still continuing but is more than halfway complete. OSI will allow any computer to communicate with any other computer. As a result, there will be greater flexibility in designing systems and lower costs to users. The Committee considers that OSI standards should be used in education and notes that the Department of Finance has directed that all procurement of computers by Commonwealth agencies must comply with these standards.

5.50 While the Commonwealth is responsible for regulating public telecommunications standards, where choice is available the decisions about standards must be cooperatively made. The Committee recommends that:

> **the Australian Education Council encourage the adoption of guidelines and standards which ensure that new communications and information technology used in Australian education is compatible within and between sectors.** *(Recommendation 1c)*

5.51 An initial project to establish the guidelines and standards could be undertaken by the Education and Technology Conference, the proposed research and development organisation, or a special task force of experts.

Telecommunications Policies

5.52 The Committee received many comments about Telecom's charging policies and the high cost of using AUSSAT services. There also continues to be much debate about the relative advantages and disadvantages of terrestrial and satellite communications. The answers to both issues depend upon the purpose for which the technology would be used.

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[14] G G Cane, *Evidence*, p 670.
[15] I R Conboy, *Evidence*, p 597.
[16] SA Government, *Submission*, pp 20-21.

5.53 As techniques such as telephone conferencing, facsimile transmissions, computer mediated communications and remote database access have become more prevalent in education, the costs of telecommunications have increased as a proportion of the recurrent expenditure by institutions. A number of commentators have put the view that the Telecom and AUSSAT charges for educational services should be at a concessional rate, particularly for institutions offering external studies. The Department of Transport and Communications explained that:

> In the past, educational institutions have sought special consideration from the communications authorities. In the new competitive environment it will not be appropriate for these businesses to subsidise (or even cross subsidise) educational use of communications services.[17]

5.54 The Committee raised the problem of costs with AUSSAT and Telecom representatives in terms of having a social obligation to assist educational services. The AUSSAT position was that '... if the Government imposes such an obligation, the Government should bear the cost but presumably there would be some dialogue on that in the process of a policy emerging'.[18] Unlike AUSSAT, Telecom has a social charter. Its response was:

> ... we believe we are covering [the social obligation] by providing ... remote services at subsidised prices, and if the education departments wish to make use of those subsidised services then we would be more than happy to talk to them, but in terms of an additional social obligation on top of that, I would say at this point in time that there is none.[19]

5.55 Another approach is for governments to provide more funds for the educational use of telecommunications. Indeed, it has been primarily because of the additional financial support of governments that satellite services have been used in education. The Western Australian College of Advanced Education has put the view that 'it is imperative that government involvement in making satellite time available for educational institution usage at minimum cost be continued'.[20] It has also been suggested that additional funds should be given to institutions which allow their distant external students to use INWATS numbers, whereby the student pays the cost of a local call and the cost of the STD component is borne by the institution.[21]

5.56 The Committee is of the view that institutions should be required to take responsibility for negotiating and managing their own budgets; expenditure constraints should be imposed and controlled at the institutional level. Similarly, overcoming high costs should be at the initiative of institutions, but

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[17] Department of Transport and Communications, *Submission*, p 7.
[18] R C Johnson, *Evidence*, p 1589.
[19] A E Gilderdale, *Evidence*, p 1568.
[20] WA College of Advanced Education, *Submission*, p 1.
[21] University of New England, *Submission*, p 2.

governments can help in forging cooperative arrangements to achieve economies of scale. From the viewpoint of not putting some students at a disadvantage compared to others, it is reasonable that institutions provide INWATS facilities. However, there could be a case for providing funding assistance to students who cannot receive Telecom services and need to install satellite communications equipment at a higher cost.

5.57 To reduce recurrent costs and obtain greater independence in the provision and maintenance of services, governments are establishing national networks. The need for computing networks in education has been apparent for some time. The most recent to be established is the National Academic Computer Network, which is being formed to increase productivity in research and teaching, assist distance education and to rationalise telecommunication costs in the higher education sector. A backbone network will connect Brisbane, Sydney, Melbourne, Adelaide and Perth with other regions being able to connect later. The network also will include a leased connection direct to North America. The network will implement OSI standards in products as they become available.

