The Year 2000 Conundrum

Competition, Equity and Access

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Provided by:

Faculty of Science, Information Technology and Education

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Submitted for the degree of Master of Education Honours.

20.11.00
I hereby declare that the work herein, now submitted for the degree of Master of Education Honours of the Northern Territory University, is the result of my own investigations, and all references to ideas and work of other researchers have been specifically acknowledged. I hereby certify that the work embodied in this thesis has not already been accepted in substance for any degree, and is not being currently submitted for candidature for any other degree.
Synopsis

The purpose of this study was to investigate the research question “How effectively is Federal telecommunications policy addressing the current and emerging telecommunications needs of schools in the Northern Territory (NT)?” More specifically the study aimed to investigate the question “To what extent are rural and remote schools in the NT able to access the Internet by the existing telecommunications infrastructure?” Schools from the urban, rural and remote areas of the NT were the focus of the study. The study examined the growth in Internet access by urban and rural/remote schools in the NT in the three year period since schools established their initial Internet connection in 1996. A survey and case study methodology identified a number of emerging issues in the utilisation of the Internet in NT education.
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# Table of Contents

Abbreviations and Acronyms ........................................................................................................... xii
Glossary of Terms .............................................................................................................................. xiv

Chapter 1 - Introduction .................................................................................................................... 1
  1.0 Introduction ......................................................................................................................... 1
  1.1.0 Definition of Terms ........................................................................................................ 3
    1.1.1 Profile of the Northern Territory ................................................................................ 4
  1.2.0 Geographic and Demographic Profile of the Northern Territory .................................... 4
    1.2.1 Transport and Communication in the Northern Territory ....................................... 6
    1.2.2 Climatic Conditions of the Northern Territory ....................................................... 7
    1.2.3 Economic Profile of the Northern Territory ............................................................ 8
    1.2.4 The Public Sector ....................................................................................................... 8
  1.3 Educational Provision in the Northern Territory ..................................................................... 9
  1.4 Liberalisation of the Telecommunications Industry and the Impact on NT Education ...................... 12
  1.5 Methodology ...................................................................................................................... 13
  1.6 Conclusion ........................................................................................................................... 13

Chapter 2 - Literature Search .......................................................................................................... 14
  2.0 Introduction ......................................................................................................................... 14
  2.1.0 Northern Territory Telecommunications History: Introduction ................................... 15
    2.1.1 Northern Territory Telecommunications History: 1871–1997 .................................. 15
  2.2 The Telecommunications Corridor ..................................................................................... 18
  2.3.0 Telecommunications Issues in the 1980s, 1990s and 2000 ............................................ 19
    2.3.1 Education - Rural and Remote Schools ...................................................................... 19
    2.3.2 Distance Education .................................................................................................... 21
    2.3.3 Satellite Access .......................................................................................................... 23
    2.3.4. The Telecommunications Regulatory Regime of the 1980s .................................. 24
    2.3.5. Aboriginal Social and Economic Aspirations ......................................................... 26
  2.4 The Internet in Northern Territory Education ...................................................................... 26
  2.5 Conclusion ........................................................................................................................... 27

Chapter 3 - Do we have a Failure to Communicate? ...................................................................... 29
  3.0 Introduction ........................................................................................................................... 29
  3.1 Public Choice Theory .......................................................................................................... 29
6.1 1996 Computing in NT Schools Survey .........................................................  69
6.2 2000 Survey: Growth and Development of the Internet .................................  71
6.3.0 Inhibiting Factors in the Use of the Internet ................................................  73
  6.3.1 Lack of Trained Personnel ...................................................................  74
  6.3.2 Phone Lines .......................................................................................... 74
  6.3.3 Lack of Dedicated Phone Line ............................................................. 75
  6.3.4 Cost ....................................................................................................... 75
6.4 Prioritised Computer Support Needs ..............................................................  76
6.5 Means of Internet Access ..............................................................................  77
6.6 Educational Applications ................................................................................ 78
6.7 Conclusion ....................................................................................................... 78

Chapter 7 - Case Studies ............................................................................................... 80

Chapter 7 - Case Studies

7.0 Introduction .....................................................................................................  80
7.1.0 Case Study 1 ............................................................................................... 80
  7.1.1 Direct Educational Outcomes of the Utilisation of Technology ...........  82
  7.1.2 Identified Factors that Inhibit the Use of Technology/the Internet ......  82
  7.1.3 Identified Issues in Exploring the Use of Technology/the Internet .....  83
7.2.0 Case Study 2 ............................................................................................... 83
  7.2.1 Direct Educational Outcomes of the Utilisation of Technology ...........  84
  7.2.2 Identified Factors that Inhibit the Use of Technology/the Internet ......  84
  7.2.3 Identified Issues in Exploring the Use of Technology/the Internet .....  84
7.3.0 Case Study 3 ............................................................................................... 85
  7.3.1 Direct Educational Outcomes of the Utilisation of Technology ...........  86
  7.3.2 Identified Factors that Inhibit the Use of Technology/the Internet ......  86
  Identified Issues in Exploring the Use of Technology/the Internet ...........  87
7.4.0 Case Study Four ........................................................................................... 87
  7.4.1 Direct Educational Outcomes of the Utilisation of Technology ...........  88
  7.4.2 Identified Factors that Inhibit the Use of Technology/the Internet ......  88
  7.4.3 Identified Issues in Exploring the Use of Technology/the Internet .....  88
7.5.0 Case Study 5 ............................................................................................... 88
  7.5.1 Direct Educational Outcomes of the Utilisation of Technology ...........  90
  7.5.2 Identified Factors that Inhibit the Use of Technology/the Internet ......  90
  7.5.3 Identified Issues in Exploring the Use of Technology/the Internet .....  90
List of Figures

Graph 1.0 Data Source Statistics and Demographic Branch of the NTDE 2000 .......... 10
Graph 1.1 Data Source Statistics and Demographic Branch of the NTDE 2000 .......... 10
Graph 1.2 Data Source Statistics and Demographics Branch NTDE 2000 ............... 11
Graph 5.3 Data Source Statistics and Demographic Branch NTDE 2000 .................. 62
Graph 5.4 Data Source 1996 Survey of Computing NT Schools ............................. 62
Graph 5.5 Data Source Statistics and Demographic Branch NTDE ....................... 63
Graph 5.6 Data Source 1996 Survey of Computing NT Schools ............................ 63
Graph 5.7 Data Source Statistics and Demographic Branch ................................. 65
Graph 5.8 Data Source 2000 Computing in NT Schools Survey ............................ 65
Graph 5.9 Data Source Statistics and Demographic Branch of the NTDE ............... 66
Graph 5.10 Data Source 2000 Computing in NT Schools ...................................... 66
Graph 6.4: Number of Computer in Individual Schools that could access the
Internet. ......................................................................................................................... 72
Graph 6.5: Analysis by Region of the Number of Computers per School That Could
Access the Internet in 2000. .................................................................................... 73
List of Tables

Table 1.0 Population Density (December 1998) ............................................................. 5
Table 1.2 Population Distribution as of June 1998 .......................................................... 6
Table 6.0 Q 19 (1996 Survey Numbers of computers in your schools have permanent phone line – i.e. They are always connected [to the internet] via a modem? .......................................................................................................................... 70
Table 6.1 Q 44(1996 Survey) Approximately how many weeks, months, and years since your school started using the Internet ................................................................................. 71
Table 6.2 Q. 50 (1996 Survey) what factors, if any, inhibit the use of the Internet in your school? ........................................................................................................................................ 71
Table 6.3 Q 15 (2000 Survey). Number of computers that can access internet simultaneously ......................................................................................................................................... 72
Table 6.5 (2000 Survey) Q24 (2000 Survey) What factors, if any, inhibit the use of the internet in your school? .......................................................................................................................... 73
Table 6.5 Q 26 (2000 survey) If you could prioritise tbr computer support your school needed what would your current priorities be? ................................................................. 76
Table 6.6 Q 18. (2000 Survey) How does your school currently access the Internet? ........................................................................................................................................ 76
Table 6.7 Q 22 (2000 Survey) How is the Internet utilised by your school? .......... 78
## Abbreviations and Acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AARNet</td>
<td>Australian Academic Research Network</td>
</tr>
<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
</tr>
<tr>
<td>ACA</td>
<td>Australian Communications Authority</td>
</tr>
<tr>
<td>ACCC</td>
<td>Australian Competition and Consumer Commission</td>
</tr>
<tr>
<td>ARPANET</td>
<td>Advanced Research Projects Agency Network</td>
</tr>
<tr>
<td>AVCC</td>
<td>Australian Vice Chancellors Committee</td>
</tr>
<tr>
<td>AUSSAT</td>
<td>Australian Domestic Communications Satellite System</td>
</tr>
<tr>
<td>BT</td>
<td>British Telecommunications</td>
</tr>
<tr>
<td>CAD</td>
<td>Computer Assisted Design</td>
</tr>
<tr>
<td>CD</td>
<td>Compact Disc</td>
</tr>
<tr>
<td>CD-ROM</td>
<td>Compact Disc- Read Only Memory</td>
</tr>
<tr>
<td>CEC</td>
<td>Community Education Centre</td>
</tr>
<tr>
<td>CIRCIT</td>
<td>Centre for International Research on Communication and Information Technologies</td>
</tr>
<tr>
<td>CPE</td>
<td>Customer Premise Equipment</td>
</tr>
<tr>
<td>CSIRO</td>
<td>Commonwealth Research Organisation</td>
</tr>
<tr>
<td>CTN</td>
<td>Consumers Telecommunications Network</td>
</tr>
<tr>
<td>DEETYA</td>
<td>Department of Education, Employment and Training and Youth Affairs</td>
</tr>
<tr>
<td>DRCS</td>
<td>Digital Radio Concentrator System</td>
</tr>
<tr>
<td>DSP</td>
<td>Disadvantaged Schools Program</td>
</tr>
<tr>
<td>DCITA</td>
<td>Department of Communication, Information Technology and the Arts</td>
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<tr>
<td>EdNA</td>
<td>Education Network Australia</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FCC</td>
<td>Federal Communications Authority</td>
</tr>
<tr>
<td>HF</td>
<td>High Frequency</td>
</tr>
<tr>
<td>IAIO</td>
<td>Improved Access Improved Opportunity</td>
</tr>
<tr>
<td>IBM</td>
<td>International Business Machines</td>
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</tbody>
</table>
ICS  Information Communication Systems
IMG  Implementation and Management Group
ISDN  Integrated Service Digital Network
ISP  Internet Service Provider
IT  Information Technology
Kbps  Kilobytes per second
Km  Kilometres
LITE  Long Term Interests of End Users
MOU  Memorandum of Understanding
NBI  National Bandwidth Inquiry
NEIC  National Energy Information Centre
NT  Northern Territory
NTDE  Northern Territory Department of Education
NTIA  National Telecommunication Information Association
NTU  Northern Territory University
OLSU  Open Learning Support Unit
PUC  Public Utilities Commission
OECD  Organisation for Economic Cooperation and Development
OTC  Overseas Telecommunications Corporation
OTL  Overland Telegraph Line
PMG  Post Master General
POTS  Plain Old Telephone System
PSTN  Public Switched Telephone Network
ROM  Read Only Memory
RTIF  Regional Telecommunications Infrastructure Fund
UK  United Kingdom
US  United States
USA  United States of America
USO  Universal Service Obligation
VAN  Value Added Network
VHF  Very High Frequency
### Glossary of Terms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Term</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUSSAT</td>
<td>Australian Domestic</td>
<td>Established in 1981 - owned and operated Australia's communications satellite and its functions included the broadcasting and provision of private network services</td>
</tr>
<tr>
<td></td>
<td>Communications Satellite</td>
<td></td>
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<tr>
<td></td>
<td>System</td>
<td></td>
</tr>
<tr>
<td>Bandwidth</td>
<td></td>
<td>Indicated the amount of information that can be transmitted in a given time.</td>
</tr>
<tr>
<td>Broadband</td>
<td></td>
<td>A Communications System of high bandwidth; capable of carrying large amounts of data.</td>
</tr>
<tr>
<td>Digital</td>
<td></td>
<td>A system in which information is handled electronically in the form of discrete pulses or bits.</td>
</tr>
<tr>
<td>DRCS</td>
<td>Digital Radio Concentrator</td>
<td>Rural radio telephone link devised by Telecom.</td>
</tr>
<tr>
<td></td>
<td>System</td>
<td></td>
</tr>
<tr>
<td>Ghz</td>
<td>Gigahertz</td>
<td>A unit of frequency corresponding to 1000 Mhz.</td>
</tr>
<tr>
<td>HF</td>
<td>High Frequency</td>
<td>Part of the radio frequency used for long distance communication.</td>
</tr>
<tr>
<td>ISDN</td>
<td>Integrated Service Digital</td>
<td>A digital network, as opposed to analogue, and capable of carrying higher volumes of data.</td>
</tr>
<tr>
<td></td>
<td>Network</td>
<td></td>
</tr>
<tr>
<td>Kbps</td>
<td>Kilobytes per second</td>
<td>Amount of data transferred per second.</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Term</td>
<td>Meaning</td>
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<tr>
<td>--------------</td>
<td>-------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Mhz</td>
<td>Megahertz</td>
<td>A unit of frequency equal to 1,000,000 hertz.</td>
</tr>
<tr>
<td></td>
<td>Microwave</td>
<td>A portion of the radio spectrum from approx. 1 Ggz to 40 Ghz. Usually capable of line of sight transmission only.</td>
</tr>
<tr>
<td>OTC</td>
<td>Overseas Telecommunications</td>
<td>A commission established in 1946 with the responsibility of handling overseas telecommunications traffic.</td>
</tr>
<tr>
<td></td>
<td>Commission</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tropospheric Scatter System</td>
<td>A specialised microwave link which forced signals over the horizon by a combination of powerful transmitters aerials and receivers.</td>
</tr>
<tr>
<td>USO</td>
<td>Universal Service Obligation</td>
<td>A legislated goal of Australian telecommunications policy since 1975. The USO includes consumer access, geographic coverage and technological standard.</td>
</tr>
<tr>
<td>VHF</td>
<td>Very High Frequency</td>
<td>Portion of the radio frequency spectrum between 30 and 300 Mhz.</td>
</tr>
</tbody>
</table>
Chapter 1

Introduction

1.0 Introduction

The purpose of this study was to investigate the research question “How effectively is Federal telecommunications policy addressing the current and emerging telecommunications needs of schools in the Northern Territory (NT)?” More specifically, the study aimed to investigate the question “To what extent are rural and remote schools in the NT able to access the Internet by the existing telecommunications infrastructure?”

Schools in the urban, rural and remote areas of the NT were the focus of the study, which examined the growth in their Internet access over the three year period since schools established their initial connection to the Internet in 1996. A survey and case study methodology identified a number of emerging issues in the utilisation of the Internet by NT schools (see Chapter 5).

Since 1996 there has been significant growth in Internet usage by NT schools. This growth has been reflected in the number of schools that have established an Internet connection as well as the number of computers in schools that can access the Internet (see Chapter 6). Whilst change and innovation characterise modern education, very few innovations are adopted system wide. As White has argued,

The quite radical changes in education over the past thirty years reflect different influences and pressures-from governments, from teachers, from employers, from parents as well as from the students themselves. And they also reflect quite different responses to the context in which education and training are taking place. (1997:26)

The impact of the Internet on Territory schools education has been significant (see Chapter 8). As evidenced by the research project there has been, in the past three years, considerable interest by urban, rural and remote NT school-based personnel in the utilisation of the Internet in education (See Chapter 7). The growth of the Internet in NT schools education has, however, been predominantly in urban schools. The emerging disparity in Internet access, as evidenced by this research project, is
influenced by a number of factors beyond the traditional constraints of curriculum reform (White, 1997; Organization for Economic Co-operation and Development, 1976; Hillson and Hyman, 1974; Evans, 1997).

The Internet was first introduced to schools in the NT in 1996. A Commonwealth funded project, the Improve Access Improve Opportunity (IAIO) project assisted schools identified as disadvantaged to gain access to the Internet by supplying each project school with one 28.8 kilobytes per second (kbps) Hayes modem, subsidised telephone calls and Internet Service Provider (ISP) access. The IAIO project coincided with the commercialisation of the Internet and the deregulation of the telecommunications industry. Since the commercialisation of the Internet and the deregulation of the telecommunications industry in 1997 not only has a significant Internet industry emerged in the NT, but the telecommunications usage and needs of Territorians have also altered considerably.

As the literature search revealed, telecommunications access in the Territory has evolved in a sporadic fashion in which the less populated areas of the Territory have been disadvantaged (see Chapter 2). Historically, the areas in the Territory that have had the most to gain from improved telecommunications access have had the poorest service (Implementation and Management Group (IMG), 1980; Legislative Assembly of the Northern Territory, 1985; Department of Industries and Development, 1987; Office of Technology and Communications, 1985; Northern Territory Government, 1987; Department of Chief Minister, 1985; Northern Territory Government, 1982; Department of Chief Minister Northern Territory, 1983; Officials of the Northern Territory Government, 1980). Without direct Federal Government intervention, the telecommunications regulatory regime that came into force with the deregulation of the telecommunications industry in 1997 has the potential to exacerbate the disparities in telecommunications access rural and remote residents of the NT experience (see Chapters 2 and 3 and 7).

The research project places the current and emerging telecommunications needs of NT schools within a broader policy context. In Chapter Three the global trend towards telecommunications privatisation and deregulation is discussed. The principles behind a market-driven approach to telecommunications growth and development
are examined against a background of the economic, legal and social objectives of a deregulated Australian telecommunications industry. The privatisation of Telstra, Australia's national communication carrier, is placed within a contemporary context and examined from a public choice perspective.

An overview of the historic significance of the Universal Service Obligation (USO) and the role of the USO in maintaining social equity to telecommunications access is provided in Chapter Four. The current and emerging telecommunications needs of the NT are placed in a contemporary context and the growth in bandwidth demand is examined from the perspective that the goals of social equity and geographic coverage are fundamental to a viable telecommunications industry in the NT. Chapter Four also briefly examines the United States model of telecommunications policy that provides discounted digital data access to disadvantaged schools, libraries and health centres.

1.1.0 Definition of Terms

The following definitions are provided to ensure the uniformity and understanding of certain key terms throughout the study. All definitions not accompanied by a citation were developed by the researcher. The terms ‘infrastructure’, ‘privitisation’ and ‘deregulation’ have been used frequently throughout the study. The definition of these terms, as referred to in the study, has been derived from Webster's Dictionary (2000).

According to Webster's Dictionary (2000) the definitions of ‘infrastructure’ includes “…the underlying foundation or basic framework (as of a system or organization), the permanent installations required for military purposes” or, “the system of public works of a country, state, or region; also: the resources (personnel, buildings, or equipment) required for an activity.” For the purpose of this study, ‘infrastructure’ has this ascribed definition: “…the system of public works of a country, state, or region; also: the resources (personnel, buildings, or equipment) required for an activity.”

The terms ‘privatisation’ and ‘deregulation,’ when used in an economic, legal and political context, have different nuances. For the purpose of the study, the term ‘privatisation’ has the ascribed definition “to change (as a business or industry) from public to private control or ownership.” ‘Deregulation’ is defined as “…the act or
process of removing restrictions and regulations.” At times, throughout this research project, the terms have been used interchangeably; however, their meaning can be derived from the context in which they appear.

The terms ‘rural’ and ‘remote’ have been used frequently throughout the project to broadly define geographic location. The term ‘remote’, as used in this study, is defined as “…out of the way, secluded” and the term ’ rural’ has the ascribed definition: “…relating to the country, country people or life.” Both definitions have also been derived from Webster's Dictionary (2000).

1.1.1 Profile of the Northern Territory

In order to understand the context in which this research project occurred, this chapter provides a geographic, demographic and climatic profile of the NT. The economy of the Territory, the transport and communications sectors as well as the public sector are also outlined. The education provision in the NT is also discussed in detail this chapter.

1.2.0 Geographic and Demographic Profile of the Northern Territory

The Northern Territory (NT) is situated in the central and northern regions of Australia. In comparison to other states and Territories the NT is geographically isolated from all the major population centres of Australia (see Appendix 1). Darwin, the capital city of the NT, is closer to Kupang in South East Asia, than it is to any major Australian city. The NT covers 1 346 200 square kilometres. In relation to Australia's seven States and Territories the NT occupies 17.5 per cent of the total land mass, “…an area 30 per cent larger than the combined areas of New South Wales and Victoria” (DEETYA, 1996).