5.58 The telecommunications networks now being formed are far more extensive. They incorporate terrestrial as well as satellite links and carry voice, video and data, depending on the users requirements. As noted above, these networks are not always compatible. State governments are linking their own enterprises in this way, which can create barriers between institutions in the same sector but different States. The view has been put to the Committee that a national educational telecommunications network should be established.

5.59 One solution could be to establish a national superstructure above the existing networks, as suggested by the Brisbane College of Advanced Education:

> ... people would log on, say, to the system they are currently using, but they have the option within that system to log back into the top superstructure that provides the connectivity between the States; that kind of connectivity would be hidden from the everyday user. However, you would then gain access to things we do not have now, such as national bulletin board systems and the ability for central groups to be able to coordinate activities across States, so that we had common curriculums and professional and research activities could occur between them. Rather than a new system, we are looking at trying to utilise the current technologies to have a superstructure. Explorations with Telecom and OTC in this direction indicate to me that this is possible. However, because we have such a fragmented set of persons trying to generate this, there is no one voice for education that allows that kind of resource to be developed.[22]

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[22] M Williams, *Evidence*, pp 410-411.

5.60 A team at the Royal Melbourne Institute of Technology is urging governments and tertiary institutions to take a 'long view' and 'develop a vision of an integrated communications system at a higher level of sophistication'.[23] Since 1985, the Institute has fostered the EDSAT project, which was set up to investigate the feasibility of establishing a tertiary educational network via satellite. The network would permit telephone conferencing, transmission of graphic material, database access, and compressed video. Again, the main obstacle has been a lack of coordination, the absence of a 'single body that is able to marshal the forces within tertiary education at a national level'.[24]

5.61 The Committee recommends that:

> **the Australian Education Council investigate the need for and feasibility of a national educational telecommunications network covering all of the education community.** *(Recommendation 1d)*

Educational Television

5.62 One of the most contentious issues raised during the Inquiry was educational television. Certainly, the Committee received evidence about much newer and possibly more revolutionary technology, but it was often pointed out that television is a potentially powerful tool of education which remains underutilised more than 30 years after being introduced to Australia.

5.63 As mentioned in Chapter 2, the major barrier to greater use of television in education has been the high cost of producing broadcast quality programs *vis a vis*the size of the target audience. Moreover, not only do views differ over whether television can be applied successfully to formal education, they differ over the educational purpose for which it should be applied. For some, the greatest educational potential of television is found in the capacity to broadcast programs to a large audience. For others, it is in the scope for interaction between the program presenters and a dispersed audience.

5.64 Many television programs can be considered 'educational' because they are informative: current affairs programs and documentaries, for example, fall within this category. Programs which contribute to formal coursework are less common, and the Committee uses the term 'educational television' to refer to these programs.

5.65 There is considerable variation in the extent to which the agencies involved in Australian television are actively involved in educational television. The ABC has been producing television programs for schools for more than 30 years, and has broadcast Learning Network programs for other students; the SBS has broadcast educational programs for TV Ed and Learning Network

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[23] D A Inglis, *Submission*, p 3.
[24] D A Inglis, *Evidence*, pp 642-643.

during downtime; the commercial television stations in metropolitan areas do not produce or broadcast educational programs at all; and the Remote Commercial Television Service operators broadcast them as required by their licences and, in Western Australia, as part of the Ed-TV project.

5.66 In order to be cost-effective, educational programs broadcast by the major television networks must be of interest to an audience which is as large and diverse as possible. This economic imperative has advantages for education. The wide coverage permitted by major broadcasters, extending beyond students enrolled in courses, is considered to be extremely important in raising the awareness of the general community about educational opportunities. An evaluation of a Learning Network program which was televised in support of a hospitality course, for example, estimated that for every enrolled student watching there were 160 other viewers.[25]

5.67 The purpose of the ABC school television productions has been to assist teachers in the classroom. While the productions once consisted of live broadcasts of lessons delivered by teachers, they now utilise the full range of techniques available to television:

> Maths and science programs are ... designed to arouse curiosity, to raise questions, to model enquiry processes, to be fun, rather than to demonstrate answers. Language programs are embedded in their culture using carefully selected graded language patterns, but leaving the basic instruction to the teacher or to other media such as audio-cassettes or work books. The best history programs are those that use authentic documentary footage of the event. English programs dramatise plays and novels, stimulating reluctant readers to turn to the original. Television can ease the difficulties found by teachers of personal development by providing a focus outside the pupils' own experience, allowing them to deal with intrusive subjects such as child abuse, sexuality or anti-social behaviour.[26]

5.68 The national TV Ed project has built on the tradition established by the ABC but has expanded into tertiary education and staff development programs. While the production standards are not always as high as those of the ABC, developing the programs is very costly. The expense is due not only to the production costs per program but to the voracious appetite of television for new material. Indeed, the greater use of educational television is constrained more by the lack of funds than by the availability of time for broadcast or the inaccessibility of those time slots for people with daytime jobs. Many production facilities in educational institutions are underutilised and the equipment outdated because funding priorities have been elsewhere:

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[25] Learning Network, 'Business of hospitality telecourse evaluation', by Rosh, White and Associates, *Submission*, p 4.

[26] H Clark, 'ABC television and adult education', *Proceedings of the National Conference for the Australian Society for Educational Technology, Designing for Learning in Industry and Education*, Canberra, 1988, p 14.

> Experience to date indicates that the production of large quantities of even low budget programs can be a more difficult and costly exercise than previously anticipated.[27]

This problem also emerged in Western Australia's Ed-TV project:

> Murdoch University has a large studio, but little equipment, less staff and next to no production budget. Nonetheless, they have struggled together to put up a program for each week of Ed-TV ...[28]

5.69 In response to a direct question as to the adequacy of the volume of educational material for television, one witness answered:

> ... I think it is a bit difficult to say that you could fill an actual station at this stage ... There is certainly quite a lot of material from overseas that could be used, but I think it is better to start at a scale where you are saying "we can manage this amount", and then build from there into the longer term.[29]

5.70 The TV Ed project is a remarkable achievement in national cooperation and tenacity in an environment of expenditure restraint. Expansion of the project to achieve further economies of scale and allow greater access by the broader community to educational opportunities is desirable, and the Commonwealth Government has been asked to provide $950,000 for this purpose.

5.71 The Committee would be reluctant to endorse a proposal which separated the administration of funds for televised materials from the administration of funds for other educational materials. There is a continuing need to ensure that the televised programs are relevant and are being used in the delivery of formal coursework. For this reason, the Committee would prefer that Commonwealth funds for educational television were drawn from the allocations to State governments for education and those to distance education centres for external higher education studies.

5.72 Funding also could be sought from industry for vocationally oriented educational television programs, which could also be distributed in videotaped form. Moreover, further economies of scale could be achieved by marketing or transmitting the programs overseas. The recently established Emerald Network project, for instance, which aims to broadcast via the Indonesian PALAPA B2 satellite to Indonesia, Burma, Southern China and the Philippines to students

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[27] P J Hosie, 'Realistic uses of AUSSAT for distance education in Western Australian primary and secondary schools, *Submission*, p 15.
[28] J C Lange, 'Talk-back television: the Western Australian experience', *Submission*, p 6.
[29] M Crooke, *Evidence*, pp 830-831.

who are undertaking courses offered by Australian educational institutions, expects to reach an audience of 50,000 - 100,000 people initially, and potentially many more.

5.73 Pessimism about the availability of programs is not unanimous. In contrast to evidence received about the difficulties of producing programs, it was observed that:

> Fortunately there is already quite a wealth of locally produced educational material on the shelves of our institutions. Theoretically much of this should be available for broadcast at cost.
>
> There is almost certainly a quantity of non-local material available for broadcast at a reasonable price and this source could be a useful supplement.[30]

5.74 It has been proposed for some time that a national television network be established. Broadly, the alternatives presented are either to build on the national efforts of the TV Ed project or to build on local efforts, such as proposals by Box Hill TAFE and the Australian Society for Education Technology, to broadcast to limited geographical areas on UHF frequencies.