Despite the geographic size of the Territory, the population represents less than 1 per cent of the total Australian population. The population density of the Territory is approximately 0.1 person per square kilometre (ABS, 1998) making it the least populated area of Australia.
Table 1.0 Population Density (December 1998)

<table>
<thead>
<tr>
<th></th>
<th>Persons per Km$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victoria</td>
<td>20.6</td>
</tr>
<tr>
<td>Queensland</td>
<td>2.0</td>
</tr>
<tr>
<td>Western Australia</td>
<td>0.6</td>
</tr>
<tr>
<td>South Australia</td>
<td>1.9</td>
</tr>
<tr>
<td>Tasmania</td>
<td>6.9</td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td>131.8</td>
</tr>
<tr>
<td>Northern Territory</td>
<td>0.1</td>
</tr>
<tr>
<td>New South Wales</td>
<td>8.0</td>
</tr>
</tbody>
</table>

(Source ABS Cat. No 3101.0 and Treasury)

According to the Australian Bureau of Statistics, as of September 1999 the total Territory population was 193,400, of which 28.5 per cent were identified as Aboriginal (ABS, 1999b). The NT has the highest percentage of indigenous population compared to any other State or Territory in Australia (ABS, 1999c). The August 1996 census also identified that 22.5 per cent of the Territory population were born overseas, many from non-English-speaking backgrounds (cited by NT Government, 1999a).

In comparison to other Australian States and Territories the NT has a relatively young population. The median age of people who reside in the Territory was, as of June 1999, 28.6 years. The national median age of the total Australian population was, as of June 1999, 35 years (ABS, 1999d).

The majority of the Territory population reside in the major urban areas of Darwin, Palmerston, Tennant Creek, Nhulunbuy, Katherine and Alice Springs. The remainder of the population reside in communities throughout the Territory. The largest concentration of population is located in Darwin, the capital city of the NT. According to the ABS, as of June 1998 53.4 per cent of the total Territory population resided in the area that encompassed Darwin City and the Darwin region. However, 24 per cent of the population (approximately 46,500 people) resided in the remote areas of the NT (see Appendix 2).
Table 1.2 Population Distribution as of June 1998

<table>
<thead>
<tr>
<th>Location</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Darwin Region</td>
<td>53.4</td>
</tr>
<tr>
<td>Darwin City</td>
<td>36.5</td>
</tr>
<tr>
<td>Palmerston</td>
<td>9.1</td>
</tr>
<tr>
<td>Litchfield</td>
<td>7.8</td>
</tr>
<tr>
<td>Katherine</td>
<td>5.2</td>
</tr>
<tr>
<td>Nhulunbuy</td>
<td>2.0</td>
</tr>
<tr>
<td>Tennant Creek</td>
<td>2.0</td>
</tr>
<tr>
<td>Alice Springs</td>
<td>13.4</td>
</tr>
<tr>
<td>Rest of the Territory</td>
<td>24.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: ACS Cat. No. 3234.7

1.2.1 Transport and Communication in the Northern Territory

The Stuart Highway is the major road route into the Territory. The Stuart Highway originates in Adelaide in South Australia and terminates in Darwin. The Barkly Highway is the second major transport route. The Barkly Highway originates at Townsville on the eastern seaboard of Queensland and connects with the Stuart Highway at Tennant Creek in the NT. The Stuart and the Barkly Highway are utilised extensively by the heavy transports that service the economic sector of the Territory. Both major road routes transverse areas prone to seasonal flooding, and, as a consequence, towns along the Stuart and Barkly highway are not only geographically isolated but also frequently physically isolated.

Domestic airlines fly to both Darwin and Alice Springs, and, by 1999, there were six international airlines servicing the Territory. There is also an extensive aero charter industry in the NT. According to the NT government, there are approximately 45 major communities with airstrips, and many properties and outstations have airfields.

“The provision of air services to the remote areas of the Territory is particularly important in the Top End where roads are regularly impassable due to heavy wet season rains” (Northern Territory Government, 1999c).

The Transport and Communications industries have been a significant economic growth area. The Transport and Communications industries in the NT grew 68.3 per
cent over the period covering 1990–91 to 1996–97. This growth rate was 1.5 times the rate of national growth (Northern Territory Government, 1999c) (see Chapter 4.4).

Until the deregulation of the Telecommunications industry in 1997, Telstra was the only communications carrier in the NT. Under the present Universal Service Obligation (USO) (Telecommunications Act 1999 Consumer Protection and Service Standards), Telstra is required to provide 96 per cent of the Australian population with digital telephone coverage. The NT, however, because of its size and population distribution, has more than 25 per cent of the population in Australia who are not connected to the Internet.

### 1.2.2 Climatic Conditions of the Northern Territory

The NT is divided into two main regions. The northern half of the Territory is colloquially identified as the “Top End”. The region around Alice Springs is known as the “Centre”. Both regions have very distinctive climatic conditions (see Appendix 3, 4).

The Top End has a monsoonal climate with two main seasons, the Wet and the Dry (Bureau of Meteorology, 2000). The Dry season extends from May to September and the temperature, at this time of the year, ranges from 15 degrees to 32 degrees Celsius. The Wet season that extends from October to April is characterised by high humidity, violent electrical storms and torrential rains. During this season almost all of the average annual rainfall of 1400 mm occurs. The temperature during the Wet season ranges from 23 degrees to 36 degrees Celsius (Bureau of Meteorology, 2000).

The Centre, which includes the area that encompasses The Barkly, Alice Springs, and Tennant Creek, is situated in the semi-arid areas of the NT. The temperature in these areas ranges from minus four degrees to 45 degrees Celsius. From October to March the weather is very hot and humid with associated thunderstorm activity. Between April and September the days are generally cooler and the nights cold. The average annual rainfall of Alice Springs is approximately 330 mm (Bureau of Meteorology, 2000). Seasonal flooding also occurs in these areas (see Appendix 3 and 4).
1.2.3 Economic Profile of the Northern Territory

In recent years the NT has undertaken a number of significant projects that have had a positive impact on the economy. The relocation of the defence forces to Darwin and the development of Darwin's East Arm Port have contributed to a strong labour market, low unemployment rate and average weekly earnings which have been higher than the national average (Northern Territory Government, 1999a).

Mining, tourism and energy production have been the major contributors to the Territory economy. Rural industries such as cattle production and horticulture are also a significant aspect of the economic infrastructure of the NT. The construction industry is a key employment area that has, in recent years, been operating at high capacity to meet “...the demands of defence force relocations and the expansion of associated commercial activity” (Northern Territory Government, 1999a). In recent years a significant telecommunications industry has also emerged in the Territory (see Chapter 4.5.1).

1.2.4 The Public Sector

The public sector makes a significant contribution to the Territory economy and, according to the NT Government, is a major participant in a range of industries including Government Administration, Education, Defence, Health and Community Service (Northern Territory Government, 1999b).

Immediately preceding this research project the NT Government announced a comprehensive review of all government activities. The review, Planning for Growth, focused on four central themes. The themes were *Back to Core Business, Outsourcing, Taking Advantage of Economies of Scale* and *Keeping Government Small*. As a consequence of the Planning for Growth review both the Power and Water Authority and the Education and Health Services also undertook extensive reviews (Northern Territory Government, 1999b).

Education constitutes a large proportion of the NT public sector. As of May 2000 there were 186 schools and one university in the Northern Territory. An educational institute that focused on the educational needs of adult indigenous students was also located in the township of Batchelor. The Northern Territory University (NTU), which
was established in 1989, caters for the Vocational Education and Training (VET) sector as well as the traditional academic areas in higher education.

1.3 Educational Provision in the Northern Territory

Educational provision in the Territory is very diverse. Government schools, Independent schools and schools that come under the administration of the Catholic Education Office constitute the main educational provision in the Territory. The majority of schools in the NT are primary schools. In 1999 the Collins report *Learning Lessons*, an independent review of indigenous education, stated that there were 120 primary schools in the Territory, 17 high schools, three secondary colleges and 36 mixed (Transition to Year 12) schools (Collins, Lea and Tess, 1999:24). The remainder of the schools include special schools, a secondary correspondence school, two Schools of the Air, a School of Sport, the School of Languages and a School of Music.

The mixed schools, also known as Community Education Centres (CECs) cater for students from Transition to Year 12 and are generally located in the remote areas of the Territory. A number of remote schools are also hub schools for Homeland or Outstation schools. The Homeland schools are small, one-teacher schools, staffed by indigenous community members. The hub schools support the Homeland schools through frequent visits by outstation teachers who provide administrative assistance and curriculum support.

At the commencement of 2000, the 186 schools in the NT came under the administration of the NT Department of Education (NTDE), The Northern Territory Catholic Education Office or the Independent Schools Association of the Northern Territory. Each system was independent of the other. However, the NTDE fulfilled a number of administrative functions common to all three systems.

At the time of conducting this research project approximately 80 schools in the NT had telecommunications access via a Telstra landline. The majority of schools, however, accessed the telecommunications network via a microwave Digital Radio Concentrator System. A small number of schools had satellite telecommunications access.
According to the Statistics and Demographics branch of the NTDE as of April 2000 there were 41,356 students enrolled in schools throughout the NT (NTDE, 2000). The majority of the student population (73.34 per cent) attended school in the major urban areas of the Territory and 26.66 per cent of the student population attended schools located in the rural and remote areas of the Territory.

Whilst the majority of the student population attended school in the major urban areas of the Territory, the majority of NT schools were located in the rural and remote areas. As Graph 1 indicates, of the 186 schools in the NT, 46.24 per cent were located in the major urban areas and the remaining 53.76 per cent of schools were located in the rural and remote areas of the NT (see Appendix 5).

At the time of the research project there were 154 Government schools, 19 Catholic schools and 13 independent schools in the NT (NTDE, 2000). The Catholic education system included both primary and post-primary education in the urban, rural and remote areas of the NT. All of the independent schools were located in the major urban areas of the Territory. There were eight independent schools in Darwin and five in Alice Springs. As Graph 1.2 indicates, as of April 2000, 82.79 per cent of
schools in the NT were government schools, 10.21 per cent of schools came under the administration of the Catholic Education Office and 6.98 per cent of schools were members of the Independent Schools Association.

![Percentage of Government, Catholic and Independent schools in the NT as of April 2000](Image)

Graph 1.2 Data Source: Statistics and Demographics Branch NTDE 2000

Immediately preceding this project the NTDE had undergone an extensive review. As a consequence of the education review a progressive restructuring of the Education Department saw an increased focus on initiatives to support schools and school-based personnel in effecting improvements in student outcomes. As the Education Department articulated these aims in *Education Review-Making Schools our Focus:*

> As a result of the consultation process and the suggestions received by the Task Group, the priorities and direction of the Department of Education are to be redirected and coordinated to focus on schools, support for teachers and better outcomes for students. (NT Department of Education, 1998)

Within the context of the NTDE review, Information Technology, curriculum, resources and infrastructure were the focus of considerable departmental restructuring. As a consequence of the education review, Information Technology in NT schools was allocated $13 million dollars in the May 2000 NT budget. As an NT Government press release stated, “Territory schools will receive $13.5 million in the next two financial years to purchase new computers, upgrade the Information Technology network infrastructure and provide training to educators” (Northern Territory Government, 2000).
1.4 Liberalisation of the Telecommunications Industry and the Impact on NT Education

The commercialisation of the Internet and the liberalisation of the Australian telecommunications industry has had a considerable impact on education in the Territory. In 1995 the Open Learning Support Unit (OLSU) of the NT applied for, and received, a Commonwealth Government grant of $130 000. The grant was to assist in providing Internet access to schools in the NT. The project was known as the Improve Access, Improve Opportunity Project (IAIO) and specifically targeted schools that were identified as disadvantaged. As the NT Department of Education stated,

The target schools were those eligible for Disadvantaged School status with the addition of a few others (Special Schools or Country Area Program schools who were not previously identified as DSP [Disadvantaged Schools Program]). One hundred and twenty schools were directly involved in the project. All others were indirectly involved, through Internet access or CD Rom provision. (NT Department of Education, 1997c: 3)

The IAIO project ensured that all schools in the NT had, by the end of 1996, at least one computer equipped with a CD ROM and Internet access. A subsequent grant of $350 000 supported the implementation of the necessary hardware and software and raised the average student computer ratio to 1 in 40. Professional development was also a component of the project and schools were supported for twelve months through the appointment of regionally based project officers.

As evidenced by this research project, approximately 93 per cent of NT schools had an Internet connection by the beginning of 2000 (see Chapter 6). Schools obtained Internet access either through an independent Internet Service Provider (ISP) or via the Department of Communication and Information Systems (DCIS) network. A number of schools in the Katherine region formed part of a local network and obtained Internet access via a server administered by Katherine School of the Air. Satellite access was also utilised in a small number of remote schools.
1.5 Methodology

In order to answer the research question “To what extent are rural and remote schools in the NT able to access the Internet by the existing telecommunications infrastructure?” a survey and case study methodology was employed in the research project (see Chapter 5). The project involved two surveys which were distributed to all schools in the NT. The first survey was distributed at the conclusion of the IAIO project in 1996, and the second survey was distributed in 2000. The surveys were utilised to obtain quantifiable data to determine the growth and development of the Internet and network technology in NT education since schools first connected to the Internet in 1996. The research project also included a series of case studies drawn from schools in the urban, rural and remote areas of the NT (see Chapter 7). A comparative analysis of the data obtained from the two surveys and the case studies identified a number of emerging issues in the utilisation of the Internet in NT education (see Chapter 8).

1.6 Conclusion

This research report was compiled during the first semester of 2000. The purpose of the research project was to examine how effectively Federal telecommunications policy was in addressing the current and emerging telecommunications needs of schools in the Northern Territory. A survey and case study methodology was employed in the research project to try to gauge this. In order to understand the context in which the research project was undertaken an overview of the Northern Territory was included in this chapter as well as a rationale for placing the telecommunications needs of Northern Territory schools within a broader policy context.

An historical perspective of telecommunications access in the NT is included in the next chapter. The issues that have dominated telecommunications debate in the NT since the early 1980s-disparities in telecommunications access, satellite access as opposed to terrestrial telecommunications access, the telecommunications regulatory regime that existed prior to deregulation and the telecommunications needs of schools in the NT-are discussed in detail in Chapter Two.
Chapter 2

Literature Search

2.0 Introduction

This chapter provides an overview of the literature relevant to telecommunications needs of urban, rural and remote schools in the Northern Territory (NT). The commercialisation of the Internet, the deregulation of the telecommunications industry in 1997, and the subsequent exponential growth of the Internet, data communications and network technology has had a significant impact on the education sector and the telecommunications industry in the NT (see Chapter 4.5.1 and Chapter 8). However, a literature search conducted at the Northern Territory University (NTU), Darwin Public Libraries, Batchelor College Library and the Northern Territory Library located at Parliament House revealed that there is very little information available in regard to the telecommunications access in the NT. The literature that was available was written prior to the deregulation of the telecommunications industry and subsequent exponential growth of digital data technology. There was also a scarcity of literature in regard to the educational application of computers in NT education.

The education sector itself is linked to the economy in a number of ways (Australian Research Council Information Paper, 1997; International Association of Higher Education, 1997; Australian Library and Information Association, 1997). Not only does the education sector aim to provide a knowledgeable and skilled workforce, but its research function can also “…lead to the commercialisation of a new product or process in manufacturing, mining or agriculture, or to an improvement in environmental management, health care or social welfare” (Australian Research Council Information Paper, 1997). Given the scarcity of literature in the areas of telecommunications and educational computing, a study of the telecommunications needs of urban, rural and remote educational institutions in the NT is warranted. An economic perspective would also assist in placing the role of telecommunications in NT education within a contemporary context. Whilst the topic of the role of telecommunications in NT education had received attention in the preceding two decades, the literature search revealed that a contemporary analysis would supplement the existing literature.
2.1.0 Northern Territory Telecommunications History: Introduction

Since the laying of the Overland Telegraph Line (OTL) from Adelaide to Darwin in 1872 telecommunications issues have been linked to the social and economic well being of the citizens of the Northern Territory. Health, education, the administration of government services and the social and economic prosperity of Territory citizens have been enhanced by increased access to telecommunications services and products. As a submission to the Australian Communications Authority (ACA) 1997 Digital Data Review argued, “Telecommunications [access] has been a fundamental aspect of overcoming the distance and isolation inherent in living and working in the Territory” (ACA, 1997:43). However, as evidenced by the literature search (Implementation and Management Group (IMG), 1980; Legislative Assembly of the Northern Territory, 1985; Northern Territory Government, 1985), the history of telecommunications in the Territory has been a history encumbered by neglect and restrictive regulatory policies.

Telecommunications access in the Territory has evolved in a sporadic fashion, which has resulted in the less-populated areas of the Territory being disadvantaged (see Appendix 2). Historically, the areas in the Territory that have had the most to gain from improved telecommunications access have had the poorest service (IMG, 1980; Legislative Assembly of the Northern Territory, 1985; Department of Industries and Development, 1987; Office of Technology and Communications, 1985; Northern Territory Government, 1987; Department of Chief Minister, 1985; Northern Territory Government, 1982; Department of Chief Minister Northern Territory, 1983; Officials of the Northern Territory Government, 1980). Without direct Federal Government intervention the telecommunications regulatory regime that came into force with the deregulation of the telecommunications industry in 1997 has the potential to exacerbate the disparities in telecommunications access that rural and remote residents of the NT experience.

2.1.1 Northern Territory Telecommunications History: 1871–1997

Telecommunications first came to the Territory in 1871 when the British–Australian Telegraph Company brought ashore a submarine cable connecting Darwin via Java, to the international network. Until the submarine cable broke, Darwin was the only place
in Australia with international telegraph access. In the following year Sir Charles Todd completed the Overland Telegraph Line (OTL) that enabled Darwin and Alice Springs to connect to the Intercolonial Telegraph network. Over the following 60 years a small number of telephone systems were established in the main population centres; however, “…no effort was made to extend them very far…” (Legislative Assembly of the Northern Territory, 1985:11). The OTL was, until 1943, the only formal Post Master General's (PMG) link with the Southern States. Wartime pressure, however, necessitated connecting the Territory to the national telephone system.

During the period between 1872 until the early 1930s telecommunications access was restricted to the major population centres of the Territory. However, for residents in the rural and remote areas a major breakthrough in communications access came in the early 1930s with the introduction of High Frequency (HF) radio. This breakthrough was to lead to improvements in health, educational provision and social contact for outback residents. However, the instigation of HF radio in outback Australia was not an initiative of the PMG. As the 1985 Legislative Assembly of the Northern Territory Report to the Select Committee on Communications Technology stated,

This development … [HF radio] … was due to the vision and persistence of Dr John Flynn It was introduced by the Flying Doctor Service not the Post Master General (1985: 11)

After 1945 Federal interest in Northern Territory telecommunications appeared to lapse for roughly 30 years (Select Committee, 1985:11). During this period existing PMG facilities were slowly upgraded but it was not until 1974 and the establishment of the Darwin-Mt Isa microwave link that a new era in Territory telecommunications began (see Appendix 6).

In 1980 a report, commissioned by Telecom, now Telstra, to assess the telecommunications needs of remote Territory residents identified that there was “a great need for improved communications services in remote areas” (IMG, 1980:4). The report revealed that there were approximately 20 600 people, or 21 per cent of the total Territory population, living outside the reach of the Telecom communication
network, who did not have reasonable access to modem telecommunications services. The IMG report recommended that,

A much higher priority than at present should be given to the provision of a modern telephone service in the remote areas of the Northern Territory. (IMG, 1980:5)

The IMG report also recommended the deployment of the microwave Digital Radio Concentrator System (DRCS) as the technology to be utilised to service remote area telecommunications needs, with the proviso that an assessment of the relative cost of satellite access also be undertaken (IMG, 1980:6). The ensuing debate over the respective merits and relative cost of a DRCS system as opposed to a satellite-based communications system lasted for most of the 1980s. Telecom, however, elected to deploy a DRCS system and, as a consequence, committed itself to a terrestrial view of telecommunications access. With a maximum transmission speed of 2400 bits per second the DRCS system would, by the year 2000, prove to be inadequate for accessing the Internet (Devlin, 2000:4).

A significant development in the physical structure of Northern Territory telecommunications during the 1990s was the completion, in 1992, of a high speed, two-megabyte fibre optic link connecting Darwin to Sydney. The link was essentially utilised and supported by the Australian Academic Research Network (AARNet) as a means of

…improv[ing] research by linking Australian scholars with others within Australia and throughout the world; [on the premise] that research ideas would be disseminated more widely and quickly; and that AARNet would open up access to vast global information resources such as library catalogues and remote data bases. (Bruce, 1996:3)

In 1997 the deregulation of the telecommunications industry and the commercialisation of the Internet also had a significant impact on education and the telecommunications industry in the Northern Territory (see Chapter 4.5.1). The subsequent exponential growth of digital data technology, the changing communications needs of Territory residents and the convergence of computing
and telecommunications, highlighted the social and economic imperative of ensuring equitable telecommunications access for Territory residents.

In recognition that telecommunications infrastructure is a key element in the social and economic development of the Territory the NT Government created, in July 1997, a Ministry for Communications and Advanced Technology. The strategic objective of the Ministry was to “…improve the range of available services and encourage economic development in the industries of the 21st Century” (Department of Communication and Advanced Technology, 1997:15). Through the development of a competitive information technology industry in the Territory, enhanced service delivery and increased educational opportunity, the NT Government aimed to “…transform the way Territorians work, live, learn and relax” (Department of Communication and Advanced Technology, 1997:Forward).