5.75 Having considered all the evidence presented, the Committee is of the view that a national television channel dedicated only to education is not appropriate in terms of cost-effectiveness and educational need. Nonetheless, the efforts of State governments and individual institutions to produce and broadcast high quality educational programs must be better supported. The Committee recommends that:

> **by 1 January 1991 metropolitan and regional commercial television broadcasters be required to broadcast educational programs as a condition of their licences, similar to the arrangements applying to remote commercial television services.** *(Recommendation 11)*

5.76 As noted above, many commentators believe that the advantage of using television for education is not so much its capacity to reach large audiences as its capacity to be used for interaction with a widely dispersed audience:

> "Candid Classroom" techniques yield better education at a fraction of the cost of video productions. An instructor teaches a normal class, with video cameras placed in the audience. The addition of a telephone conference call

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[30] A B Greig and J G Hedberg, 'A national educational television network for Australia - why, how and when', *Proceedings of the National Conference for the Australian Society for Educational Technology, Designing for Learning in Industry and Education,* Canberra, 1988, p 11.

> allows distant classrooms to ask questions EXACTLY as if they were physically present. Students isolated by distance or handicapp can participate from their homes.[31]

5.77 Interactive television has been transmitted by a commercial broadcaster, Golden West Network. A series of programs, called 'Education Talkback', was designed and presented in 1987. Viewers were able to ring a toll-free 008 number and direct questions and comments to a panel of experts in the Ministry of Education's television studio. Because of the large and diverse audience, the programs, and the questions asked of the panel, had to be of broad interest and not too complex:

> For example, in those programs primarily aimed at teachers, for whom a degree of prior knowledge of the topic could be assumed, a certain amount of time was spent explaining the background to the topic, so that the rest of the program would make more sense to a casual viewer.[32]

5.78 The alternative is to target the programs to specific groups of people. TSN 11, for example, 'narrowcasts' interactive television via satellite to particular institutions. UHF transmission, providing line-of-sight coverage, is suitable for small audiences, but it does not allow the specific targeting that satellite transmission can provide. As compressed video becomes more affordable, it could be used for talkback television between institutions, taking over some of the services offered in Queensland by TSN 11.

5.79 The Committee was very impressed by the TSN 11 operations, primarily because they can reach remote and metropolitan areas simultaneously, they permit a wide range of organisations access to a form of communication which otherwise would not be available to them, and they allow the material transmitted to reflect the requirements of a selected audience.

5.80 The Committee recommends that:

> **the Commonwealth and the State governments support and extend innovations in the use of 'narrowcast' television for educational purposes, particularly in the possibilities presented by the use of compressed video.** *(Recommendation 12)*

5.81 The potential and the cost-effectiveness of educational television will be affected significantly if the Commonwealth Government were to decide to permit the widespread introduction of pay television, delivered by cable or as radiated subscription television (RSTV). The issue is actively being considered

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[31] J C Lange, *Submission*, p 1.
[32] A Dean, 'Educational talkback: television for interactive learning', *Australian Journal of Educational Technology*, Vol 4, No 1, 1988, p 49.

by the Commonwealth Government at the moment. Certainly, pay television could restrict access by financially disadvantaged people but it also could open new opportunities for education.

5.82 An extensive report on pay television was completed by the Australian Broadcasting Tribunal in 1982. The Tribunal concluded that cable television is 'a far more suitable medium for access and special purpose use than RSTV' but also that educational cable television services 'cannot generally be economically self supporting'. These findings were based on overseas experience, where the pattern of educational cable television projects was inadequate planning and funding; termination of the experiment; and disappointment. Moreover, the educational product overseas was reported to be substandard because of a lack of commitment by educators and a lack of support by cable companies.[33]

5.83 It is appropriate that the issue has been re-opened. Since the completion of the Tribunal's report, there have been significant changes in education which have led to better cooperation and better prospects for cooperation in the future. Able to plan and work together more effectively, education ministries and institutions could be capable of taking full advantage of any new educational television options.