2.2 The Telecommunications Corridor

In the early 1980s prior to the deployment by Telecom of the DRCS there were two main telecommunications corridors in the Northern Territory (see Appendix 6). In 1974 the Darwin-Mt. Isa microwave telephone link was established and, in 1979, the Darwin-Alice Springs microwave link provided the second interstate route. The third interstate microwave gateway between Katherine and Kununurra in Western Australia commenced construction in 1985 (Select Committee, 1985:12). Telecom also hired microwave capacity from the Australian National Railways to provide telecommunication access from Alice Springs to Tarcoola in South Australia and from Alice Springs to Yulara in central Australia.

The Telecom links were the conventional microwave system that required a line-of-sight repeater station every 40 kilometres (km). Telecommunications access could be extended to within 50 km of a microwave station via a Very High Frequency (VHF) radio link. The ability to extend telecommunications services to either side of the route led to the concept of two communications corridors, approximately 100km wide, which followed the Stuart and Barkly Highways in the Northern Territory.

As indicated in the 1985 Select Committee Report of the Legislative Assembly, telecommunications access outside the communications corridors had evolved in an
eclectic fashion (1985:14). A tropospheric scatter system, a specialised microwave link that used powerful transmitters, complex receivers and large aerials to force signals over the horizon, carried telecommunications traffic between Darwin, Nhulunbuy and Jabiru. However, the main telecommunications medium in the outlying rural and remote areas was via HF radio, a system that had been in use in outback Australia since the early 1930s.

2.3.0 Telecommunications Issues in the 1980s, 1990s and 2000

In the two decades preceding this research report, interest in telecommunications issues in the NT has waxed and waned according to the perceived capacity of telecommunications access to enhance the social and economic development of the Territory. Throughout the 1980s there were no less than five Northern Territory Government reports and Inquiries into the telecommunications needs of the Northern Territory (Officials of the Northern Territory Government, 1980; NT Government, 1982; Department of the Chief Minister, 1983; Office of Technology and Communications Dept. of the Chief Minister, 1985: Legislative Assembly of the Northern Territory, 1985; Northern Territory Government, 1987). The disparities in telecommunications access, the need to up-grade services to remote schools, and the viability of a satellite system to facilitate telecommunications access and enhance the educational provision of the NT were significant issues in a number of the reports and inquiries.

2.3.1 Education - Rural and Remote Schools

Reiterated in the government reports and inquiries throughout the 1980s was the need to upgrade telecommunications access to schools in the rural and remote areas of the Northern Territory. Improvements in telecommunications access were perceived as vital for enhancing educational provision in remote areas, assisting in the administrative function of schools and providing an adequate level of safety for departmental personnel (IMG), 1980; The Select Committee, 1985; Vander Star, 1985). As the Implementation and Management Group (IMG) report revealed, in 1980 there were 57 Northern Territory schools outside the telecommunications corridor and, as a consequence, were not connected to either a telephone, radio/telephone or a radio (IMG, 1980:2.20) (see Appendix 7). In assessing the telecommunications needs
of remote outback residents the IMG report stated, “… school teachers (and many Aborigines) want telephones before anything else” (IMG, 1980:3.20).

In 1985 telecommunications access to rural and remote schools was still a matter of concern and was a major issue in two NT Government telecommunication inquiries. The 1985 Select Committee report indicated, ’…half of the Territory schools… [are] … outside the telecom corridor…” (1985:9) and, as a consequence, the schools had either no telecommunications access or were reliant on a HF radio system for contact outside the community (see Appendix 7). The limitations of a HF radio system, as indicated in the 1985 Select Committee Report, particularly the lack of privacy, the long wait time and the limitation of calls to 12 minutes (1985:15) must have exacerbated the feelings of isolation and frustration for teachers living in the remote areas of the Territory. As the Select Committee report acknowledged,

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The need for a …, reliable telephone service to these small schools is overwhelming. The committee has no doubt that the lack of readily available advice and support is a major cause of the high staff turnover in such places. (1985:52)
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The need for improved communications for schools outside the telecommunications corridor was also reiterated in a report prepared, in 1985, by J. Vander Star for the Office of Technology and Communications Department of the Chief Minister. The Vander Star report argued that “…the greatest communication need is for the installation of a … automatic telephone into all school locations, including the 51 primary schools which are located outside the Telecom corridor” (Vander Star, 1985: 44).

By 1992 telecommunications access to Northern Territory schools had improved. However, there were at least 30 schools still not connected to the telephone network. In the paper, Education Service Delivery in Rural and Remote Areas, presented to the 1992 Darwin conference Service Delivery and Communications in the 1990s, Dr. J Cameron reported,

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Many schools have good telecommunications links, with both fax and telephone … However, nearly one school in five is dependent upon radio or radio telephone. Three schools have no communication
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facilities at all. Radio reception is variable, frequently in the range from poor to awful. Mail deliveries across the Territory, particularly for those communities accessed by unsealed roads, can be interrupted for weeks through heavy rainfall.

Whilst Cameron perceived telecommunications access as an important aspect in stabilising the high teacher turnover characteristic of remote schools, he argued that the utilisation of communication technologies, from a curriculum perspective, should be to assist in the provision of a culturally and linguistically appropriate educational curriculum and to “…reflect… and …sustain…the values and priorities of rural and remote communities” (Cameron, 1992).

### 2.3.2 Distance Education

Due to the population demographics, the vast geographic area of the Territory (see Appendix 2) and a relatively high itinerant population, distance education had been a significant component of the educational provision of the Northern Territory since the early 1950s. The School of the Air and a secondary correspondence school have been responsible for the educational provision of primary and secondary students who, due to their isolated living conditions or itinerant nature, are unable to access a school on a daily basis. Technology, in particular communications technology, has historically been the fundamental means of providing education for distance education students in the Northern Territory.

The Alice Springs School of the Air was established in 1951 and made its first broadcast using a HF transceiver from the Royal Flying Doctor Base in Alice Springs. By 2000 the Alice Springs School of the Air had an estimated broadcast area of 1.3 million square kilometres (see Appendix 8). The School of the Air based at Katherine commenced operation in 1966 and serviced students who resided in the top half of the Territory. The “school” covered a geographic area of 800 000 square kilometres (see Appendix 9). In 1980 it was reported that the two Schools of the Air base stations, Katherine and Alice Springs, had their own HF frequencies and serviced 175 outposts (IMG, 1980:2.6). The 1985 Select Committee report described the School of the Air as a
... well established service combining correspondence courses with interactive sessions using HF radio transceivers. ... The pupils are mainly found on pastoral properties and are usually supervised by a parent or governess. In recent years the school has provided loan videocassette recorders to pupils and circulates tapes to supplement lessons. Unfortunately the HF system used by the school of the Air has severe limitations both in reliability and quality. (1985:52)

The majority of students who participated in School of the Air programs lived outside the communications corridor and, as a consequence, were reliant on HF broadcasts not only for curriculum delivery, but also for social contact. The social contact was essential in the development of a sense of participation in “school” and was an important component in the success of the School of the Air in providing education to students living in the remote areas of the Territory.

In an era before the ready availability of conference telephone calls the 1985 Select Committee Report on Communications Technology acknowledged the importance of social contact for distance education students and the role of HF transceivers in the development of classroom rapport. The Select Committee acknowledged the possible limitations of telephones in creating a classroom atmosphere because “…the children cannot hear each other, as they can on HF…” (1985:53). The Select Committee also mooted the possibility of a large number of concurrent telephone users overloading the rural telephone system that was currently being deployed in the remote areas of the Territory.

In consideration of the cost of satellite technology and the high mobility of students who were studying through distance education, the 1985 Select Committee were cautious in their recommendations in regard to distance education (1985:54). However, the urgent need for a high quality telephone service in the areas beyond the telecommunications corridor was evident. In 1985 the Vander Star report also acknowledged the limitations of HF transmission for School Of The Air students and teachers and recommended the implementation of “…a good quality duplex (two way) telephone circuit to each location…” as a priority in the upgrading of telecommunications (Vander Star, 1985:44).
A perspicacious vision of the potential of network technology to address disparities in educational provision for students in rural and remote areas of the NT was explored in the article *Education, Equity and the Crisis in the Rural Community* (Snowdon, 1992). The article was written at least six years before the Internet, email and network technology had become a reality in NT schools and articulated a vision of “… an individual home or small community setting up a communications centre with equipment such as computers, printer, modem, telephone, fax machine and various computer software.” The home or community “Telecentres” were perceived as a potential means of improving access to educational provision in the NT and as a means of supplementing distance education (Snowdon, 1992:11).

### 2.3.3 Satellite Access

According to the report *A Study of Remote area Telecommunications in the Northern Territory* (IMG, 1980:3.16) the Northern Territory Education Department's communications requirements in the late 1970s and early 1980s were influenced by two preoccupations:

… The proposal to launch a communications satellite in 1984… and the problem of how to solve the educational needs of Aboriginal children and adults, and in particular how to meet the needs of those Aboriginal people living in outstations. (1980:3,17)

The publication in 1981 of the report, *Domestic Satellites and School of the Air* (Forster, 1981), which explored the potential of satellite technology for disadvantaged students living in rural and remote locations of the NT, certainly would have contributed to the satellite versus DRCS debate.

However, despite what appeared to be a widespread interest in the area of satellite communication to enhance telecommunications access and educational provision, Parliamentary reports indicate that, in the late 1980s, discussions of telecommunications issues in the Northern Territory were dominated by the perception of an inhibitive telecommunications regulatory regime that favoured Telecom and their terrestrial view of telecommunications access (Legislative Assembly of the Northern Territory, 1985; Northern Territory Government, 1987). The 1985 Legislative Assembly of the Northern Territory *Report of the Select Committee on*
Communications Technology acknowledged that the main telecommunications priority for remote area residents was the provision of a reliable high quality service (1985:ix). The Select Committee reported that the lack of telephone services in the remote areas of the Territory not only disadvantaged residents but also inhibited the efficient delivery of Government services and handicapped economic development (1985:4). Whilst the 1985 Select Committee report acknowledged that Telecom's deployment of the terrestrial Digital Radio Concentrator System (DRCS), a rural radio telephone link devised by Telecom, would “…significantly improve telephone services in the rural and remote areas … [of the NT]…” (1985:ix), it questioned the choice of the deployment of a DRCS rather than a satellite system.

The 1985 Select Committee report argued in favour of a domestic satellite system as a means of accelerating the deployment of telephones throughout the NT. Enhanced telecommunication access to remote schools and the potential of a satellite communications network to “…significantly enhance the quality and scope of distance education programmes…” (1985:55) emerged as significant issues in the inquiry. However, despite the acknowledged urgency of the problems associated with poor telecommunications access in remote areas, the report concluded that the “…committee is of the opinion that Telecom is locked into the DRCS system and it is very doubtful if it will be prepared to provide a satellite system even as an interim measure” (1985:55).

2.3.4. The Telecommunications Regulatory Regime of the 1980s

The telecommunications regulatory regime that existed during the 1980s prevented the use of satellite technology in NT education. As the 1987 Telecommunications Strategy Report stated,

The Federal Government has, by Act of Parliament, set up Telecom Australia with a wide ranging telecommunications monopoly with only restricted and specific exceptions. (Northern Territory Government, 1987:8)

Whilst Australian Domestic Communications Satellite System (AUSSAT) was the Australian-owned and operated communications satellite, its functions included the broadcasting and provision of private network services and it was restricted, by
legislation, from providing switched telephone or switched data services. The restrictions in effect, reduced AUSSAT's function to one of providing transmission capacity only.

The NT Government Telecommunications Strategy Report in 1987, was very critical of the telecommunication regulatory regime that existed at the time and urged the Northern Territory Government, in the interests of its constituents, to press for changes to the regime (Northern Territory Government, 1987:8). In the face of a perceived threat to their monopoly status as the national communications carrier, Telecom was criticised for its obstructionist policies and attitude. As the 1987 Telecommunications Strategy Report argued,

Telecom has:

Developed legalistic and rigid interconnection rules for Aussat satellite provided capacity.

Consistently provided obscure technical and policy evidence to enquiries (e.g. NT Government Telecommunications Enquiry and the Federal Parliament Expenditure Committee) on terrestrial and satellite technical issues.

Formalised their “Common Interest Group” rules to make traffic aggregation difficult for potential users. (Northern Territory Government, 1987:8)

As a consequence of the apparent rivalry that existed in the 1980s between the two carriers, Telecom and AUSSAT, and the reported ability of Telecom to exploit the regulatory regime that existed at the time, the utilisation of satellite technology to provide telecommunications access to remote schools and enhance distance education in the Northern Territory was not realised in the 1980s. Educational provision and telecommunications access in the Northern Territory through the decade of the 1980s was, essentially, forced to conform to Telecom's terrestrial view of telecommunications access.
2.3.5. Aboriginal Social and Economic Aspirations

The 1980 Implementation and Management Group (IMG) report highlighted the disparities that existed in the Northern Territory in regards to telecommunications access. The report acknowledged that nearly 60 per cent of the Aboriginal population lived in the rural and remote regions of the Territory and in areas that were not served by the telecommunications corridors. As the IMG report argued, “This population distribution means that there is a major inequality in access to communication services” (IMG, 1980:17). The report also acknowledged the low socio-economic status of many Aboriginal people in the Territory and the need for telecommunications access to enhanced health, legal and education services (IMG, 1980:19). Access to telecommunications services in order to support Aboriginal social, cultural and economic life was also a need expressed by the Aboriginal people who were interviewed and surveyed for the IMG report (IMG, 1980:24,25,30).

A relaxation in domestic satellite regulation in the early 1990s and the subsequent privatisation of AUSSAT enabled some communities in the Territory to utilise enhanced telecommunications access via satellite. In 1992, at a cost of $1.8 million the Warlpiri people of the Tanami region of the Northern Territory established the Tanami Network, a satellite-based video conferencing network. This network linked the four remote Warlpiri settlements of Yuendumu, Lajamanu, Willowra and Kintore with each other and with video conferencing sites in Sydney, Darwin and Alice Springs (see Appendix 10). The Tanami Network, owned and operated by the Warlpiri people had, as reported on the Tanami Network web site,

...given the communities access to basic services often taken for granted by urban Australians. Secondary education has been introduced in some areas for the first time, while legal, health and welfare programs previously only available thousands of kilometres away are now part of everyday life. (About Tanami Network, 2000)

2.4 The Internet in Northern Territory Education

The commercialisation of the Internet in 1995 and the liberalisation of the telecommunications industry in 1997 had a significant impact on education in the Territory. The convergence in computing and telecommunications that had been a
reality in NT higher education, as well as the business and government sectors also became a reality for Territory schools. The *Improve Access and Improve Opportunity Project* also highlighted the disparities remote schools faced in terms of telecommunications access (see Chapter 1.4).

According to Bruce (1996, ix) Australia's initial connection to the Internet was established in 1990. Originally conceived in America in the 1960s by the Defence Department as a research project to connect computers at distributed sites the Advanced Research Projects Agency Network (ARPANET), as the Internet was initially known, was readily utilised by the research and academic community as a means of sharing and disseminating information. In recognition of the need to upgrade education and develop infrastructure in network communications between higher institutions the Australian Vice Chancellors Committee (AVCC), in conjunction with CSIRO, established the Australian Academic Network (AARNet). The actual network was introduced into service in June 1990 and its launch was regarded with considerable optimism. As Thwaites (1990:3) declared at the time,

> Computers conquer the tyranny of distance, Australians researchers are coming in from the cold; [Australian researchers] are now only as far away as their computer terminals and a few seconds from six million other researchers throughout the world.

However, by 1995 the increasing cost involved in maintaining a research data network, the exponential growth of its user population and a strong commercial interest in the potential of the Internet prompted the AVCC to sign a memorandum of understanding (MOLT) with Telecom to explore the management of AARNet. As a consequence of the MOU the management of the Internet was leased to Telecom for a two-year period and access to the Internet was effectively placed in the public, commercial and broader education domains.

**2.5 Conclusion**

As the literature search revealed, telecommunications access has had a significant role in shaping the social and economic development of the Northern Territory. Throughout the 1980s and 1990s the importance of telecommunications access to health, education and administration of government services in the Northern
Territory has been documented in the inquiries (IMG, 1980) Government reports (Legislative Assembly of the Northern Territory, 1985; Office of Technology and Communications, 1985; Northern Territory Government, 1987; Department of Chief Minister, 1985; Northern Territory Government, 1982; Department of Chief Minister Northern Territory, 1983; Officials of the Northern Territory Government, 1980; Department of Communication and Advanced Technology, 1997) and the academic literature (Cameron, 1992; Snowdon, 1992:11; Forster, 1981). The importance of adequate telecommunications access in meeting the social and economic aspirations of Territory residents was also reiterated throughout the literature.

Historically, the rural and remote areas of the Northern Territory have been disadvantaged in terms of telecommunications access. Restrictive regulatory policies, a terrestrial view of telecommunications access and years of neglect have led to disparities in telecommunications provision. The deregulation of the telecommunications industry, the commercialisation of the Internet and the changing telecommunications needs of Territorians have signalled a changing telecommunications environment (see Chapter 4.5.1). The development of the Tanami Network has also demonstrated the importance of adequate telecommunications access in supporting the economic and social aspirations of Aboriginal communities. Without direct Federal intervention the disparities in telecommunications access Territorian experience may only be exacerbated in a deregulated telecommunications environment.

Chapter Three examines the global trend towards privatisation and deregulation. The principles behind a market-driven approach to telecommunications growth and development are examined against a background of the economic, legal and social objectives of the current and emerging Australian telecommunications industry. The privatisation of Telstra, Australia's national communication earner, is placed within a contemporary context and examined from a public choice perspective.
Chapter 3
Do we have a Failure to Communicate?

3.0 Introduction
This chapter examines the global trend towards privatisation and deregulation. The principles behind a market driven approach to telecommunications growth and development are examined against a background of the economic, legal and social objectives of the current and emerging Australian telecommunications industry. The privatisation of Telstra, Australia's national communication carrier, is placed within a contemporary context and examined from a public choice perspective.

3.1 Public Choice Theory
Public choice theory, according to Rossi is “…defined broadly as the application of the assumptions and methodology of microeconomics to describe or predict the way public officials exercise their power”(Rossi, 1997). As a theory it is inherently interdisciplinary and has, since its emergence after World War 2, gained mainstream acceptance for its descriptive and analytical insights into the areas of law and politics as well as economics.

The basic assumption of public choice theory is that self-interest is a strong primary motivation (Gwartney and Stroup, 1987:87; Rossi, 1997; Stretton and Orchard, 1994:26; Williams, 1997). Through descriptive analysis the theoretical application of public choice provides an understanding of the complexities involved in the economic and political process. Felkins describes public choice as a theory “…directed towards the study of politics based on economic principles” (Felkins, 1999).

Deregulation is, according to Tunstall, “politicisation.” Tunstall qualifies this contention by stating that,

Deregulation does not take communication out of politics. On the contrary, to deregulate communications is to move it out of the government bureaucracy and throw it into the twin market places of commerce and politics. The giant new communications field is a political field. (Tunstall, 1986.6)
According to Public Choice theory, stakeholder motivations, whether they are individual or representative of a collective group are primarily self-serving (Gwartney, 1987:87; Stretton and Orchard, 1994). In privatising a large public corporation conflict inevitably exists between the stakeholders whose wealth will be affected with the result that they may seek to influence the process. According to Williams,

Those who … effect the transfer of an enterprise to private ownership and those who will be affected by it, will seek to influence the changes that occur during the process of privatisation in ways which will further their own interest. (Williams, 1997)

Balancing these tensions is partly determined by the structure of the political, economic and a social institution within which privatisation occurs. Consensus does not exist without tension. Consensus is often the net result of conflict.

Williams effectively advocated the case for a public choice perspective on the process of privatisation. Williams argued that,

The process of privatisation is inherently political. The changes that occur will be the outcomes of interaction between the government and those who will be affected by its decision to privatise, and will be shaped by the institutional context within which political and administrative activity takes place. The conclusions from the studies which compare performance and efficiency before and after privatisation must, in these circumstances, be qualified. (Williams, 1997)

3.2 The Deregulation Process

Communications privatisation and deregulation has no neat beginning and is unlikely to have a tidy conclusion. It is a process that is contentious, obscure and fast changing. Having fewer rules does not mean that there are no rules at all. According to Ungerer, regulatory agencies across the world, by vocation, tend to regulate more, and not less (Ungerer, 2000). Explicit national objectives for Information Communication Systems (ICS) and an understanding of the different stakeholder expectations are essential in order to support the implementation and review of the privatisation process.
The commercialisation of Australia's telecommunications industry is part of a global trend precipitated by a number of political, economic and pragmatic objectives that have promoted active and dynamic debate amongst a host of constituencies. The Government, industry and end users are all significant stakeholders in the privatisation and commercialisation of what was once Australia's largest government-owned monopoly – Telstra. As Beardsley and Patsalos-Fox (1995:3) argued,

Nowhere is the privatisation debate more robust and activity more dynamic than the area of telecommunications. In the past few years, privatisations in this sector have taken off, with more than 17 countries selling stakes totalling over US $140 billion. In the European Union alone Denmark, France, Germany the United Kingdom, Greece, Belgium, the Netherlands, Italy and Portugal either have already privatised or expect to privatise their state owned telephone companies and liberalize their telecom sectors by 1998 - a radical shift given that they were all state owned monopolies just fifteen years ago.

It is the debate that gives impetus for the growth and development of the industry and assists in determining the objectives of privatisation. As Beardsley and Patsalos-Fox claimed, “…successful privatisation is dependent upon objectives which are tailored to local cultural, legal, political and economic conditions’” (Beardsley and Patsalos-Fox, 1995:3). Hence privatisation cannot be an end in itself but must be underpinned by a vision of how the telecommunications industry should evolve.

Beardsley, Patsalos-Fox and Treheux have claimed that the underlying objective of privatisation should be to improve industry performance by increasing the role of market forces (Beardsley and Patsalos-Fox, 1995:9, Treheux, 1992) Buckley however has argued that “The trend to privatisation must be for the overall benefit of the customers, and the criterion of benefit to customer should be used to design the privatisation scheme as a whole” (Buckley, 1992:749) Both objectives are valid and highlight the complexities involved in the privatisation process.

3.3 A Global Trend

The deregulation of Australia's telecommunications industry in 1995 and the partial privatisation in 1997 of the national telecommunications carrier Telstra was part of a
global trend towards increasing the efficiency, effectiveness and productivity of large government monopolies through the introduction of competition. The deregulation movement, according to Gersten (1988:5), had its origins in the United States in 1887 with the passage of the Interstate Commerce Act and, like any serious political and economic trend, had a long gestation period. The call for deregulation, however, has antecedents throughout the history of many industrialised nations and was, as Gersten argues, “…as much as anything else, a reaction to the expansion of government” (Gersten, 1988:5).

Privatisation, according to the National Energy Information Centre (NEIC) report *Privatisation and the Globalisation of Energy Markets*, represents a reversal of the process of nationalisation which was begun early last century (NEIC, 1997). During the post World War 2 economic restructuring, publicly owned utilities were perceived as necessary for economic prosperity and middle-class stability. Nationalisation, according to the NEIC report, “…represented a cherished post war … ideal to create large vigorous state owned business that provided pools of public jobs and allowed … politicians to wield influence over their economies” (NEIC, 1997). However, the wave of nationalisation began to lose favour by the late 1970s. An increased disenchantment with the efficiency and effectiveness of government enterprise heralded the beginnings of privatisation. As Williams argued,

In the 1980s, increasing dissatisfaction with their performance, the pressure their deficits were placing on public sector budgets, and the apparent inability of their managers to pursue wider social objectives, motivated government in a number of countries to privatise these enterprises. (Williams, 1997)

As an economic and political reality, privatisation and deregulation came to preeminence in the 1980s. It was during this period under the Thatcher administration in the United Kingdom (UK) and the Regan administration in the United States of America (USA) that many large public corporations, widely regarded as belonging to the public sector because of their monopoly characteristics or their importance to the national economy, were either transferred to private ownership or forced to relinquish their monopolistic status. Hulsink (1999:4) claims that as a response to economic stagnation, European governments also laid emphasis on curbing public
expenditure, on administrative reform and deregulation, and on the decentralisation of collective bargaining.

The overseas experience of deregulation and privatisation is complex and difficult to evaluate. According to a 1994 World Bank Report, for many nations, privatisation had become the only effective method of raising investment capital on favourable terms. High levels of past public sector borrowing had saddled many nations with large levels of debt. As a consequence, these nations have had little recourse but to sell state assets to reduce debt, generate revenue and raise capital investment.

In the global arena there are numerous models of privatisation. These models have evolved out of the pre-existing domestic economic, legal, social and political context and have been driven by the increasing globalisation of the world economy. Competitiveness in international trade, the NEIC (1997) report argues, has become an essential factor in a nation's ability to create jobs, raise wages and generate wealth.

According to the NEIC (1997) countries as different as the UK and Chile have led the way in privatisation. Between 1988 and 1993, roughly 2 700 state owned enterprises in over 95 countries were transferred to private individuals, raising over $270 billion. Up until 1997, the largest privatisation had been the sale of Japanese Telecom for $73 billion. In Western Europe, the UK had been at the fore-front of privatisation.

3.4 Privatisation in the United Kingdom

The Conservative Thatcher Government that came to office in the UK in 1979 privatised more than nine publicly owned enterprises during its first term in office. According to Williams (1997), between May 1979 and June 1983 the Thatcher Government transferred to public ownership British Aerospace, British Rail hotels, Jaguar, Britoil and Enterprise Oil, Amersham International, Cable and Wireless, Associated British Ports, National Freight and Sealink, the British Rail ferry subsidiary. It was, however, the sale of the monopolistic telecommunications carrier, British Telecommunications (BT) in 1984 that heralded for the British public, the end of nationalisation.
With the sale of BT the nature and scale of privatisation in the UK changed. The subsequent sale of a number of significant public sector enterprises, which included British Gas, British Airways, The British Airports Authority, British Steel, the water and electricity authorities and British Rail, condemned the era of British nationalisation to history. If the success of privatisation is measured only in terms of raising investment capital, then the UK experience can certainly be regarded as a triumph. According to the National Energy Information Centre (NEIC) report, *Privatisation and the Globalisation of Energy Markets*, “Britain has raised $95 billion through the privatisation of formerly state-owned enterprises” (NEIC, 1997).

### 3.5 Deregulation of the Telecommunications Industry in the United States

In 1984 the sale of British Telecommunications coincided with a significant event in the privatisation and deregulation evolution occurring in the United States. Prior to 1984 the American telecommunications industry was organised as a private regulated monopoly in which telephone services were provided by AT&T and its associates, also known as the Bell System. This private conglomerate was subject to formal regulation by the Public Utilities Commission (PUC) and the independent Federal Communications Commission (FCC) and was protected from competitive entry. However, increasing convergence in the computing and telecommunications markets, the construction and operation of private microwave transmission systems and a gradual relaxation of prohibitive barriers to competition at the edge of the network eventually led to an antitrust suit by the US government against AT&T.

As a consequence of the legislative action the US champions of telecommunications and computing AT&T and International Business Machines (IBM) were allowed to penetrate each other's markets. The implementation of these deregulatory measures in the US, however, implied more than just the instigation of domestic competition between the two giants. The bigger aim, as Hulsink (1999:93) argued, “...was to reinforce US techno-economic world leadership and dominate the fast growing markets of data communications and telematics.” Whilst the decision to deregulate the US telecommunications industry was part of a straightforward industrial and trade policy aimed at increasing the efficiency and competitiveness on the US telematics sector (Shiller, 1982; Hills, 1986; Pool, 1990) the implications spread beyond the domestic market.
The US strategy of domestic deregulation of the telecommunications industry accompanied by intensified international competition was, in retrospect, effective. Not only did the UK and Japan commence the liberalisation of their telecommunications market, the US deregulation strategy also placed liberalisation and regulatory reform on the European agenda. As Huslink perceptively stated,

> Confronted with the (international) deregulation policies of the world leader in the telecommunications market, followed by two other leading countries, many Western European countries realised that a revision of their traditional policies and institutional structures was inevitable. (Huslink, 1999:98)

In more recent years the continued convergence of telecommunications, computing and broadcasting, the increased globalisation of the economy and the development and application of new technologies have added new dimensions to the deregulation debate. What, however, is of significance in the issues surrounding deregulation is that ultimate success of privatisation, in both the domestic and international arenas, will be measured in terms of the economic and social benefits for the consumer. As Kok has stated, “…privatisation is not a panacea and, by itself, does not necessarily yield greater efficiency or consumer benefits” (Kok, 1992: 699).

### 3.6 Deregulation in Australia

The privatisation of Australia's national telecommunications carrier commenced in 1997 amidst considerable public concern. A Senate Inquiry into the proposed sale of Telstra conducted in 1996 by a Senate Environment, Recreation, Communications and the Arts Reference Committee received 650 submissions and heard evidence from 136 witnesses in Adelaide, Brisbane, Canberra, Melbourne, Perth, Sydney and Townsville. The inquiry acknowledged the extent and depth of community feeling against the partial or full privatisation of Australia's national communications carrier.

The issues in the privatisation debate centred on fears that a market-driven approach to telecommunications growth and development would be at the expense of the less profitable social objectives of telecommunications policy. A discussion paper prepared by the Consumer Telecommunications Network (CTN) in 1996 was typical of many submissions. This paper, *Selling off the (Telstra) Farm. Do Consumers Benefit?*,
argued that whilst privatisation often leads to increased shareholder profits this may be at the expense of consumer benefits. Allocative efficiency is, according to Williams, (1997) a strong incentive in private ownership.

The Senate Inquiry submission by the Communications, Electrical and Plumbers Union (CPEU) also highlighted the social equity issues as well as the need for government regulatory intervention in order to maintain equitable access to telecommunications services.

As the CPEU submission pointed out market forces alone have never been adequate to create a reliable, ubiquitous, integrated network such as is needed to underpin the universal delivery of ‘‘plain old telephone service’’ (POTS), let alone the capabilities required to provide the more advanced services now being developed. The achievements of such social goals have always required government intervention. (Senate Inquiry, 1996:132)

The Universal Service Obligation (USO), the legislative basis for Telstra's responsibility for providing a basic telecommunication service through out Australia, received considerable comment in the Senate Inquiry. Concerns were raised that the broader social goals of consumer access, geographic coverage and social equity enshrined in the USO would not be adequately protected, maintained and enforced in a deregulated environment (Senate Inquiry, 1996:121,145).

Equity, access and quality of service, particularly in light of developments in digital network technology, were the issues of greatest public concern throughout the Senate Inquiry. Fears that services to rural and regional Australia, traditionally the less profitable areas, would suffer in a liberalised telecommunications environment were clearly articulated as a major issue (Senate Inquiry, 1996:122). A number of submissions argued that “…the trade off between lower returns and other greater social benefits is irrelevant under public ownership, provided the benefits accrue to the community as a whole.” Private ownership, it was argued, introduces a fundamental tension between profit maximisation and broader social goals (Senate Inquiry, 1996:128,131).
During the Senate Inquiry Dr Rodger Buckeridge and Mr Jim Groves effectively argued the case for potential policy intervention (Senate Inquiry, 1996:128). In their respective submissions *Rural Australia on Line* and *Policy Issues in Putting Rural Australia on Line* the authors noted that a demonstrated existence of ‘market failure’ or ‘externalities’ justified government intervention. As the authors argued,

A market failure is where a well designed policy intervention can produce a better outcome than will be the case with the untrammelled operation of market forces; externalities arise when the benefits (or costs) of an activity flow beyond the immediate decision maker, who therefore faces a distorted set of incentives from society's point of view. For intervention to be justified it must be shown that, in the practical world, the benefits of intervention exceed the cost. (Senate Inquiry, 1996:128)

Buckeridge and Groves also argued that the new information systems had significant potential to assist in improvements in access to education and training, in the environment area and in assisting in the information flow between government agencies and their customers. The Senate Committee agreed that benefits such as these “…could well provide an even greater justification for [policy] intervention than was the case for the existing universal service obligation.” The Senate Committee also acknowledged that, “This justification clearly goes beyond the traditional argument about equity of access” (Senate Inquiry, 1996:129).

Despite the Senate Committee's recommendation that “Telstra remain in full public ownership” (Senate Inquiry, 1996:vii), Parliament approved the partial sale of Telstra and, in 1997, one third of the national communications carrier passed into the commercial arena via a public share offer. A further public share offer in 1999 reduced Federal ownership to 50.1 per cent.

### 3.7 Australia's Telecommunications Industry Post 1997

According to the Australian Communications Authority (ACA) “An efficient, competitive and increasingly self-regulated communications sector which meets the needs of the Australian community”, were the objectives of the telecommunications regulatory framework established at the time of deregulation (ACA, 2000c). The
deregulated market opened the door for competition in the telecommunications sector and assisted in the acceleration of technological growth and development, particularly in the area of data communications. According to the Australian Communications Authority 34 telecommunications Carrier Licenses were granted between the period of 1 July 1997 and the 10 March 2000 (ACA, 2000b) and, as of March 2000, 918 Internet Service Providers (ISPs) were registered on the Australian ISP List.

The deregulation of the telecommunications industry precipitated exponential growth in the area of network technology, data transmission and Internet usage. The 1998 Digital Data Inquiry conducted by the Australian Communications Authority stated that,

…the number of Internet users in Australia has increased from about 500,000 in June 1995 to 1.6 million at the start of 1998 Internet growth rates are not abating-predictions of future growth rates indicate that current levels of growth will continue over the next three to five years. (ACA, 1998:107)

The ACA Inquiry also concluded that the range of services and applications available over the Internet would only increase. Interactive video, video on demand and live audio over the Internet were mentioned as some of the near future technologies that would not only become available but also require much higher data rates (ACA, 1998:107).

However, social issues continued to dominate the telecommunications debate. A USO cost claim by Telstra for $1.8 billion in 1997–98, which was subsequently capped at $250 million, rekindled public anxiety about Telstra's commitment to service the rural and remote areas. The announcement in March 2000 of Telstra's plans to shed 10,000 jobs at a time when the company had a record six-month profit of $2.1 billion also refocused community attention on the carrier's apparent objective of maximising shareholder profits at the expense of service to the traditionally unprofitable areas (The Age, 2000).

These issues were not unique to Australia. According to Beardsley and Patsalos-Fox, “…[a] price cost squeeze, triggered often by price-capping regulation imposing cuts
in real prices, has been the primary cause of the massive employment reductions in the US, the UK, and elsewhere” (Beardsley and Patsalos-Fox, 1995:8). In Japan, the waiving of USO costs for new carriers set a low interconnect rate in favour of new competitors. As a consequence the incumbent carriers’ stock fell by more than 60 per cent in the five years following privatisation.

The successful privatisations of telecommunications industries have qualities of their own. Beardsley and Patsalos-Fox claimed that there is no single ‘right” set of objectives for privatisation. Governments, Beardsley and Patsalos-Fox argued, “… need to think beyond the mere question of ownership and form a view of how they would like the entire sector to develop over the next … five to ten years” (Beardsley and Patsalos-Fox, 1995: 3). Meeting these objectives in an environment with such complex dynamics calls for a clear vision of how the telecommunications environment should evolve.

### 3.8 Privatisation Objectives

There is, as a number of economists have stated, more than one-way to privatise and it is generally agreed that the objectives of the major stakeholders in the privatisation process are complex and often in conflict with one another (Beardsley and Patsalos-Fox, 1995; Treheux, 1992; Buckley, 1992; Kok, 1992). Kok, contends that,

> Privatisation is a very complex game that involves at least four major constituencies. Not only does each of these constituencies have objectives that may conflict with those of other groups there is often a considerable diversity of opinion. (Kok, 1992:701)

In the report *Reviewing Australia's Competition Model for Communications*, Northfield (1999:20,21) produced a comprehensive table of stakeholders in the Australian privatisation process. According to Northfield *Government, Industry; Government/Industry and Users* were the four major stakeholders involved in the telecommunication privatisation process. A number of representative bodies and individuals fell within these four broad groups and each stakeholder group had an articulated role and objective.
Understanding the values, objectives and expectations of the different stakeholders is essential in order to support the balancing of trade-offs between policy approaches and outcomes for alternative players. Stakeholder consensus involves trade-offs that have consequential effects on resources, the market and the stakeholders themselves. These trade-offs are a result of the government responding to the influence of those who will be affected by its decision. As Williams effectively argued,

Privatisation will provide incentives for the enterprise's response to these external changes. The scope of the enterprise's activities, and the way in which the use of resources is coordinated and controlled, will change in response to the changes in its relationship with the government, and to the changes in market structure. (Williams, 1997)

The stated objectives of Australia's telecommunications competition model are broadly defined with meeting the Long Term Interests of End Users (LTIE) (Northfield, 1999:7). Means of serving the LTIE include efficient use of infrastructure, efficiency and competition in markets and any-to-any connectivity. Both the ACA and the Australian Competition and Consumer Commission apply the LTIE concept in relation to their telecommunications regulatory role. However, according to Northfield, “…the link between communications policies and broader national policies and strategies has been … nebulous” (Northfield, 1999:7).

Access to networks and services is essential for the development of a viable telecommunications industry in a post-deregulation environment. Northfield supports this contention and argues, “Once a decision has been made to liberalise communications markets, establishing functional and acceptable access arrangements is [the] key to the achievement of national objectives” (Northfield, 1999: 11). A number of stakeholders have reiterated this sentiment and access has been a prevailing issue since the 1996 Senate Inquiry (CTN, 2000b: 1; ACA, 1998:52; Moon, 1999). How to achieve equity of access in a deregulated, competitive telecommunications environment is the year 2000 conundrum.

3.9 Conclusion.

The telecommunications sector is one of the most active and dynamic areas of privatisation and deregulation. In Europe during 1999, less than a year after the
liberalisation of their telecommunications industry, 1000 new carrier licences had been issued, prices for long-distance and international calls had fallen, in some instances by a factor of 10, and stocks of telecom and IT-based companies had become the major driver of Europe's main stock indices. Merger/acquisition activity in the technology sectors equalled the activity of all nine preceding years of the decade. Much of this was telecom and Internet related (Ungerer, 2000).

In the speech delivered at the February 2000 Symposium on Europe, European Union Fellow, Dr Ungerer stated that,

Out of the 1999 world-wide mergers/acquisitions of some 3.3 trillion Euros -or $US- telecom/TT/Internet values accounted roughly for a third, some 1 trillion. Out of the largest transactions 10 were related to those sectors, with a number of them above the $US 1000 billion.

(Ungerer, 2000)

The deregulation and privatisation of the telecommunications industry, which began in earnest in the last two decades of the twentieth century, evolved into a world-wide trend and precipitated a global economy of almost inconceivable proportions.

Beginning in the US in 1984 with the divestiture of monopoly communications carrier AT&T, privatisation and deregulation of the telecommunications industry spread to the UK, Japan and the European Union. Countries as different as the UK and Chile led the way in privatisation and countries as different as Peru and Poland followed (NEIC, 1997). Although privatisation efforts have differed substantially from country to country, there had been a strong economic rationale underlying the various decisions to privatise.

There is no defined procedure for the successful privatisation and no single “right” set of objectives (Beardsley and Patsalos-Fox, 1995; Treheux, 1992; Buckley, 1992; Kok, 1992). Successful objectives will both support and, to a certain extent, be defined by local, cultural, legal, political and economic needs. As Beardsley and Patsalos-Fox (1995:3) effectively stated, “Dramatic differences in starting points, pressures for change and priorities mean that each country must determine its own objectives” (Beardsley and Patsalos-Fox, 1995:3). Clearly articulated objectives, an
understanding and balancing of the needs of different stakeholders and a vision of how the telecommunications environment should evolve, will ultimately assist in creating a climate for satisfactory privatisation.

In Australia the telecommunications privatisation process commenced in 1997 with the partial privatisation of the national communications carrier Telstra. The privatisation of Telstra initiated considerable community debate. Concern that a market-driven approach to telecommunications growth and development would be at the expense of the less profitable social objectives of telecommunications policy emerged as a major issue. Fears that the broader social goals of consumer access, geographic coverage and social equity enshrined in the USO would not be adequately addressed in a deregulated telecommunications environment, were clearly articulated in the Senate Inquiry conducted during 1996 in the lead up to the sale of Telstra.

Since deregulation, social issues have been a major feature of the deregulation debate. Record profits by Telstra at, what was perceived to be, the expense of services to the rural and remote regions; forced redundancies and an increased disparity in the services and products available to rural and remote users have been the negative consequences of commercialisation. However, Australia's deregulated telecommunications industry has also opened the door for competition in the telecommunications sector and has assisted in the acceleration of technological growth and development particularly in the area of data communications.

Exponential growth in the areas of network technology, data transmission and Internet usage was characterised by a large increase in residential Internet connections. According to the Australian Bureau of Statistics, in 1999 there was a 40 per cent increase in the number of households that had established Internet connections. This growth however, has been predominantly in the major metropolitan areas (ABS, 2000b).

Whilst the stated government objective of Australia's telecommunications competition model is broadly defined with meeting the long-term interests of end users, balancing the competing objectives of the major stakeholders has not been without tension. The trade-offs have had consequences that have had broader political, social, economic,
cultural and policy implications. Access, according to Northfield (1999:11) is the key to the development and use of Information Communication Systems (ICS) and the achievement of national objectives. Balancing the Long Term Interests of End Users (LITE) with social policy, commercial and efficiency aims, and industry development has presented an ongoing challenge. In order to facilitate appropriate access arrangements and broader policy goals there has been a need to link the LTTE concept with the development of a post-deregulation universal service philosophy and model. An overview of the historic significance of the Universal Service Obligation (USO) and the role of the USO in ensuring geographic coverage and maintaining social equity to telecommunications access is provided in the next chapter. The current and emerging telecommunications needs of the NT are placed in a contemporary context and the growth in bandwidth demand is examined from the perspective that the goals of social equity and geographic coverage are fundamental to a viable telecommunications industry in the Northern Territory.
Chapter 4
The Universal Service Obligation - Equity Access and Geographic Coverage

4.0 Introduction

This chapter provides an overview of the historic significance of the Universal Service Obligation (USO) and the role of the USO in maintaining social equity to telecommunications access. The current and emerging telecommunications needs of the Northern Territory (NT) are placed in a contemporary context and the growth in bandwidth demand is examined from the perspective that the goals of social equity and geographic coverage are fundamental to a viable telecommunications industry in the Northern Territory. This chapter also briefly examines international approaches to the USO. The United States model of telecommunications policy that provides discounted digital data access to schools, libraries and health centres is also discussed in this chapter.