5.84 With regard to the relative merits of the two forms of pay television, the Committee can see potential educational roles for both. Cable television can offer many more channels for education but it would not be introduced for some time - especially in some remote and rural areas. RSTV services can reach all Australians and, from 1992, the AUSSAT B Satellites will provide an enhanced capacity to do so.

5.85 In the United States of America cable systems operators with over 3 500 subscribers were required from 1972 to provide up to four access channels, one of which was to be available free for educational purposes for five years. Once the relevant regulations were overturned following a Supreme Court hearing in 1975, non-formal, community education and access was generally abandoned and replaced with more profitable entertainment programs.

5.86 Any widespread introduction of pay television in Australia should be accompanied by a similar legislative requirement. The Committee recommends that:

> **in the event of pay television being widely introduced in Australia there be a requirement that a specified amount of broadcast capacity be made available free for educational purposes, and that the service operators provide assistance in producing the educational programs which are broadcast.** *(Recommendation 13)*

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[33] Australian Broadcasting Tribunal, *Cable and Subscription Television Services for Australia*, Report, Parl Paper 389/1982, pp 204, 211, 213; Parl Paper 386/1982 p 12.83.

5.87 Regardless of whether or not pay television is introduced, there is a need for a national approach to educational television.

5.88 The Committee is concerned that the programs broadcast be of good quality and be relevant to formal coursework. Currently, divergent curricula and unwillingness to transfer credit between institutions militate against the viability of a national network. Moreover, adequate funding to produce a sufficient amount of quality material to support a network is not available.

5.89 Progress to date in overcoming these obstacles is commendable and further development should be supported. The locally initiated projects are no less important than the national project and there could be more scope for cooperation between the various interest groups in producing, marketing and broadcasting programs. Perhaps the AEC has a role to play, through the Education and Technology Conference.

Other Policy Issues

5.90 In this chapter the issues which were most frequently raised during the Inquiry as requiring national action have been highlighted. Other issues of concern are canvassed below.

Teaching and Technology

5.91 The need for a national effort in preservice and inservice teacher training in the use of technology for education was discussed in Chapter 4. The Committee notes that a priority issue for the AEC Education and Technology Conference currently is 'improved teacher education to enable more effective use of technology in education and learning'.

Credit Transfer

5.92 The capacity to transfer credit between courses and between institutions is an essential feature of open learning systems. Credit should also be considered for competencies gained at work, through informal courses and through life experience. The Department of Employment, Education and Training is actively pursuing this matter with higher education institutions.

Access to Equipment

5.93 It has been proposed that systems be developed to help students gain access to equipment, and especially computers. Audit regulations currently hamper initiatives by institutions to loan or rent equipment to students.

Industry Links

5.94 There continues to be a requirement to encourage industry to participate in providing learning opportunities. A suggestion has been made that tax incentive schemes be introduced to encourage investments in retraining schemes using learning packages delivered to the workplace.

Exports

5.95 There is clearly a growing international market for high quality products covering subjects studied universally such as the sciences and languages. Australia has a ready but discriminating market for such products in South East Asia and it is not restricted to this part of the globe. It is also clear that if Australia is not able to produce courseware of a sufficiently high quality for the international market we will increasingly become a net importer of such material.

Conclusion

5.96 In conclusion, the Committee is convinced that there is the opportunity for a 'great leap forward' in the use of technology in Australian education. The technology - a range of technologies - exists and offers an inspiring potential to extend access to education throughout Australia to broaden the range of courses available to students and to improve the quality of student performance.

5.97 The realisation of this potential requires clear vision, cooperative effort and persistence on the part of those responsible, beginning with the Commonwealth Government and the Australian Education Council. It requires consultation between the educational agencies and the telecommunications agencies. It requires a concerted and sustained program of staff development to make teachers familiar with the technology and its potential. It requires that a group of people expert in the area be given responsibility on a continuing basis to lead and facilitate these measures. It is not a matter for a one-off report and an isolated decision.

5.98 If these things are done, Australia would once again lead the world in the use of technology to enhance education and overcome disadvantage. Benefits would accrue to Australian students and a profitable export market could be tapped.