4.1 History of Universal Service

Universal service is the goal of making telecommunications universally accessible to all consumers. This goal emerged in the early days of the development of the telephone and remains critically important to the present-day delivery of telecommunications. In light of developments in digital technologies, in particular the Internet and network technology, the policy of universal service is fundamental to ensuring geographic coverage and maintaining equity of telecommunications access in the Northern Territory.

Historically, commercial goals and broader social issues have been a fundamental aspect of the telecommunications debate. Full and active participation in society has long been recognised as an integral aspect of universality of access and use of telecommunications. As Wilson and Goggin stated, “To its first advocates the principle of universal service represented widespread provision of an interactive communications technology which was publicly accessible and in concert with economic and social development” (Wilson and Groggin, 1993:1).
Theodore Vail, the General Manager of the Bell Telephone Company, first propounded the principle of universal service in the United States (US) of America in 1910. In the AT&T 1910 annual report Vail stated that,

The Bell system was founded on broad lines of “One System”, “One Policy”, “Universal Service” and the idea that no aggregation of isolated independent systems not under common control, however well built or equipped, could give the country the service. One system with a common policy, common purpose and common action: comprehensive, universal, interdependent, intercommunicating like the highway system of our country, extending from every door to every other door, affording electrical communication of every kind, from every one at every place to everyone at every other place (Cited in Dordick, 1990:230)

Although the monopolistic US telecommunications carrier AT&T initially conceived universal service as a corporate policy, by 1934 the concept of universal service had become enshrined in the US Telecommunications Act. The evolution of universal service from corporate tradition to public policy was an acknowledgement that universal access to telecommunications services was perceived as both socially and economically desirable. The social objective of telecommunication access had, for the first time, been incorporated and acknowledged in legislation. However, Mueller has argued that the original use of the USO in the United States context had little to do with equity and access issues but more to do with ensuring that telephone companies technically interconnected customers (Mueller, 1993:352–369).

For a considerable number of years AT&T enjoyed a local phone-service monopoly and was insulated from market pressures for most of its history. However, as Hochheiser stated,

… changes in telecommunications … [and increased competition]…. eventually led to an antitrust suit by the U.S. government against AT&T. The suit began in 1974 and was finally settled in January 1982 when AT&T agreed to divest itself of the wholly owned Bell operating companies that provided local exchange service. (Hoecheiser, 2000)
This led to the creation of seven regional “Baby Bells”, which subsequently enjoyed a monopoly as local call providers, at least until the advent of the US 1996 Telecommunications Act. The 1996 US Telecommunications Act was a significant redefinition of telecommunications policy. This redefinition was precipitated by considerable public discourse in relation to the role of the USO in maintaining equity and access to telecommunications in a deregulated and increasingly commercial orientated environment.

In Australia, between 1901 and 1975, telecommunications was administered as a department of the public service within the Post Master General's Department (PMG). Whilst universal service did not become a legislated goal until 1975, debates over the role of the PMG in relation to commercial viability versus a service-oriented department occurred early in the twentieth century. According to Moyal, it was the Victorian Senator, Best, who argued in favour of a more service-oriented department and articulated the concept of telecommunications service to the bush (Moyal, 1985:90–91). Best's proposition was “…we have here a vast undeveloped continent … and a duty to render to those who do not crowd themselves into cities. We ought to offer them every possible facility with a view to making lives as agreeable as possible” (cited in Wilson and Goggin, 1993:6).

In the era preceding the telecommunications Act of 1975 the concept of universal service was implicit in the spread of telecommunications facilities throughout Australia. Whilst universal service was not mentioned in any of the Post and Telegraphic Acts that governed the PMG Department, a complex series of cross-subsidisation assisted in raising the telephone penetration rate to 1 in 5 Australian homes by 1959. Post World War 2 subsidies also facilitated a rise in private telephone connections and, by 1975,62 per cent of households in Australia had telephones connected (Wilson and Goggin, 1993:7). In 1975, following the Vemon Report recommendations, the PMG was disbanded and Telecom, a government-owned and managed telecommunications utility, was formed.

Telecom (initially the Australian Telecommunications Commission) resulted from a separation of the telecommunications and postal parts of the operational section of the PMG department. Telecom remained under full government ownership and
had a statutory monopoly on all aspects of the provision of telecommunications facilities and technical regulation of the industry. In 1975 this monopoly also extended to the supply, installation and maintenance of customer premise equipment (CPE) and value-added network services (VANs). Whilst the Overseas Telecommunications Commission (OTC) had been established in 1946 with the responsibility of handling overseas telecommunications traffic, the domestic reticulation of traffic came under the auspices of Telecom.

In 1981 a third carrier, Australian Domestic Communications Satellite System (AUSSAT), was formed. AUSSAT owned and operated Australia’s communications satellite and its functions included the broadcasting and provision of private network services. Telecom maintained its domestic monopoly, allowing AUSSAT interconnection with the Telecom network for the origination and termination of calls.

At the time of its formation in 1975 Telecom was endowed, through legislation, with the powers to provide telecommunications access to all Australians on an equitable basis, wherever they reside or carry out their business. According to the Telecommunications Act 1975 Telecom was to provide a service that would,

… best meet the social, industrial, and commercial needs of the Australian people for telecommunications services and shall, so far as it is, in its opinion, reasonably practicable to do so, make its telecommunications services available throughout Australia for all people who reasonably require those services. (Section 6 (1) (Cited in Wilson and Goggin, 1993:7)

Later in the Act another clause added that Telecom must consider: “…the special needs for telecommunications services of Australian people who reside or carry on business outside the cities (section 6 (2) (b) iii)” (Cited in Wilson and Goggin, 1993:7).

Since 1975 universal service has been a legislated goal of Australian telecommunications policy. The Australian concept of universal service has explicitly included geographic coverage, equity of access and consideration of the technological standard of the basic telephone service. Since its inception in legislation the
USO has been the fundamental mechanism to ensure that the goals of consumer access, geographic coverage and social equity were maintained. Consistent with most international approaches to telecommunications access the Universal Service Obligation has been, as Evelyn Richardson argued, “a ‘trailing’ or ‘catch up’ mechanism designed to ensure that a basic telephone service is delivered to all” (Richardson, 1998:1).

In the post-1975 era the concept of universal telecommunications reach has been the focus of a number of reports and investigations (The Broadband Services Expert Group Report, 1994; The Austel Occasional Report, 1996; The Information Policy Advisory (IPAC) Report, 1997; The Australian Communications Authority (ACA) Digital Data Inquiry, 1998). Many of these reports have paid particular attention to the telecommunications requirements of rural and remote Australians. The quality of service, the range of service provision and the need to upgrade infrastructure in order to maintain equitable telecommunications access have been consistent themes reiterated in the reports.

In recent years a number of factors have shaped and influenced the redefinition of universal telecommunications service. These influences have included changes and convergence in technology, the emergence of new services, the deregulation of the telecommunication industry, increased competition in the market, the exponential growth of data services and the globalisation of communications (see Chapter 4.3). Increasingly, the role of the USO has been considered not only as a “catch up” mechanism but also as a means to facilitate market demand.

Australia's telecommunications industry has, according to a report prepared by the Productivity Commission (1997:71), “...undergone a remarkable transformation since 1975...[and]... these changes broadly involve liberalisation.” Commencing with the corporatisation of Telecom in the late 1980s Australia's telecommunications industry had, in the 1980s and 1990s developed a significant commercial focus. In the 1990s the formation of Telstra through the amalgamation of OTC and Telecom, the privatisation of AUSSAT and subsequent purchase by Optus, precipitated the deregulation of the telecommunications industry in the mid 1990s.
In 1997 the partial sale of Telstra highlighted the growing tension between the commercial objectives of deregulation and liberalisation and the social objectives inherent in telecommunications policy. In the deregulated telecommunications environment that was emerging there was considerable public concern over the capacity of market forces to deliver and maintain equitable telecommunications access. It was feared that in a fully privatised, deregulated environment telecommunications carriers would focus on maximizing commercial returns to shareholders at the expense of service to the non-profitable areas. This concern was highlighted by an emerging demand for high-speed data access. As the Telstra Unions argued in their submission to the 1996 Senate Telstra Inquiry,

… the Government’s approach to Telstra reveals an ambivalence which is unfortunately, widespread in the industry and of which the ISDN debate is a prime example. On one hand there is an ideological and (in the case of much of the industry) self-interested support for market forces as a chief driver of service delivery: on the other, there is the call for Telstra to provide high quality, low cost platform for both customers and competitors, irrespective of its own commercial interests. These demands are fuelled by a perception of the growing importance of telecommunications services to economic, social and cultural life. To the degree that provision of such network capabilities may be uneconomical, they amount to a call for an extension of the USO (Telstra Unions, 1996:29)

It was perceived that in the transition to a competitive telecommunications environment a self-regulating commercial industry would, without government intervention, disadvantage rural and remote Australians. It was feared that without sufficient investment in basic telecommunications infrastructure the benefits of the digital information age and the “Information Highway” would bypass the rural and remote regions (IPAC Report, 1997:10). By the end of the 1990s the USO was coming under increasing scrutiny not just as a means of fulfilling social objectives but also as a potential market development mechanism.
4.2 International Approaches to Universal Service

According to Richardson (1998:7), by the late 1990s policy makers around the world were struggling to define universal service in a liberalised and deregulated environment. Both the United Kingdom (UK) and the European Union (EU) had taken a conservative approach to the issue of redefining the legislation underpinning the USO. This approach was based on the premise that the liberalisation of telecommunications was still evolving and early legislative intervention may actually inhibit the potential consumer benefits brought about by competitive forces. However, as Richardson argued (1998: 26,28), both the UK and the EU were committed to promoting access to advanced communications and information services in the education sector. In the UK, public access points, such as educational institutions and health facilities, were perceived as an important means of extending telecommunications services and promoting market development. The OfTEL report, Beyond the Telephone, The Television and the PC, (1996) recognised the need for broadband access to schools, colleges and libraries and recommended a layered approach in redefining the USO, suggesting that higher levels of service be provided for public assess points. Up until the end of the 1990s the majority of Member States of the EU had not seen the need to establish specific schemes for sharing USO costs. However, the USO was examined within the context of the 1999 EU review of telecommunications legislation.

In the US, however, the issues surrounding a redefinition of the USO attracted considerable public attention. As a consequence of the debate, the “community access” concept was enshrined in the 1996 United States Telecommunications Act. The legislation explicitly stated that schools, libraries and health care providers have access to advanced telecommunications services as well as basic services (US Telecommunications Act 1996: Section 254). According to Richardson (1998:25), “These provisions are the first internationally, to include public institutions in the Universal Service Requirement.”

The 1996 amendment to the US Telecommunications Act was precipitated by a recognised need to modernise the universal service policy in an increasingly competitive market place and to expand its applicability (NTIA: 1997). Fuelling the debate was considerable public concern that low income earners and
telecommunications consumers in rural, insular and high cost areas, already disad
vantaged in terms of their capacity to access the National Information Infrastructure, would be further disenfranchised in the emerging digital information age (US Dept of Commerce, 1995). According to the US Dept of Education (1998), the key objectives of the 1996 Telecommunications Act were to:

…encourage competition in the telecommunications and broadcasting industry; reduce regulatory burdens; provide consumers with greater choice and lower rates, and expand and maintain an existing system of universal service that provides high-cost areas, low income families, and schools, libraries, and rural health care providers with affordable access to advanced telecommunications. (US Dept of Education, 1998)

As a direct consequence of the revised US Telecommunications Act all schools and public libraries were eligible for discounted telecommunications access. The initiative, known as the E-Rate, was funded through the USO and administered by the US Schools and Libraries Corporation. All schools and public libraries qualified for the program and were eligible to receive discounts in the range of 20 to 90 per cent on telecommunications services, internal connections, and Internet access. The discounts were dependent upon an institution's level of economic disadvantage and geographic location. The telecommunications companies supplying the services were paid from the Universal Service fund. Companies were reimbursed the cost of the service plus a profit margin.

In the US the link between Information Communication Systems (ICS), competition policy and the achievement of social policy objectives was explicit and enshrined in Telecommunications legislation. However, as Richardson has argued (1998:25,26), the US 1996 Telecommunications Act was also an acknowledgement that Congress did not trust market forces to deliver services at acceptable prices. The Act also acknowledged the role of Government in addressing inequalities in telecommunications access. What was less explicit in the legislation was a redefinition of the USO from a functionalist “catch up” mechanism to its application as a market development driver.
In Australia, by 2000, the paradigm of a monopolistic, government-owned and highly regulated national telecommunications carrier serving the political, economic, cultural and social needs of the nation had outlived its usefulness. However, the conundrum of reconciling the tensions between social policy, competition objectives and the commercial activity of new entrants in the market to the benefit of the Long Term Interests of End Users (LTIE) was yet to be achieved. There was, as Northfield (1999:7) stated, “A need to explicitly link the LTIE concept with the development of Australian universal service philosophy and model post 1 July 1997”, if the goals of consumer access and social equity were to be maintained.

4.3 Changing Telecommunications Usage

Australia's telecommunications usage has altered significantly in recent years. Since the commercialisation of the Internet in Australia in 1995, digital data transmission over the Plain Old Telephone System (POTS) has grown at an exponential rate. As Moon stated in the research report Bandwidth Requirements for the Australian Education and Training Sector, “In September 1998, and for the first time in history, Australian networks carried a larger volume of data than telephone traffic” (Moon, 1999). According to the Australian Bureau of Statistics (ABS) household survey in 1998, 19 per cent of Australians had home Internet access. Wider studies indicated that 65 per cent of homes with school-age children had access (Moon, 1999). The exponential growth of the Internet showed no sign of abating. As Sheridan Roberts, the Director of Science and Technology Statistics, ABS, stated on the release of the 2000 ABS figures,

Twelve months ago there were 19% of Australian households, that's 1 3 million households which had Internet connections. By November 1999 that has risen to one quarter of households, 1.7 million. This is in fact nearly a 40% increase in the number of households with Internet access (ABS, 2000a)

Full and active participation in society no longer required access to voice telephony but also access to digital communications products such as the Internet and network technology. As a submission to the 1998 Digital Data Inquiry argued,
In recent years the Internet and network technology has become an integral aspect of the social, economic and cultural fabric of modern society. New communications products and systems have become essential to an individual's ability acquire, sustain and develop marketable job skills and to be an informed and active participant in society. (ACA, 1998:42)

The ACA Digital Data Inquiry also argued that communications products and systems have become vital to the ability of Australian businesses to remain competitive in a global market place (ACA, 1998: 28). Moon also supported this contention and argued that, “Access for all Australians to the Internet (and other data services), [had] become a fundamental component of business, government, education and recreation” (Moon, 1999).

In recognition of Australia's changing telecommunications needs, the Telecommunications Act 1999 (Consumer Protection and Service Standards) was enacted to

…ensure that all people in Australia, wherever they reside, or carry on business, should have reasonable access, on an equitable basis, to digital data services, standard telephone service, payphones and prescribed carriage service. (DCITA, 1999c)

The digital data service specified in connection with the USO included a general Digital Data Service and a Special Digital Data Service broadly comparable to a transmission speed of 64 kilobytes per second.

4.4 Social Issues

However, both social and equity issues continued to dominate the telecommunications debate. As Evelyn Richards (1998:3) stated, “In the Australian context, it is generally accepted that rural and remote parts of Australia have benefited least from the introduction of new technologies. Historically, services to rural and remote Australians have lagged behind the urban counterparts” (Richardson, 1998:3,4). Statistics from the ABS released on 1 March 2000 supported this contention. According to the ABS “Of
the 1.7 million households with Internet access at November 1999, seventy five per cent (1.3 million households) were located in capital cities” (ABS, 2000b).

Whilst the growth in Internet access had been exponential, the growth has been predominately in the major urban areas. In an analysis of the 89 submissions received by ACA 1998 Digital Data Review the review team concluded that “Inequality in terms of data access rates and price in rural areas was identified as the major barrier to the benefits of the full range of information services” (ACA, 1998:52). It would appear that not only was the Information Highway bypassing rural and remote residents it was exacerbating the economic, social, cultural and educational inequalities rural and remote residents already faced.

In order to assess the adequacy of telecommunications services in metropolitan, regional, rural and remote areas of Australia, in March 2000 the Minister for Communication, Information Technology and the Arts announced the Telecommunications Service Inquiry. The inquiry received in excess of 1000 submissions (Telecommunications Service Inquiry, 2000a), undertook extensive field trips and conducted public consultation in all capital cities and regional areas. Concern over the capacity of a self-regulating, competitive telecommunications industry model to achieve national policy objectives was expressed in a number of submissions. As the CIRCIT (2000:3) submission stated “…The core requirements of enhanced infrastructure cannot be dealt with by competition policy alone.” In October 2000 the Final Report of the Telecommunications Service Inquiry stated that a number of consistent themes emerged in relation to the telecommunications needs of Australians and the extent to which people believed those needs are being met (Telecommunications Service Inquiry, 2000d). The report concluded that,

… research indicates Australians who live in metropolitan and regional centres enjoy good telecommunication services and are generally satisfied with them. However, a significant proportion of those who live and work in rural and remote Australia have concerns regarding key aspects of services which, at this stage, are not adequate.

(Telecommunications Service Inquiry, 2000d)
4.5 The Northern Territory Context

Historically, telecommunications access has had a significant role in overcoming the isolation inherent in living and working in the Territory (see Chapter 2). The laying of the overland telegraph line (OTL) from Adelaide to Darwin in 1872 was, for instance, an important factor in opening up the Territory for settlement. The OTL also had a fundamental role in promoting the economic and social viability of, not just the Northern Territory but also a geographically isolated, colonial Australia. As the editor of the Sydney Morning Herald prophetically declared when the first telegraph message from the United Kingdom was successfully relayed to the colony, “The ultimate effects of the combined international cable and telegraph networks on commerce and politics [are] impossible to conceive” (cited in Livingston, 1996:85).

4.5.1 Telecommunications in the Northern Territory

Since the commercialisation of the Internet in 1995 and the deregulation of the telecommunications industry in 1997 a significant Information Technology industry has emerged in the Northern Territory. As of June 1999 there were approximately 20 local service providers operating in the Northern Territory (Australian ISP List. Northern Territory, 1999). The growth rate in Internet connections had, according to the Manager of one ISP “…doubled every eight months” (Irvine, 1998). The Northern Territory was, according to the ABS figures on the Regional Distribution of Internet Users Aged 18 and Over, second only to the Australian Capital Territory in Internet usage per head of population. Approximately 30 per cent of the population aged 18 years and over accessed the Internet regularly. Significantly, the major penetration areas had been in the commercial, government and residential sectors of the metropolitan areas. This followed a similar trend nation wide (ABS, 1998).

Up until 2000 Internet access in the Northern Territory had been predominantly via the Public Switch Telephone Network (PSTN) using modems at data rates below 56 kilobytes per second (Kbps). However, the exponential growth of the Internet and network technology had prompted the demand for higher speed access. In March 1998 the Northern Territory Government announced the establishment of a fibre optic network encompassing the Central Business District of Darwin. A number of research
and commercial institutions established their own networks and leased high speed Integrated Service Digital Network (ISDN) access from the major carriers.

According to the Northern Territory Department of Communications and Advance Technology, by 1998 ISDN access at the rate of 64 Kbps was available to all the major population centres and some regional areas of the Northern Territory (1998). However, in most of the remote areas of the Territory, where approximately 24 per cent of the population resided, only standard voice grade access up to 9.6kbps was available. This access was either via a landline or microwave. As recently as 1997 telephone access to a number of remote communities was unavailable (Northern Territory Department of Education, 1997c: 23).

The upgrading of telecommunications in rural and remote areas is a significant issue in the Northern Territory. According to the Department of Communications, Information Technology and the Arts (DCITA),

The Northern Territory is recognised as having the least developed telecommunications infrastructure of all States and Territories in Australia. The impact on communities has been great, affecting the quality of established services like telephone and facsimile as well as the availability of new communications services like the Internet. (DCITA, 1999a)

In order to promote the development and application of network technologies in rural and remote Australia the Department of Communication, Information Technology and the Arts initiated the Regional Telecommunications Infrastructure Fund (RTIF). The RTIF was established in 1997 and funded from the partial sale of Telstra. Since the inception of the RTIF the Northern Territory Department of Communications and Advanced Technology, the Local Government Association of the Northern Territory and the Galiwin’ku Community Incorporated had made submissions to the Department of Communications and the Arts for the upgrading of telecommunications infrastructure and training in new technologies. The Outback Digital Network Indigenous Taskforce had also received funding from the Regional Telecommunications Infrastructure Fund to enable the Taskforce to consult with community members and stakeholders on the proposed upgrade and extension of
the Tanami Network. The Tennant Creek Regional Telecommunications Infrastructure Project and the Daly River Region were also successful in receiving funding for improving telecommunications access in their respective regions (DCITA, 1999b).

The Northern Territory Department of Education also acknowledged the need for the upgrading of telecommunications infrastructure to remote communities if equity of access to educational provision was to be achieved. According to the Northern Territory Department of Education, the demand for modern services to meet client requirements, especially those from parents, employers, students, teachers and staff, was increasing beyond the capacity of current Information Technology installations and resources (Northern Territory Department of Education, 1997).

4.6 Conclusion

Historically, telecommunications access has been a significant aspect of the social, cultural, political and economic fabric of Australian society. Universal access to telecommunications services and products has been an implicit and explicit goal of telecommunications development and application since Federation. It was not, however, until 1975 that the concept of universal service was enshrined in Telecommunications legislation. Since 1975 the Universal Service Obligation (USO) has been the fundamental mechanism to ensure that Australians have equitable access to telecommunications infrastructure, services and products.

In the last two decades of the twentieth century, however, the telecommunications industry has undergone a considerable transformation. These changes broadly involved a liberalisation of the telecommunications industry. A deregulated industry coupled with convergence in technology, the exponential growth of data services and increased competition in the market have focused community and political attention on the USO. Traditionally the USO has been a “catch up” mechanism designed and implemented to ensure that basic telephony was universally available. In the rapidly changing telecommunications environment public concern over the capacity of market forces to deliver equitable telecommunications access to commercially unprofitable areas led to a re examination of the USO.
Equity issues in telecommunications access are not unique to Australia. Policy makers around the globe have redefined the scope of the USO in a liberalised and deregulated environment. Whilst the concept of a tiered system of discounted telecommunications to public access points, such as education institutions, libraries and health care providers has gained considerable attention, up until 2000 only the US had legislated to include public institutions in the Universal Service Requirement.

Under US Telecommunications legislation, schools and public libraries qualified for discounts on a wide variety of networking products, telecommunications services and Internet access. The initiative, which was known as the E-Rate, was created when US Congress passed the US Telecommunications Act in 1996. The scheme was aimed to offset the disparities in access to telecommunications goods and services (Schools and Libraries Corporation, 1997). The education sector was specifically targeted as a means of redressing what the White House described as “…the Digital Divide, the… unequal access to technology and high-tech skills by income, educational level, race, and geography” (White House, 2000).

In the Northern Territory there has been considerable growth in the local telecommunications industry and the upgrading of telecommunications infrastructure had become a significant issue. This growth was reflected in the number of people who accessed the Internet regularly as well as the number of ISP who had entered the market. The rural and remote areas of the Territory, however, continued to suffer from inadequate service and infrastructure. In particular, the telecommunications needs of educational institutions were increasing beyond the capacity of information technology installations and resources.

The challenge that faced the telecommunications sector was how to ensure equitable delivery of service to rural and remote Australia in a commercially viable manner. Central to this challenge was the USO. Equity, access and geographic coverage were the social issues defined in the USO and enshrined in legislation. In a competitive, deregulated telecommunications environment what the mechanism needed, however, was a new paradigm.
This research project was undertaken to investigate the research question “How effectively is Federal government policy addressing the current and emerging telecommunications needs of schools in the NT?” In order to ascertain the growth and development of the Internet in NT schools education in the three-year period since schools first established an Internet connection in 1996, a survey and case study research methodology was employed. This research methodology is discussed in Chapter Five.
Chapter 5
Methodology

5.0 Introduction

This chapter places the deregulation of the telecommunications industry and the commercialisation of the Internet within the educational context of the Northern Territory (NT). The purpose of the study is included in this chapter as well as the research methodology employed. As the research project involved both quantitative and qualitative data, the methodology employed in the statistical and qualitative data analysis is also included in this chapter.

Consistent with survey and case study research methods in education, the research project involved both quantitative and qualitative analysis (Wiersma, 1991; Gay, 1987; Jackson, 1988; Cates, 1985). The data collection instruments included two surveys, a series of case studies and interviews with key stakeholders in NT education. The data collection phase of the research project took place during the second semester of 1996 and the first semester of 2000. The first survey was distributed to schools during the fourth term of 1996. The second survey was distributed in the first term of 2000.

5.1.0 The Purpose of the Study

The purpose of this study was to investigate the research question “How effectively is Federal telecommunications policy addressing the current and emerging telecommunications needs of schools in the Northern Territory (NT)?” More specifically, the study aimed to investigate the question “To what extent are rural and remote schools in the NT able to access the Internet by the existing telecommunications infrastructure?” Schools from the urban, rural and remote areas of the NT were the focus of the study. The study examined the growth in Internet access by urban and rural/remote NT schools education in the three-year period since schools established an initial connection to the Internet in 1996. A survey and case study methodology identified a number of emerging issues in the utilisation of the Internet in NT education.
5.1.1 Factors that Inhibit Internet Use

The factors that inhibited Internet use were identified on the 1996 and the 2000 Computers in NT Schools Survey by the question –

**What factors if any inhibit the use of the Internet in your school?**


The inhibiting factors include -

- Access speed
- Access costs
- State of current hardware
- Poor telephone connection
- Lack of dedicated telephone connection
- Lack of trained personnel
- Lack of expertise

5.2 Data Analysis

The data collected from the 1996 and the 2000 surveys was recorded on the database File Maker Pro. The recording of the survey results on the database enabled a quantitative and demographic analysis of the growth and development of the Internet in Northern Territory education in the three-year period since schools established their initial connection in 1996. Qualitative data from the case studies was also recorded on the database File Maker Pro. The qualitative data was utilised to triangulate the results of the two surveys and anecdotal comments by survey respondents (Wiersma, 1991:232).

5.3.0 1996 Survey of Computing in Northern Territory Schools

The major data collection instruments utilised in the research project were two surveys. The initial survey was designed and developed in 1996 by the Open Learning
Support Unit (OLSU), the researcher and the project officer assigned to evaluate the
*Improve Access Improve Opportunity* (IAIO) project (see Chapter 1.0). Consistent
with survey research methodology, the survey was tested for construct validity prior
to distribution (Wiersma, 1991:170, 175; Gay, 1987:131). In consultation with the
Certification and Research Branch of the Northern Territory Education the survey was
pre-tested by NTDE personnel and a number of questions were rewritten or omitted
on the grounds of redundancy. The first survey was administered to 186 schools in
the Northern Territory during the fourth term of 1996 (see Appendix 11). In order to
increase the response rate a follow-up letter was distributed to non-respondents prior
to the survey return date. The follow-up letter prompted a slight increase in survey
returns. The 1996 survey had a response rate of 40.32 per cent.

### 5.3.1 1996 Survey Response Rate

According to Jackson (1988:171) and Wiersma (1991:180), mail out surveys have a
typically low response rate. In order to eliminate bias in the data due to the high non-
response rate it was necessary to undertake a demographic breakdown of the survey
returns (Wiersma, 1991:184). Of the surveys returned, 48.68 percent were from the
remote schools in the NT and 51.32 percent were from schools located in the major
urban areas of the NT. As *Graphs 5.3 and 5.4* indicates, in comparison with the total
NT response, there was a 5.08 per cent higher response rate from schools in the
urban areas of the Territory.

<table>
<thead>
<tr>
<th>Percentage of school located in the Urban and Rural/Remote locations of the NT</th>
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<tbody>
<tr>
<td>Urban: 63.76%</td>
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<tr>
<td>Rural/Remote: 46.24%</td>
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*Graph 5.3 Data Source Statistics and Demographic Branch NTDE 2000*

<table>
<thead>
<tr>
<th>Percentage of survey returned from schools in the Urban and Rural/Remote areas.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban: 48.68%</td>
</tr>
<tr>
<td>Rural/Remote: 51.32%</td>
</tr>
</tbody>
</table>

*Graph 5.4 Data Source 1996 Survey of Computing NT Schools*
5.3.2 Demographic Analysis and Non Respondents

A demographic analysis also revealed that of the 86 85 per cent of the survey returns were from Government schools, 7.89 per cent were from Catholic schools and 5 26 per cent were from independent schools in the NT.

As Graphs 5.5 and 5.6 illustrate, in comparison to the actual demographics of schools in the NT the survey returns demonstrated no significant bias.

An informal canvassing of non-responding schools indicated that lack of time and teacher turnover were the major reasons cited for not responding to the survey. The 5.08 per cent disparity’ in urban/rural responses was therefore not regarded as significant and the surveys returned were broadly representative of schools in the Northern Territory.

5.4.0 2000 Computing in Northern Territory Schools Survey

The second survey was designed and developed by the researcher with the assistance of the Northern Territory Department of Education (NTDE) in particular, with the Manager of Strategic Planning Evaluation and Review and the NTDE Year 2000 Project team (see Appendix 12). Consistent with survey research methodology (Wiersma, 1991:170, 175), the construction and validation of the survey involved a series of detailed steps. In consultation with NTDE Manager of Strategic Planning Evaluation and Review and the NTDE Year 2000 Project team, a number of original survey questions were omitted on the grounds that the Year 2000 Project team had,
during 1998 and 1999, extensively surveyed NT schools in order to obtain Year 2000 compliance data. In order not to overburden schools with another survey that was ostensibly seeking the same information, the Year 2000 Project team made access available to the data they had already collected.

On the advice of the NTDE Manager of Strategic Planning Evaluation and Review the Year 2000 survey was tested, prior to distribution, for content validity (Wiersma, 1991: 278; Jackson, 1988:28,29). Ten questionnaires were distributed to NTDE and non-NTDE personnel to assess the adequacy of the questionnaire. On the basis of the feedback from the personnel who pre-tested the survey, a number of minor re-writes occurred before the survey and the covering letter were distributed to schools at the commencement of term one 2000. In total 189 survey forms were distributed. The distribution targeted all schools in the NT including the School of Music, the School of Languages and the School of Sport.

In order to increase the survey response rate (Wiersma, 1991:182) a follow-up letter was distributed to all schools two weeks before the surveys were due to be returned (see Appendix 13). Schools received the follow-up letter during the first week of term two 2000. The follow-up letter prompted an increase of 8 per cent in completed survey returns. Prior to distribution all surveys were coded in order to protect the identity of individual schools. Aggregate results only were used in the data analysis. The 2000 survey had a response rate of 40.21 percent. This response rate was slightly less than that achieved in 1996.

**5.4.1 Demographic Analysis of Survey Responses**

Due to the low response rate it was necessary to once again determine if the survey returns were broadly representative of schools in the Northern Territory. A demographic analysis of the surveys that were returned revealed that 43.43 per cent were from schools in the urban areas of the Territory and the remaining 56.57 per cent were from schools in the rural/remote areas. As the graphs 5.7 and 5.8 illustrate, the survey responses were broadly representative of the actual demographics of schools in the Northern Territory.
In comparison to the 1996 survey returns there was however, a 7.89 per cent increase in the number of responses from schools located in the rural and remote areas of the NT. In 1996 the survey response rate from rural and remote schools was 48.68 per cent (see Graph 5.4). In 2000 the response rate from rural and remote locations had risen to 56.57 per cent.

Of the schools that did respond to the 2000 survey 90.78 per cent were Government, 6.58 percent were Catholic and 2.63 per cent were Independent schools (see Graph 5.10).

As the graphs 5.9 and 5.10 illustrate, there was a 7.99 per cent disparity in the number of government schools that responded to the survey compared to the actual demographics. The disparity was not significant given the large proportion of Government schools in the NT. The demographic analysis of schools by “category” was conducted to account for any extraneous influences or variables that may affect the validity of the study (Gay, 1987:276).
**5.4.2 2000 Survey Non Respondents**

An informal polling of non-respondents indicated that teacher turnover and lack of continuity of staff were the major reasons cited for non-response to the survey. Teacher turnover was a major issue for schools in the remote areas of the Territory. The Collins report, an independent review of indigenous education, stated that teacher turnover had a major impact on student outcomes and school stability (Collins, Lea and Tess, 1999:74,75). According to Collins, Lea and Tess, the average length of stay at a school for non-indigenous teaching staff was 2.7 years. Remote schools had, however, cited situations where three different Head Teachers had been employed in eighteen months. One school had a reported staff turnover of sixty teachers in seven years (Collins, Lea and Tess, 1999:75).

Other than the cited “teacher turnover” by non-respondents, there were a number of other contributing factors that accounted for the low survey return rate. Mail deliveries to some isolated and remote communities are hampered during the wet season. Mail planes often cannot access communities on a regular basis and communication with schools is precarious. During the survey mail-out time the two main arterial transport routes in the Territory, the Stuart and Barkly Highways were flooded and access to remote communities was limited. A number of dirt airstrips were closed and mail deliveries to remote communities were delayed.

Given the constraints of administering mail surveys in the Northern Territory, a 40 per cent survey return was, according to the Director of Learning Delivery Support (11.05.00), a very good response. A demographic analysis revealed that there was no
significant bias in either the 1996 or the 2000 the survey returns. The survey returns were broadly representative of schools in the Northern Territory.

5.5 Case Studies

In order to obtain comprehensive qualitative data a series of case studies were undertaken during the first semester of 2000. The case studies were conducted to corroborate, or triangulate, the data collected from the 1996 and 2000 survey (Wiersma, 1991:232). The case studies involved interviews with school-based personnel and observation. The case studies assisted in providing a descriptive analysis of the current and emerging telecommunications needs of schools in the Northern Territory.

The schools that participated in the case studies were chosen to be representative of schools in the NT. The schools were drawn from the urban, rural and remote areas of the Northern Territory and included government and non-government schools. Primary schools, secondary schools and Continuing Education Centres participated in the case studies. A total of nine case studies were undertaken (see Chapter 7).

The schools selected to participate in the case studies were initially contacted by letter (see Appendix 14). A follow-up phone call confirmed each school's involvement in the research. Permission to contact schools in remote communities was also sought and granted by the relevant Land Council (see Appendix 15). The request to involve schools in the research was discussed and granted at the Land Council Meeting No 52 conducted on the 18 May 2000.

In order to obtain comprehensive qualitative data, interviews with school-based personnel participating in the case studies were tape-recorded. The qualitative data was then transcribed and recorded on the database File Maker Pro. The statistical analysis of the survey results was utilised in conjunction with the qualitative data obtained from the case studies to answer the research question “To what extent are rural and remote schools in the NT able to access the Internet by the existing telecommunications infrastructure?” (Wiersma, 1991:306).
The questions and issues discussed with the school personnel who consented to be involved in the research, are included as Appendix 16. Prior to participation in the case studies the personnel involved were given a plain language statement explaining the nature and purpose of the research. Informed consent to tape record interviews was also obtained from participating school personnel.

5.6 Conclusion

This chapter described the purpose of the study and the methodology employed in conducting the research. The purpose of this study was to investigate the research question “How effectively is Federal telecommunications policy addressing the current and emerging telecommunications needs of schools in the Northern Territory (NT)?” More specifically the study aimed to investigate the question “To what extent are rural and remote schools in the NT able to access the Internet by the existing telecommunications infrastructure?” Schools from the urban, rural and remote areas of the NT were the focus of the study. The study examined the growth in Internet access by urban and rural/remote NT schools education in the three year period since schools established an initial Internet connection in 1996. A survey and case study methodology identified a number of emerging issues in the utilisation of the Internet in NT education. This chapter outlined the steps taken to determine the content validity of the surveys utilised as data collection instruments and methodology employed to eliminate bias in the survey returns. The methodology employed in the statistical and qualitative data analysis was also included in this chapter. An analysis of the survey returns is discussed in Chapter Six. The case studies are contained in Chapter Seven.
Chapter 6
Results of 1996 and 2000 Surveys

6.0 Introduction

This chapter describes the results of the survey component of the research project. The data collection instruments utilised in the research were two surveys (see Appendices 11 and 12) and a series of case studies. The first survey was administered at the conclusion of the IAIO project in 1996 and the second survey was administered in 2000. The data from the 1996 survey provided an appropriate base line to gauge the growth and development of the Internet and network technology in schools in the Northern Territory (NT). A comparative analysis of the data obtained from the 1996 survey and the 2000 survey identified a number of emerging issues. A demographic analysis of the survey returns also revealed that the growth in Internet connections had been predominantly in schools situated in the major urban areas of the Northern Territory. Anecdotal comments by school-based personnel and a series of case studies enabled a corroboration of the data obtained from the 1996 and 2000 surveys. The case studies are contained in Chapter Seven.

6.1 1996 Computing in NT Schools Survey

The 1996 Survey of Computing in NT Schools was distributed during the second semester of 1996 (see Appendix 11). The survey was implemented immediately after the Improve Access Improve Opportunity (IAIO) project (see Chapter 1.0) and was distributed to all schools in the Territory. The survey had a response rate of 40.32 per cent. Despite the low response rate the survey was broadly representative of schools in the Northern Territory (see Chapter 5.3.1) and provided an appropriate base line to gauge the growth and development of the Internet and network technology in education during the three year period to 2000.

The IAIO project was initiated with the aim of “…improving access to modern generation computers through the delivery of one hundred and twenty five computers…” to project schools in the Northern Territory (Northern Territory Department of Education, 1997c: 2). The schools that participated in the project received Macintosh Performa 580 CD computers, educational CD ROMs and one
28.8 kilobytes per second (kbps) Hayes modem. After the initial implementation of hardware and software, the IAIO project was extended to include subsidised Internet access and associated telephone charges (Northern Territory Department of Education, 1997c: 2).

As Table 6.0 indicates, approximately 68.41 percent of schools in the Northern Territory had access to the Internet by the end of 1996,

Table 6.0 Q 19 (1996 Survey Numbers of computers in your schools have permanent phone line – i.e. They are always connected [to the internet] via a modem?

<table>
<thead>
<tr>
<th>No. of Computers with a permanent access to a phone line Territory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of Schools in the Territory</td>
</tr>
<tr>
<td>4 or more</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>Question left blank</td>
</tr>
</tbody>
</table>

However, by the end of 1996 the majority of schools in the Northern Territory (40.78 per cent) that did have access to the Internet only had one computer with permanent access to a telephone line. Approximately 24 per cent of schools indicated that they had no computers connected to the Internet and multiple Internet access was uncommon. A demographic analysis of the survey returns revealed that, of the 6.57 per cent of schools with four or more computers that had permanent access to a phone line, 80 per cent were secondary schools and 20 per cent were primary schools. All of these schools were located in the major urban areas of the Territory.

At the time of the 1996 survey the schools that had an established Internet connection **had** very little experience of the Internet. As indicated by Table 6.1, by the end of 1996, 63.15 per cent of schools had been using the Internet for less than 12 months and 7.89 per cent of schools had been utilising the Internet for a period of one to four years.
Table 6.1 Q 44(1996 Survey) Approximately how many weeks, months, and years since your school started using the Internet

<table>
<thead>
<tr>
<th>How long has your school been using the Internet?</th>
<th>Percentage of schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than 1 year but less than 4 years</td>
<td>7.89</td>
</tr>
<tr>
<td>More than 5 months but less than 12 months</td>
<td>9.21</td>
</tr>
<tr>
<td>More than 1 month but less than six months</td>
<td>52.63</td>
</tr>
<tr>
<td>None</td>
<td>1.31</td>
</tr>
<tr>
<td>Question left blank</td>
<td>28.94</td>
</tr>
</tbody>
</table>

Whilst the majority of respondents to the 1996 survey had little experience of the Internet, respondents identified a number of factors that inhibited the use of the Internet in NT schools. As indicated by Table 6.2, in 1996 the most frequently cited inhibiting factors in the utilisation of the Internet were lack of a dedicated phone line, access cost, poor quality phone lines, the need for training and lack of expertise.

Table 6.2 Q. 50 (1996 Survey) what factors, if any, inhibit the use of the Internet in your school?

<table>
<thead>
<tr>
<th>Inhibiting Factors in Internet Use</th>
<th>% Of Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>7.89</td>
</tr>
<tr>
<td>Lack of dedicated phone line</td>
<td>19.73</td>
</tr>
<tr>
<td>Poor quality phone line</td>
<td>19.73</td>
</tr>
<tr>
<td>The need for training</td>
<td>22.36</td>
</tr>
<tr>
<td>Lack of expertise</td>
<td>32.89</td>
</tr>
<tr>
<td>Access Costs</td>
<td>19.73</td>
</tr>
</tbody>
</table>

6.2 2000 Survey: Growth and Development of the Internet

In order to determine the growth, development and educational application of the Internet in Northern Territory schools since schools established an initial Internet connection in 1996, a second survey was distributed to all schools at the commencement of semester one 2000 (see Appendix 12). According to respondents of the 2000 survey, 93.43 per cent of schools had Internet access at the beginning of first semester 2000 (see table 6.3). This was a 24 per cent increase in the number of schools able to access the Internet in the three-year period since the initial 1996 survey.
Table 6.3 Q 15 (2000 Survey). Number of computers that can access internet simultaneously

<table>
<thead>
<tr>
<th>Number of Computers with Internet Access in the Schools</th>
<th>Percentage of Schools In the Territory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question left blank</td>
<td>1.33</td>
</tr>
<tr>
<td>None</td>
<td>6.56</td>
</tr>
<tr>
<td>One</td>
<td>37.33</td>
</tr>
<tr>
<td>More than 1 but less than 6</td>
<td>13.33</td>
</tr>
<tr>
<td>More than 5 but less than 20</td>
<td>12</td>
</tr>
<tr>
<td>More than 19 but less than 50</td>
<td>17.43</td>
</tr>
<tr>
<td>More than 49</td>
<td>12</td>
</tr>
</tbody>
</table>

As evidenced by table 6.3, the growth in Internet utilisation by schools was also reflected in the number of computers within schools connected to the Internet. In 1996, 6.47 per cent of schools had four or more computers that could permanently access the Internet. However, as table 6.3 indicates, by 2000, 41.43 per cent of schools had six or more computers with permanent Internet access. More significantly, 12 per cent of schools had established networks in which in excess of 50 computers had Internet access.