5.99 If these things are not done, and the present situation (which nobody regards as satisfactory) continues, a major opportunity will have been missed. The Committee supports the sentiments expressed by one witness who observed:

> I am just hoping that in this particular Inquiry other people's submissions and also mine will not end up going into a black hole or a void, because that has been our experience with many inquiries. I hope this one will be a strong exception. The information is generated, it just does not seem to go anywhere. It ends up on the desk of some guy who has 55 other reports to read and act on, and nothing actually occurs. I reckon that would be a great shame because this is an important junction in the development of education technology in this country.[34]

JOHN BRUMBY
Chairman
16 February 1989

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[34] P J Hosie, *Evidence*, p 259.

APPENDIX A

CONDUCT OF THE INQUIRY

On 25 May 1988 the Minister for Employment, Education and Training, the Hon J S Dawkins, MP, asked the Committee to inquire into 'the potential of new technology, particularly satellite technology, to improve educational access and outcomes in Australia'. Mr Dawkins added that the Committee should 'pay particular regard to the potential use of new technology, including computer technology, in distance, rural and remote education'.

Advertisements inviting submissions from the public appeared in major metropolitan and regional newspapers over the period 8-15 June 1988. Press releases and letters publicising the Inquiry also were distributed. The Committee received 109 submissions; those people and organisations that made submissions are listed at Appendix B.

The Committee also received evidence from 101 witnesses at public hearings over the period 6 September - 25 November 1988 and conducted a number of informal inspections and discussions. A list of witnesses appears at Appendix C, and a chronology of the hearings and inspections appears below.

Inspections and Hearings

5 July 1988	Inspections and discussions at the Western Australian College of Advanced Education
6 July 1988	Inspection of Audio-Visual Centre, Western Australian Department of Education
	Discussions with former Western Australian Satellite Education Advisory Group
	Inspection and discussions at Curtin University of Technology
	Inspection and discussions at Murdoch University
26 July 1988	Inspection and discussions at Darling Downs Institute of Advanced Education

27 July 1988	Inspection and discussions at School of Distance Education, Brisbane
	Inspection and discussions at TSN 11
	Inspection and discussions at Ithaca College of TAFE Electronic Learning Centre
	Demonstration at Ithaca TAFE of video disc produced for Univations Pavilion at Expo by Mr R Armstrong of the Prentice Computer Centre, University of Queensland
	Inspection and discussions at Brisbane College of Advanced Education
15 August 1988	Discussion at Radio 5UV, University of Adelaide
	Inspection and discussions at Adelaide TAFE
	Inspection and discussions at Broken Hill School of the Air
16 August 1988	Discussions with representatives of the Northern Territory Department of Education
	Inspection of Yuendumu School and discussions with representatives of the Yuendumu School Council, Warlpiri Media Association, and the Central Australian Aboriginal Media Association
17 August 1988	Inspection of Central Australian Aboriginal Media Association's facilities
	Inspection and discussions at Alice Springs School of the Air
6 September 1988	Public hearing - Perth
13 September 1988	Public hearing - Brisbane
14 September 1988	Inspection of Schools Across Australia project, Brisbane
	Inspection of computer managed learning facilities, Department of Economics, University of Queensland

21 September 1988	Public hearing - Melbourne
22 September 1988	Inspection and discussions at Deakin University
	Demonstration of equipment for visually and physically impaired students by Mr S Hosking, Warrnambool Institute of Advanced Education
23 September 1988	Public hearing - Sydney
4 October 1988	Public hearing - Melbourne
5 October 1988	Public hearing - Adelaide
24 November 1988	Public hearing - Canberra
25 November 1988	Public hearing - Canberra

APPENDIX B

SUBMISSIONS RECEIVED

Individuals

Allen, Ms G, Morven, Queensland

Bayne, Mr P, Australian National University
Berman, Ms P A, Weetangera, Australian Capital Territory
Beven, Dr T, Hackett, Australian Capital Territory
Bigum, Dr C, Deakin Institute for Studies in Education, Deakin University