As indicated by graph 6.4, in the three-year period since the 1996 Computers in NT Schools Survey there had been a significant growth in the number of computers that were connected to the Internet in Territory schools (see Chapter 7.1, 7.9).

Graph 6.4: Number of Computer in Individual Schools that could access the Internet.

A demographic analysis of the 2000 survey responses revealed that the growth in Internet access had been predominantly in urban schools. As graph 6.5 demonstrates,
urban schools had significantly more computers that could access the Internet than rural and remote schools (see Chapter 7).

According to the respondents of the 2000 survey, 89 per cent of schools that indicated they had one computer with Internet access were located in the rural and remote areas of the Northern Territory. The student population in these schools ranged from 11 students to in excess of 200 students. Twenty-five per cent of the schools had a student population greater than 50 (see Chapter 7.2, 7.4, 7.7 and 7.8)

6.3.0 Inhibiting Factors in the Use of the Internet

Whilst there had been significant growth since 1996 in the number of computers in schools connected to the Internet, respondents to the 2000 survey also cited a number of inhibiting factors in the use of the Internet. As indicated by table 6.5, access costs, lack of dedicated phone connection and lack of trained personnel were the major reasons cited as constraints in the utilisation of the Internet.

Table 6.5 (2000 Survey) Q24 (2000 Survey) What factors, if any, inhibit the use of the internet in your school?

<table>
<thead>
<tr>
<th>Inhibiting Factors in Use of the Internet</th>
<th>% of Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access Speed</td>
<td>26.66</td>
</tr>
<tr>
<td>Access Costs</td>
<td>42.66</td>
</tr>
<tr>
<td>State of Current Hardware</td>
<td>22.66</td>
</tr>
<tr>
<td>Poor Telephone Connection</td>
<td>32.00</td>
</tr>
<tr>
<td>Lack of Dedicated Phone Connection</td>
<td>46.66</td>
</tr>
<tr>
<td>Lack of Trained Personnel</td>
<td>46.66</td>
</tr>
</tbody>
</table>
6.3.1 Lack of Trained Personnel

Anecdotal comments by respondents to the 2000 Computer in NT Schools Survey provided an insight into the issues teachers were experiencing in incorporating the Internet into the school curriculum and school administration. The lack of expertise on staff and lack of trained school based personnel was a major issue for 46.66 per cent of schools that responded to the 2000 survey (see Chapter 7.1; Chapter 7.5). As a number of survey respondents commented –

The Internet at our school is used only by teachers - however, I would like children to be given lessons by a person who has good knowledge.

Need for teacher training.

Lack of time to assist teachers develop skills and teachers general lack of time to learn procedures in each school site we use.

Maintaining the web is our problem due to (a) lack of dedicated staff and (b) lack of skills from others.

Whilst 39.47 per cent of the schools that responded to the 2000 survey indicated that they had a designated computer specialist on staff, 80.27 per cent of respondents indicated that there was no one on staff with any formal qualifications in educational computing.

6.3.2 Phone Lines

In the 1996 Survey of Computing in NT Schools, 19.73 per cent of respondents that had an established Internet connection cited “Poor quality phone lines” as a constraint in the use of the Internet. In the 2000 survey the quality of the phone lines was once again cited as a factor inhibiting Internet access. However, the percentage of schools that cited the quality of phone lines had increased from 19.73 per cent in 1996 to 32 per cent in 2000 (see Chapter 7.2, Chapter 7.7, Chapter 7.8). As respondents to the 2000 survey commented –

Internet access for teachers at the school is very good (ISDN) but for our remote students the quality and cost of phone calls is very poor.
Poor Telephone connection - We are on a radio telephone. I would love to have a dedicated line in the classroom to use with students.

6.3.3 Lack of Dedicated Phone Line

Not only were poor quality phone lines an emerging issue for schools in the Territory, the lack of a dedicated telephone line was also cited as a significant factor inhibiting Internet access. In 1996, 19.73 per cent of schools cited “Lack of dedicated telephone line” as a constraint in Internet access (see Chapter 7.4). This figure had risen to 46.66 per cent of schools by 2000. Comments from survey respondents –

No Internet access at the school “Telstra said forget it” due to lines. We are not able to connect to the Internet.

indicated that some schools had been informed that Internet access was not possible over the existing telecommunications network. Clearly, the limitations of the Digital Radio Concentrator System (DRCS) such as low access speed, limited number of concurrent users and a system prone to atmospheric interference, were becoming apparent.

6.3.4 Cost

The cost associated with extending Internet access in schools was also cited as an inhibiting factor by 42.66 per cent of schools that responded to the 2000 survey (see Chapter 7.3). The cost of telephone charges incurred by schools in remote areas, the prohibitive expense of internal cabling and the lack of commercial competition in the rural and remote areas were cited by respondents as constraints in Internet access –

Cost of installing lines etcetera. Would have it throughout the school but the cost of cabling etcetera is prohibitive.

Additional funding to allow cabling etc would be great.

Finding a competitive server [ISP] for bush schools. Bush schools are putting their trust in only one supplier in the … region who may not be the best.
Monetary gains play a big part in the supplier's support and selling of computers. Follow-up support is expensive and tends to blitz the school budget!!

6.4 Prioritised Computer Support Needs

In order to identify school-based needs question 26 of the 2000 survey requested that schools prioritise the computer support their school needed. As table 6.6 indicates technical support was an urgent issue identified by 53.94 per cent of NT schools (see Chapter 7.6)

Table 6.5 Q 26 (2000 survey) If you could prioritise tbr computer support your school needed what would your current priorities be?

<table>
<thead>
<tr>
<th>Needs</th>
<th>Urgent %</th>
<th>Ongoing %</th>
<th>Not a Need %</th>
<th>Did Not Respond %</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Servicing</td>
<td>43.42</td>
<td>48.68</td>
<td>0</td>
<td>7.89</td>
</tr>
<tr>
<td>Increased funding</td>
<td>35.52</td>
<td>42.10</td>
<td>6.57</td>
<td>15.81</td>
</tr>
<tr>
<td>Technical Support</td>
<td>53.94</td>
<td>38.15</td>
<td>2.63</td>
<td>5.26</td>
</tr>
</tbody>
</table>

Table 6.6 Q 18. (2000 Survey) How does your school currently access the Internet?

<table>
<thead>
<tr>
<th>How does your School connect to the Internet?</th>
<th>Modem %</th>
<th>ISDN %</th>
<th>Stellite %</th>
<th>No Access %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>73.31</td>
<td>14.73</td>
<td>2.63</td>
<td>6.57</td>
</tr>
</tbody>
</table>

Whilst the in-servicing of staff and an increase in funding were perceived by school-based personnel as ongoing issues the need for technical support was reiterated in the anecdotal comments included on the surveys –

    Barkly currently has no computer support.

    We have basic expertise in the school. We are all able to use the computers but have no technical knowledge to be able to repair. We are in urgent need of support which is not readily available….

The set up and maintenance [of the network] is something above and most times beyond our normal load. A staff member allocated to work with this committee in conjunction with school may be a good option.
With the demise of the [support centre] tech support has dropped
Hardware [is] now becoming dated (as is software) [and the] newer
software doesn't run on older machines.

On going maintenance of current machines is a huge headache.

[An excellent resource] When the Internet is accessible Have not been
able to access the Internet due to technical difficulties.

6.5 Means of Internet Access
The initial survey, the 1996 Survey of Computing in NT Schools, did not indicate
how schools achieved Internet access. However, as the Improve Access Improve
Opportunity (IAIO) project distributed to the 125 participating project schools a
28.8kbps Hayes Modem, it is safe to assume that the majority of schools, in 1996,
were connected to the Internet via a modem over a telephone link supplied by the
national communications carrier.

As table 6.6 indicates, by the first semester of 2000 the means by which schools
achieved Internet access included modem connections, a direct Integrated Service
Digital Network (ISDN) link and satellite access. The schools with ISDN access
were either on the Government network or obtained ISDN access through an Internet
Service Provider.

Whilst the majority of schools were connected to the Internet via a dial-up modem,
14.73 per cent of schools had a 64 kbps ISDN link. A demographic analysis revealed
that all schools with ISDN access were in the major urban areas of the Territory (see
Chapter 7.1, 7.9). Whilst only 2.63 per cent of schools indicated they had satellite
access, anecdotal comments included on the 2000 survey indicated that satellite access
was under consideration by some schools (see Chapter 7.8).

No Internet access as yet. Future satellite access.

It is worth noting that at the time of this research project the NT Department
of Communication and Information Systems (DCIS) were conducting satellite trials
in select regional and remote locations throughout the Territory. According to the
contract manager for DCIS (23.6.00) the trials were primarily focused on the provision of administrative services for Health, Police and Education Services. The trials commenced at the beginning of 2000 and involved sites with ISDN access as well as sites with dial-in modem access over conventional and microwave telephone links.

6.6 Educational Applications

As the respondents to the 2000 survey indicated, the most frequent application of the Internet was the use of email. Seventy one per cent of respondents to the 2000 survey indicated that email was utilised frequently in their school (see Chapter 7.1, Chapter 7.6, Chapter 7.9).

Table 6.7 Q 22 (2000 Survey) How is the Internet utilised by your school?

<table>
<thead>
<tr>
<th>Internet Utilisation</th>
<th>Frequently %</th>
<th>Occasionally %</th>
<th>Rarely %</th>
<th>Did Not Respond %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>30.26</td>
<td>35.52</td>
<td>21.52</td>
<td>12.7</td>
</tr>
<tr>
<td>Educational Applications</td>
<td>28.94</td>
<td>35.52</td>
<td>18.42</td>
<td>17.12</td>
</tr>
<tr>
<td>Access NTDE Information</td>
<td>23.68</td>
<td>44.73</td>
<td>15.81</td>
<td>15.81</td>
</tr>
<tr>
<td>Email</td>
<td>71.05</td>
<td>14.47</td>
<td>1.31</td>
<td>13.17</td>
</tr>
</tbody>
</table>

6.7 Conclusion

As evidenced by the results of the 1996 and 2000 surveys there had been considerable growth in Internet access by schools in the Northern Territory since the initial Improve Access Improve Opportunity (IAIO) project (see Chapter 1.0). In the three-year period since schools established an initial connection to the Internet, the number of schools with Internet access had increased by 24 per cent. By the first semester 2000 approximately 93 per cent of schools had at least one computer with a permanent connection to the Internet. The growth in Internet access by schools in the NT was also reflected in the number of computers in schools with Internet access. In the first semester of 2000, 41.43 per cent of schools had six or more computers with Internet access. More significantly, 12 per cent of schools had established networks in which in excess of 50 computers had Internet access. The growth in Internet access had however, been predominantly in urban schools.
Respondents to the 1996 and 2000 survey identified a number of factors that inhibit the use of the Internet. The major constraints in Internet access identified by respondents to the surveys included access cost, poor quality phone lines, lack of dedicated phone lines and lack of staff expertise. The need for technical support was also identified by 53.94 per cent of respondents. Anecdotal comments by survey respondents reiterated the issues and constraints experienced.

In order to obtain comprehensive qualitative data a series of case studies were undertaken during the first semester of 2000. The nine schools participating in the case studies were chosen to represent the range of schools in the Northern Territory. The case studies are included in Chapter Seven.
Chapter 7
Case Studies

7.0 Introduction
This chapter includes the series of case studies that were undertaken in order to corroborate the data from the 1996 and the 2000 Computers in NT Schools Surveys. The case studies were conducted during the latter half of semester one 2000. The schools involved in the case studies either indicated an interest in participating in the research beyond responding to the survey or were chosen at random from schools across the Territory. The schools that were involved in the case studies were from both the government and non-government sectors and included primary, secondary and Community Education Centres. Urban schools and schools from the rural and remote areas in the Northern Territory were included in the case studies.

7.1.0 Case Study 1
Site One School is a government primary school located in an outer suburb of Darwin. The school opened in 1999 and originally employed seven teachers. In the eighteen months since the school was opened it has experienced considerable growth in its student population. At the time of the case study the school had a student enrolment of approximately 411 students and employed 25 teachers. The school also employed a full-time technology technician. There were 17 composite classes ranging from Transition to Year 7 with approximately 20 to 29 students per grade.

Site One School has, since its establishment, adopted an information technology (IT) focus. All classrooms are equipped with three computers and it is school policy to provide all teachers with a portable computer. Site One School also subsidises the cost of the staffs private Internet accounts.

The school has been fully networked since its establishment and all classroom computers and teacher workstations can access the Internet. The school has a direct ISDN link and is connected to the Northern Territory Government network. The rapid growth in student population has necessitated the construction of demountable (portable) classrooms. The demountables as well as the school stage area are also...
networked. However, access to the school server from the demountables and the stage area is via a radio-wave link. The school has 48 computers in classrooms, five computers utilised as administration workstations and 25 lap top computers for staff use. All classroom computers and workstations are networked to the school server and have Internet access. The lap top computers that have Internet access also access the school server via a radio wave link.

Every classroom in the school has three computers networked to the server. There are, however, sufficient data outlets in every classroom to accommodate ten computers. Given the rapid increase in student numbers, maintaining the student-computer ratio has been a school priority.

The utilisation of IT at Site One School has strong support from the senior management of the school. The school has established an IT Action Group and a Technology Committee. The Action Group consists of the Principal or Assistant Principal, the Teacher Librarian, a representative from the Primary section of the school and a representative from the Early Childhood section. Membership of the IT Action Group also constitutes membership of the Technology Curriculum Committee. The aim of the Action Group is to encourage the utilisation of technology in all facets of the curriculum. As a consequence IT is not taught as a discreet subject but utilised as a tool to help achieve outcomes across the curriculum.

The utilisation of IT in the curriculum, and for daily administration purposes, is an expectation of all staff members. Email is the main communications medium throughout the school and is used extensively by staff and students. All daily notices, announcements and memos are distributed via email. A number of teachers have developed an electronic daybook and email communication between students, teachers and parents is not uncommon. The school has also developed an extensive intranet, which the students have designed, developed and maintained. The intranet is utilised frequently by staff and students.

Site One School envisages, over the next few years, an increasing utilisation of online interactive learning. The school anticipated a situation where students could eventually log into the school server from home. According to the computer coordinator there is
a considerable number of students with Internet access at home. Student involvement in the utilisation of technology at Site One School is considerable. The school has established an Early Childhood Computer Club as well as a Computer Management Team. The Early Childhood Club was established with the aim of increasing student confidence in computer use through exposure to a range of software and hardware. The Early Childhood Club consists of students in grades two, three and four. There are eight members of the Club and they are supported and tutored by the senior students’ Computer Management Team.

The Computer Management Team consists of students in grades five, six and seven. The role of the Computer Management Team is to act as computer “trouble shooters” in their respective classrooms, develop and maintain the school Intranet, provide peer support and assist with the Early Childhood Computer Club. Students have to apply in writing for positions on the Computer Management Team.

Due to the rapid growth of the school and subsequent increase in staff, Information Technology is a focus of staff professional development. Professional development is conducted at the school by a staff member and varies from the teaching of basic computer skills to the advanced use of peripheral equipment. Professional development is ongoing and based upon the needs of the staff.

7.1.1 Direct Educational Outcomes of the Utilisation of Technology
At Site One School information technology is regarded a tool to support and enhance learning outcomes across the curriculum.

7.1.2 Identified Factors that Inhibit the Use of Technology/the Internet
According to the computer coordinator, teacher confidence is identified as an inhibiting factor in the utilisation of the information technology at Site One School. There is a wide range of skills on staff and there is a need to continually provide professional development and encourage the utilisation of technology by staff members. The need for more resources, hardware in particular, and finding the time to incorporate information technology in a busy curriculum are also identified constraints. Anecdotal comments by respondents to the 2000 survey also reiterated these issues,
Teacher time, teacher training.

In servicing [needed to enable] teachers to feel comfortable using the Internet with students.

7.1.3 Identified Issues in Exploring the Use of Technology/the Internet

At Site One School it is considered important that information technology be utilised in the curriculum for a valid purpose and that tasks are designed for specific learning outcomes. It is also regarded as important to provide students with suitable and valid sites through which they can explore, interact and engage in their learning.

7.2.0 Case Study 2

Site Two School is located in a remote area of the Northern Territory. The population of the community is predominantly Aboriginal and ranges from 700 to 1000 people. There are twenty-one clans in the community and seven different language groups. Access to the community in the dry season is by four-wheel drive and, in the wet season, access is often limited to air service only. The school is situated south east of Darwin in some of the most rugged and isolated terrain found in the Territory.

Site Two School is a Community Education Centre. The school has a student enrolment of 260 students and caters for students from Preschool to Year Eight. The school also caters for post-primary students through the provision of courses in Foundation Studies and General Studies. Site Two School also provides a basic Kriol language program. The student population is totally Aboriginal. English is, for many of the students, their second, third or even fourth language.

During 1999 Site Two School implemented a major upgrade of their computing resources. The Macintosh computers that were in place throughout the school were systematically replaced with Pentium Three computers. At the time of the case study Site Two School had 40 computers. Eighteen of the computers are in a computer laboratory situation where there is one Internet connection. The school has twenty computers distributed in classrooms throughout the school, and two computers in the school office area. Internet access at Site Two School is, according to the Principal, very unsatisfactory. The school is connected to the Internet via a dial-in modem...
connection to a service provider in Darwin. Access to the Internet is irregular and, when the school is able to connect to the Internet, the connection drops out frequently. Anecdotal comments made by respondents to the 2000 survey also indicated that poor telephone connections were a constraint in the utilisation of the Internet in a number of schools in the Territory,

If we could get a good connection for our students [the] Internet would be an excellent tool for remote students.

We have a problem with the phone lines dropping out and connections to the server suffer.

At the time of the case study Site Two School did not have an established Technology Committee. A member of staff had, however, been designated as the Information Technology Coordinator and the school has developed a Managing Technology in School Plan. The school's technology plan has the specific focus of upgrading the schools software to support the hardware upgrade. The in-servicing of staff and the induction of students, particularly those of secondary age, into using technology for self-managed learning, are also identified as priorities. At the time of the case study teachers were, according to the Principal, utilising technology informally in the curriculum. However, the Principal stated that the incorporation of technology in the curriculum was planned as a teacher focus for 2001.

7.2.1 Direct Educational Outcomes of the Utilisation of Technology
At Site Two School Talking Books and audio-based educational games are utilised to improve English Phonology and Oracy/ Literacy.

7.2.2 Identified Factors that Inhibit the Use of Technology/the Internet
Access to the Internet is the major inhibiting factor at Site Two School. At the time of the case study, staff used the Internet frequently and, according to the Principal “…students not at all…”.

7.2.3 Identified Issues in Exploring the Use of Technology/the Internet
According to the Principal of Site Two School the main issue in the utilisation of information technology was “…getting children to understand the communications
concept involved. For Aboriginal children, who have very capable, but very oral related communications and social structures, the mechanism and communication gap of using technology is a specific hurdle, as well as an advantage.”

7.3.0 Case Study 3

Site Three School is situated approximately 95 kilometres from Darwin. The school is located in a small but relatively well-serviced community south west of Darwin. There are approximately 160 students in the school. However, the student population is highly mobile and there is a 70 per cent student turn over in any given year. The mobility of the student population impacts on the programs the schools offers and, as a consequence, literacy acquisition is a priority of the school.

Site Three School is involved in a number of Commonwealth-funded projects aimed to enhance the acquisition of literacy, extend the experiences of the students and provide opportunities for the students to apply skills in context. At the time of the case study, one of the major projects operating at the school was aimed at improving the literacy standards of the boys. The target group are the boys in Years Three to Seven. Reading groups, parental involvement and a Reading Club are some of the strategies employed in improving the literacy standard of the targeted students.

Site Three School is an Area School and caters for students from Transition to Year 10. The students who wished to extend their secondary education beyond Year 10 either commute daily by bus to Darwin, board in Darwin from Monday to Friday or attend boarding school on a full-time basis. Some families have moved out of the community in order to enable their children to access secondary education. For most of the students, correspondence education, for a variety of reasons, is not a preferred option.

Site Three School is fully networked. There are thirty-two computers in the school and all computers are networked to the school server. Approximately twenty-two computers are for student use; the remaining twelve computers are for teaching and administration staff use. All computers can access the Internet; however, access is restricted due to the cost of access. Every primary classroom in the school has one computer and there are fifteen computers in a mini-laboratory situation. The
Vice Principal and another member of staff share the responsibility of providing the technical support for the school.