Castles, Professor A C, University of Adelaide
Chirgwin, Mr R, Darwin Institute of Technology
Clark, Mr N J, Bendigo College of Advanced Education
Czernezkyi, Mr V, Northern Territory Department of Education

Devlin, Mr B J, Keperra, Queensland
Dunnett, Mr C W, Education Department, South Australia

Elliott, Mr N, Ministry of Education, Victoria

Fasano, Professor C, University of Wollongong

Galligan, Ms J, Brisbane
Gledhill, Professor V X, Macquarie University
Gudiksen, Mr V, Rockhampton, Queensland
Guiton, Mr P, Murdoch University

Haberecht, Mr N, Ainslie, Australian Capital Territory
Harper, Dr B M, University of Wollongong
Hermann, Mr A, Darwin Institute of Technology
Hosie, Mr P, Kingsley, Western Australia

Inglis, Mr D A, Royal Melbourne Institute of Technology

Kelly, Professor J C, University of New South Wales
Kemmis, Professor S, Deakin Institute of Studies in Education, Deakin University

Lee, Mr J H, Muldoon Information and Resource Centre, Tuggerah
Lockwood, Mr J, South Australian College of Advanced Education
Lundin, Dr R, Brisbane College of Advanced Education

Marsh, Mr J F, Orana Community College
Millar, Mr A C, Victoria College
Mune, Ms M, South Australian Institute of Technology

Paltridge, Mr S, University of Wollongong
Parker, Mr I W, Broken Hill High School, New South Wales

Robottom, Dr I M, Deakin University

Samuel, Ms A R, Pilot Project for Parent Education, Victoria
Smith, Mr P J, Gordon Technical College
Stanford, Mr J D, University of Queensland

Tuovinen, Mr J E, Riverina-Murray Institute of Higher Education

Watson, Mr G J, Mallee Cluster Implementation Committee
White, Dr P B, La Trobe University

Educational Institutions

Bellaire, Ceres, Freshwater Creek and Mt Moriac Primary Schools, Victoria
Box Hill College of Technical and Further Education
Brisbane College of Advanced Education
Broadmeadows College of Technical and Further Education

Curtin University of Technology and the University's Educational Media Centre

Darling Downs Institute of Advanced Education
Deakin University

Gippsland Institute of Advanced Education (School of Applied Science)

Karratha College

Murtoa High School, Donald High School and Birchip Community Education Complex, Victoria

New South Wales State Conservatorium of Music

Orange Agricultural College

Port Augusta School of the Air
Primary Correspondence School, Victoria

Roseworthy Agricultural College

Sunraysia College of Technical and Further Education

University of New England

Wangaratta College of Technical and Further Education
Warrnambool Institute of Advanced Education
Western Australian College of Advanced Education

Organisations

Applied Learning Australasia Pty Ltd
Australian Open Learning Information Network
Australian Schools Catalogue Information Service
Australian Society for Educational Technology
- Australian Capital Territory Chapter
- New South Wales Chapter
- Victorian Chapter

Australian Vice-Chancellors' Committee
Australian Vice-Chancellors' Committee/Australian Committee of Directors and Principals in Advanced Education Joint Working Party on Networking
Austratech Communications

Central Australian Aboriginal Media Association

Educational Media Australia Pty Ltd

Golden West Network Limited

Hudson-Allen Limited

Isolated Children's Parents' Association
- Federal Council
- New South Wales Executive
- Western Australia

Learning Network Pty Ltd
Library Association of Australia, School Libraries Section (Western Australia Group)

McDonnell Douglas Limited
Mountain University

National Electrical and Electronic Industry Training Committee Ltd

Pacific Satellite Services Pty Ltd

Queensland Catholic Education Office; Association of Independent Schools, Queensland; Queensland Catholic Education Commission

Royal Flying Doctor Service of Australia (Western Australian Section) Inc.

Western Regional Council for Adult Education, New South Wales

Yuendumu School Council

2SER-FM

State Governments, Government Departments and Government Agencies

AUSSAT Pty Ltd
Australian Broadcasting Corporation - Adult Education Radio

Central East Regional Development Advisory Committee, Western Australia
Central South Regional Development Advisory Committee, Western Australia
Central West Regional Development Advisory Committee, Western Australia
Commonwealth Department of Employment, Education and Training
Commonwealth Department of Transport and Communications

Education and Technology Conference, Australian Education Council

New South Wales Department of Education
New South Wales Department of Technical and Further Education
Northern Territory Library Services, Northern Territory Department of Education

Queensland Department of Education
Queensland Department of Employment, Vocational Education and Training

South Australian Education Department, Western Area Office
South Australian Government
Sunrise School (a joint project of the Australian Council for Educational Research and the Musuem of Victoria)

TAFE National Centre for Research and Development Ltd
Tasmanian Government
Telecom Australia
TSN 11

Victorian Government
Victorian Ministry of Education
- Regional Board of Education, Loddon Campaspe Mallee Region
- Statewide School Support and Production Centre
- TV Ed Australia

Western Australian Government

APPENDIX C

WITNESSES WHO APPEARED AT PUBLIC HEARINGS

Abrahart, Mr A	Member, Education and Technology Conference of the Australian Education Council
Atkinson, Dr E P	Projects Director, Portfolio Policy Coordination Division, Ministry of Education, Victorian Government
Bishop, Mrs R	Consultant, National Electrical and Electronic Industry Training Committee Ltd
Bowen, Mr A J	Manager, Technology, Department of Employment, Vocational Education and Training, Queensland Government
Brownrigg, Dr E B	Director, Computing and Information Technology Bond University
Buck, Mr N L	Principal Executive Officer, Curriculum Issues Unit, TAFE and Skills Formation Division, Department of Employment, Education and Training
Burson, Mr G	Director of Projects, Open Learning Agency, Canada
Cane, Ms G G	Executive Director, Australian Schools Catalogue Information Service
Carss, Dr B W	Senior Executive Officer, Australian Vice-Chancellors' Committee/ Australian Committee of Directors and Principals in Advanced Education Joint Working Party on Networking

Clyde, Dr L A	Senior Lecturer, Department of Library and Information Studies, Western Australian College of Advanced Education; and Member, Library Association of Australia
Conboy, Mr I R	Senior Policy Officer, Information Systems - Telematics, Ministry of Education, Victorian Government; and Executive Member, Australian Open Learning Information Network
Corish, Mr B A	Member, Education and Technology Conference of the Australian Education Council; and Director, Curriculum Development Centre, Department of Employment, Education and Training
Crooke, Ms M	Executive Director, Learning Network Pty Ltd
Cowdroy, Mr C R	Inspector of Schools, Distance Education, Schools Directorate, Department of Education, New South Wales Government
Dalwood, Mr P J	Project Officer, Education Department, South Australian Government
Davis, Mr W M	Head of Sound Production, and Producer of Bushfire Radio, Central Australian Aboriginal Media Association
Deshon, Mr J P C	Manager, Continuing Education, Brisbane College of Advanced Education
De Sousa, Mr A O	Academic Registrar, Curtin University of Technology
Elliott, Mr N A	Telematics Consultant, Loddon Campaspe Mallee Region, Ministry of Education, Victorian Government

Eunson, Mr I B	Telematics Coordinator, Box Hill College of TAFE
Fasano, Prof C	Head, School of Policy and Technology Studies in Education, University of Wollongong
Ferris, Mr D J	TV Ed Australia Coordinator, Ministry of Education, Victorian Government
Foks, Mr J G H	Head of TAFE Off-campus Network, Ministry of Education, Victorian Government
Fox, Mr R M K	Acting Head, Educational Media Centre, Curtin University of Technology
Gal, Dr M	Senior Lecturer, School of Physics, University of New South Wales
Galligan, Ms J D	Project Coordinator, Schools Across Australia
Gardner, Mr J K	Executive Treasurer, Australian Open Learning Information Network
Gelonesi, Mr J	Producer, 2SER-FM
Genoni, Ms L C	Educational Consultant, Ministry of Education, Western Australian Government
Gilbert, Mrs A	Manager, Technology Projects, Office of TAFE, Western Australian Government
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