Teaching staff are actively encouraged to incorporate the use of information technology in the curriculum and in the administrative practices associated with their role. However, the cost of upgrading the current hardware and software as well as the cost of providing unlimited Internet access is an identified constraint in the utilisation of information technology at Site Three School.

Site Three School staff envisage that over the next few years they will be moving towards changing the computer platform they currently are using. The need for students to have exposure to both PC and Macintosh computers is perceived as important in the students developing platform-independent computer skills. Site Three School also anticipates they will be exploring the potential of Internet access via satellite as well as the utilisation of Lap Top computers.

### 7.3.1 Direct Educational Outcomes of the Utilisation of Technology

Site Three School anticipates that information technology, in particular the increasing use of online resources, will have a considerable impact on traditional education. Ideally, Site Three School envisages a situation where all teachers have Internet access at home and can log into the school server. However, at the time of the case study this situation was not feasible due to the cost involved.

### 7.3.2 Identified Factors that Inhibit the Use of Technology/the Internet

Access cost is the identified major factor that inhibited the utilisation of the Internet at Site Three School. At the time of the case study Site Three School obtained their Internet access from an independent Internet Service Provider. The hourly access rate plus the STD telephone charges associated with Internet access, prohibits unrestricted use of the Internet. Whilst teachers are actively encouraged to utilise the Internet, its use is restricted to dial-in access when needed. Anecdotal comments included by respondents to the 2000 survey also highlighted access costs as an inhibiting factor in the utilisation of the Internet -

> Access Costs - We have pastoral calls costed per minute which makes [Internet access] expensive.
Identified Issues in Exploring the Use of Technology/the Internet

Management of the Internet in the classroom environment is seen as an important issue in the educational use of the Internet at Site Three School. Teaching students how to access valid sites, to discriminate between appropriate and in appropriate content and to utilise the Internet for a valid purpose are identified as important issues in exploring the educational use of the Internet at Site Three School. Anecdotal comments by survey participants also acknowledged that classroom management is important in the effective utilisation of the Internet in the curriculum.

7.4.0 Case Study Four

Site Four School is located approximately 200 kilometres from Darwin. The school is considered remote as the only means of access to the community where the school is situated is by air. A light air-service runs regular daily flights to the community and charter planes also carry passengers and freight to the community on a regular basis. The community consists of approximately 480 indigenous members and approximately 20 non-indigenous members. The school has a population of 103 students.

At the time of the case study there were five grades at Site Four School. The grades include a Preschool and composite classes from Transition to Year Seven. There are no special programs operating in the school and the school does not have a Technology Committee. There are five non-indigenous teachers on staff and most grades have at least one indigenous community member employed as a teaching assistant.

Every grade in the school has one computer and the middle and upper primary classes have two computers. The shared school/community Library has two computers and the school office has one computer. The computers are not networked and only the Library computer has Internet access. The one computer with Internet access does not have a permanent telephone connection. In order to supply the Library computer with Internet access the facsimile telephone line is diverted when necessary.

Over the next few years Site Four School staff envisage that they will be changing computer platforms. Site Four School also anticipates a situation where they will lease
computers rather than purchase them. The establishment of a computer laboratory instead of computers in every classroom, is also being considered.

At the time of the case study the computers were incorporated into the curriculum through the use of word processing, educational games and skill building CD-ROMs. According to the Principal most teachers reserved the use of computers in the curriculum for themselves.

7.4.1 Direct Educational Outcomes of the Utilisation of Technology

The identified educational outcomes of the utilisation of technology in the curriculum at Site Four School is the consolidation of basic reading, spelling and mathematics skills.

7.4.2 Identified Factors that Inhibit the Use of Technology/the Internet

According to the Principal, lack of training and knowledge are the major factors that inhibit the use of Technology and the Internet at Site Four School. The Principal also commented that there is a desperate need for the school's hardware to be upgraded.

7.4.3 Identified Issues in Exploring the Use of Technology/the Internet

The main issues identified at Site Four School in exploring the educational use of technology in the curriculum is the need for students to develop information skills and the ability to search for information. The need for students to discriminate between appropriate and inappropriate content was also commented on by the Principal.

7.5.0 Case Study 5

Site Five School is a primary school situated in urban Darwin. At the time of the case study the school had a population of approximately 275 students. There are twelve grades in the school ranging from Transition to Year 7. All but one Transition class is a composite grade. The school has a number of special programs running which include Special Education, an English as a Second Language program and a Language Enrichment program. The utilisation of technology in the curriculum is also targeted at Site Five School.
The school has a computer laboratory, which is equipped with 15 PCs, and there is at least one computer in every classroom. The school library had four computers and a printer. All computers are networked to the school server and all computers can access the Internet. There is no internal email system operating in the school. However, the implementation of an email system is anticipated in the following twelve months.

The school has a designated full-time computer specialist. The specialist has occupied this position for three years and has been instrumental in updating the school's computer hardware, software and network. In the three years the computer specialist has been employed at Site Five School the school's computer network has evolved from one computer in the Library with Internet access, an AppleTalk computer network in the laboratory and stand alone computers in every classroom, to a fully networked school. The majority of computers that are utilised at Site Five School are ex-government stock that has been acquired through the Education Network Australia (EdNA) project.

The schools Computer Committee, which is comprised of the Principal, an Upper Primary Senior Teacher, an Upper and Lower Primary School teacher and the Computer Specialist is active in curriculum development and policy formation. The Computer Committee were, at the time of the Case Study, developing a Computer Policy, which would have a strong Acceptable Use emphasis. The Computer Committee are also organising a professional development day for term three. According to the Computer Specialist considerable computing professional development occurred at Site Five School, most of which was informal, conducted on site and was ongoing.

The computer specialist at Site Five School envisaged, over the next few years, an increased use of technology to achieve educational outcomes. The staff's professional development in computing is directed towards this end. Encouraging teachers to incorporate the use of technology in the curriculum and administrative aspects of their teaching is reinforced continually. Staff are encouraged to access minutes of meetings and notices from the server as well as store their own work electronically.
7.5.1 Direct Educational Outcomes of the Utilisation of Technology
The stated direct educational outcomes of the utilisation of technology at Site Five School are “…to assist in achieving educational goals across the curriculum”. Science simulations, the use of Logo to enhance the acquisition of Maths concepts and the development of cross curricula multi media assignments were cited by the computer specialist as examples of the effective utilisation of technology at Site Five School.

7.5.2 Identified Factors that Inhibit the Use of Technology/the Internet
The major factor that inhibited the utilisation of the Internet at Site Five School, as identified by the Computer Specialist, is the lack of teacher skills and the lack of expertise and experience on staff. The computer specialist also commented that, for practising classroom teachers, lack of time to incorporate technology into the curriculum was an inhibiting factor. Respondents to the 2000 survey also reiterated these issues. Anecdotal comments on the survey included –

In servicing [needed to enable] teachers to feel comfortable using the Internet with students.

Lack of time to assist teachers develop skills and teachers general lack of time to learn procedures in each school site we use.

7.5.3 Identified Issues in Exploring the Use of Technology/the Internet
At Site Five School the need to develop and reinforce the school's Acceptable Use Policy is an identified issue. The Computer Specialist commented, “…students needed to be aware that they do not access unacceptable content. The Internet should not be utilised for just searching. Students needed to be given directed activities.”

7.6.0 Case Study Six
Site Six School is situated in a semi-rural area of the Northern Territory. The school is a non-Government school located approximately 50 km from Darwin. The school is located in one of the fastest growing areas of the Northern Territory. In order to cater for the increasing population two new primary schools had opened in the area since 1996 and another one was proposed for 2001. Site Six School was opened in 1996 and, at the time of the case study, had a student population of 210 students. There are eight teachers on staff and both the Principal and the Assistant Principal have a
teaching load as well as administration responsibilities associated with their role. The Vice Principal is responsible for the teaching of information technology across the school and is also responsible for providing technical support and assistance.

Site Six School was fully networked when it was opened in 1996. At the time of the case study the school had one computer in every classroom and a bank of fifteen computers in the library. All computers are networked to the school server and all computers have Internet access. The school also has one portable computer for staff use and two computers in the library for administration purposes. Both the Principal and Vice Principal also have a computer. The school has developed an extensive Intranet that contains all policy documentation and curriculum overviews. The school also has an internal email system that is used extensively.

Every year Site Six School identified a curriculum focus. The aim of the focus was to enable teachers to integrate a learning area across the curriculum. In 2000 the focus was Indigenous Education, in 2001 the school plans to focus on Religious Education and in 1999 the school-identified focus had been Information Technology. As a consequence of a whole-school approach to integrating information technology in the curriculum, Site Six School has produced a CD Rom containing the units of work teachers had developed and implemented during 1999.

Site Six School has a very active and committed Technology Committee. The Committee comprises of a representative of the Board of Education Subcommittee, the Principal, the Vice Principal, one staff member and two parents. Incorporating parental involvement in the role of technology in education is a significant aspect of the school's philosophy. Site Six School has conducted a number of parental information evenings on the use of the Internet and the school also plans to provide a computer, with Internet access, in the foyer of the school for community use.

It was estimated that approximately 30 per cent of the parental body of Site Six School had Internet access. Extending access to educationally disadvantaged students in the community is considered an important function of the school. The school web site is linked to the Parish web site and a number of relevant community associations have linked their site to the school's web page.
In order to build upon the utilisation of the Internet and information technology in the curriculum at Site Six School, ongoing professional development is supported and encouraged. Teachers are encouraged to negotiate time with the Vice Principal for educational support and technical assistance. Every term, two whole-of-staff professional development sessions are devoted to information technology and every second staff meeting incorporates some form of technology in-service.

7.6.1 Direct Educational Outcomes of the Utilisation of Technology
At Site Six School information technology is perceived as a new form of literacy. As a consequence, providing students with access to technology and the opportunity to acquire the necessary skills to access the Internet and educational CD-ROMs is an important role of the school. The school has a firm commitment to empowering students through technological literacy. The Principal commented that with increased access to technology students are developing computer literacy skills at a younger age and, as a consequence, the school is continually refining their policies and programs.

7.6.2 Identified Factors that Inhibit the Use of Technology/the Internet
At Site Six School, there are very few identified factors that inhibited the use of Technology/the Internet in the curriculum. The school has an established process of information technology policy development and implementation. The School Policy contains, as an appendix, a Students, Parents and Teachers Acceptable Use Policy and the utilisation of technology is an integral aspect of the educational provision of the school.

7.6.3 Issue Identified Issues in Exploring the Use of Technology/the Internet
The staff at Site Six School are very well aware of the fact that they work in a school that has excellent technological resources. However, maintaining or improving the existing level of computer resources, the need for technology support and the need to improve their access speed were emerging issues. Anecdotal comments included on the 2000 survey returns also highlighted the need for technical support –

As a school we are not allocated an IT support officer and with a network system the IT committee spends a large amount of time “helping” others with small things.
We need technical support for Primary schools. Teacher training in the use of computers [is] essential. [We] Need a full time person to service teachers computer needs. Schools should share technicians

In order to address their emerging telecommunications needs Site Six School is in the process of investigating ISDN and satellite access.

7.7.0 Case Study Seven

Site Seven School is situated on the Stuart Highway approximately 110 kilometres from one of the major urban areas of the Northern Territory. At the time of the case study this primary school had a population of 65 students and catered for students from Preschool to Year Seven. There are three grades in the school as well as a Preschool The classes are all composite grades with one Transition/Year One class and two grades that caters for students from Year Two to Seven. There is also a school/community Library attached to the school.

The school population is, according to the Principal, relatively stable with the majority of students beginning and completing their primary education at Site Seven School. The school is situated in a town with a population of approximately 150. There is no secondary school in the immediate vicinity. Post-primary students commute daily by bus to the nearest Area School.

Literacy acquisition is a priority of Site Seven School. The Principal is concerned about the literacy levels of the students and the identified need to raise the literacy levels to equate with national benchmarks. As a consequence the school has implemented a number of literacy programs. Twelve students are identified as high risk and these students receive concentrated literacy tuition.

During the twelve months preceding the case study, technology had not been a focus of Site Seven School. According to the Principal, the school's capacity to fund raise was limited and the school had elected to focus its efforts on raising funds to purchase a school bus rather than upgrading the computer hardware that was in place in the school. However, the need to replace the existing computer hardware is a school-identified issue.
At Site Seven School there are two computers in every classroom, one computer in the preschool, one computer in the office and one school computer in the Library. The computers are not networked and two of the computers can access the Internet. One computer with Internet access is in a classroom and the other is situated in the school/community Library. As the school has only one Internet account, simultaneous access to the Internet is not possible. The computers are not networked and Internet access is via separate modems over a telephone line. Access is, according to the Principal, intermittent.

According to the Principal, approximately ten of the families that attended the school have Internet access at home. A small number of families have Internet access at work. The majority of the school community has no Internet access other than through the school/community Library. The Library had in the twelve months preceding the case study conducted a number of computer courses for the school community and school ancillary staff. The courses focused on the acquisition of basic computer skills.

Site Seven School envisages upgrading the schools computer facilities in 2001. The Principal anticipates that, with the recently announced NT Government Budget allocation for IT support (see Chapter 1.3), the school will be fully networked and all computers will have Internet access within twelve months. Professional development in computing is also identified as a priority for 2001.

7.7.1 Direct Educational Outcomes of the Utilisation of Technology

Whilst the Principal acknowledges that technology heavily supports the acquisition of skills across the curriculum, he also voiced concerns about the role of technology in education and the possible adverse consequences of too much emphasis placed on the acquisition of computer skills rather than traditional literacy skills.

7.7.2 Identified Factors that Inhibit the Use of Technology/the Internet

At Site Seven School the identified factors that inhibited the use of the Internet are the need for staff professional development, the cost of Internet access, the state of the hardware and software that is in place and intermittent phone access.
7.7.3 Identified Issues in Exploring the Use of Technology/the Internet

The main issue identified by the Principal as important in exploring the educational use of the Internet at Site Seven School is security and the need to teach students about accessing appropriate content as opposed to inappropriate sites. Providing students with the skills to ascertain quality sites and the capacity to sort through the vast quantities of information on the Internet are also perceived as educationally important issues.

7.8.0 Case Study Eight

Site Eight School is approximately 20 minutes flying time from Darwin. The community, where the school is situated, is considered remote as access to the community is by air only. Site Eight School is a non-government, bilingual school that caters for students from Preschool to Year Seven. The student population is all Aboriginal and, at the time of the case study, there were approximately 219 students enrolled at the school. According to the Principal there is relatively high student mobility at Site Eight School. Students move frequently between other communities, the outstations and the mainland. Despite the student mobility the student numbers at Site Eight School are fairly constant.

Site Eight School also caters for post-primary students through the provision of bridging courses in Foundation Studies and General Studies. The majority of the students, however, continue their post primary education at the secondary school that is also located in the community. A small number of students attend a secondary boarding school in Darwin.

The community where Site Eight School is located has a population of approximately 1200 people. The population is predominately Aboriginal and whilst the vernacular is the preferred spoken language, English is also used extensively. There are a number of indigenous enterprises in the community and economic development is, according to the Principal of Site Eight School, a community priority.

The school has an indigenous Principal and four indigenous Vice Principals. Literacy in both the vernacular and English is a focus of the school. Students in the early childhood years are taught in the vernacular by indigenous teachers. English is
progressively introduced through the middle and upper primary school until Years Five, Six and Seven when 20 per cent of the tuition is in the vernacular and 80 per cent of the tuition is in English.

Site Eight School also conducts a Commonwealth-funded intensive oral English program. Twenty-three students from Grade One to Year Seven participate in the program, which is aimed at improving the student's proficiency in oral English. Site Eight School also has its own Literature Production Centre. The Literature Production Centre produces vernacular reading materials and has also produced educational CD-ROMs in the vernacular.

A hearing program, conducted by the Menzies School of Health is also implemented at Site Eight School. The hearing program is aimed to monitor and treat the relatively high incidence of middle-ear infection amongst students at the school. The program also has a strong education component.

An outstation school is attached to Site Eight School. The outstation is two hours drive from the community and has a population of approximately 50 people. There are approximately thirteen students attending school at the outstation. The students are in a multi-aged grade and are taught by an indigenous member of the outstation community. The outstation school is supported by a visiting teacher from Site Eight School, which also supplies the outstation school with educational resources as well as administrative support.

At Site Eight School there is one computer in every classroom, four computers in the Literature Production Centre and two computers in the school office. The Principal also has a computer. All of the computers are stand-alone units. There are two computers that have Internet access in the school. One computer with Internet access is situated in the school Library and the other is situated in the Literature Production Centre. However, when the need arises to provide whole class access to the Internet, the school negotiates time with the secondary school. The secondary school has a computer laboratory with Internet access.

Teachers are encouraged to incorporate technology in the curriculum at Site Eight School. Professional Development both at the school and in Darwin is encouraged and
supported. The need for teachers and students to develop computer skills and utilise technology to support the acquisition of literacy and numeracy is an acknowledged area of the curriculum.

Site Eight School anticipates that the school will be fully networked in 2001. According to the Principal the upgrading of computer hardware, extending Internet access to every classroom and the school administration area and the installation of a satellite dish to facilitate high speed Internet access is envisaged within twelve months.

According to the Principal, Site Eight School has relatively high student mobility. The Principal commented that an Information Technology recommendation in the Collins Report, an independent review of indigenous education, is for the implementation of a comprehensive student tracking system (Collins, Lea and Tess, 1999:52). The Principal stated that the ability to track student enrolments and to monitor student progress through a centralised on-line administration system will enable the school to facilitate the educational needs of highly mobile students.

7.8.1 Direct Educational Outcomes of the Utilisation of Technology

The Principal of Site Eight School commented, “We want our students to have access to new technology. Everywhere kids need to know how to use it. We want our children to learn new skills.”

7.8.2 Identified Factors that Inhibit the Use of Technology/the Internet

At Site Eight School the identified factors that inhibited the use of the Internet are the state of the current equipment, security and sporadic telephone problems.

7.8.3 Identified Issues in Exploring the Use of Technology/the Internet

The Principal commented that research is an important issue in the educational use of the Internet. “We need to encourage our kids to see and use information & all variety of things that is unknown to them. The more they use & [technology/the Internet] & the more they will know.”
7.9.0 Case Study 9

Site Nine School is situated in urban Darwin. The school is a secondary school that caters for students in Year Eight to Year Twelve. Site Nine School has a student population of approximately 760 students. At the time of the Case Study there was a number of special programs in operation at the school, including Special Education, Indigenous Education, and Film and Video production. However, individualised learning is a whole-of-school focus that is encouraged and promoted throughout the school.

At Site Nine School the utilisation of the Internet in the curriculum has grown considerably since the school established its initial connection in 1996. Approximately three years prior to the case study, Site Nine School established an account with a local ISP and connected the school to the Internet. Initially, the school had a “minimal number of computers that could access the Internet. The computers each had their own modem and discrete Internet account. At the time of the case study, however, Site Nine School had 216 “Internet-capable” computers throughout the school. The actual student computer ratio, however, is approximately 1:2. The school is fully networked and in the process of implementing and upgrading computers in every classroom. Access to the Internet is through a 64 kbps ISDN line via an independent Internet Service Provider. Site Nine School also has five computers in the administration area connected to the Government Wide Area Network.

At Site Nine School Information Technology (IT) is taught as a discrete subject at every year level. However, IT is also incorporated extensively across the curriculum. There are two computer laboratories in the school for Computer Studies, a computer laboratory for Mathematics, an English, Social Education and Business Studies laboratory; a Computer Assisted Design (CAD) laboratory for Technical Studies; a laboratory for Special Education, and a small computer laboratory in the Arts area. Site Nine School also employs a full-time IT officer to provide technical support.

All teachers have access to an Internet-capable computer for teaching and administration purposes. It is an expectation of the school that all teachers will utilise IT in their teaching practices as well as utilise IT as a research vehicle to support
their curriculum knowledge. Professional development in IT is available to all staff members.

By leasing a number of their computers Site Nine School can continually maintain the level of technological standard required to teach specific subject areas. Computers that cannot support the high-end applications needed in the Arts, Photographic and Music areas are recycled through the school. However, the cost of maintaining the school network and equipment is an issue identified by the Principal.

There is an internal email system in operation in the school that is utilised extensively by staff. All staff have their own email address and it is an intention of the school to provide all students with an email address as well as individual space on the school servers. The Principal envisages that over the next few years home-school access will increase and school will expand its individualised learning program by placing the school curriculum on the Internet.

According to the Principal approximately 50 per cent of the student population have Internet access at home. The student population is of mixed socio-economic status and equity issues, in regard to Internet access, are very much a consideration in the role of IT and the school's future direction in educational provision.

7.9.1 Direct Educational Outcomes of the Utilisation of Technology

According to the Principal the direct educational outcome of the utilisation of technology at Site Nine School is that it enables all students to achieve academically. Students with poor literacy skills are able to engage in individualised, self-paced learning and produce independent reports. The utilisation of IT also broke down skills barriers (for example, poor hand-writing skills are no longer an obstacle in presentation) for students, as well as the physical barriers that had been a constraint for some Special Education students. Not only is IT utilised in supporting the acquisition of literacy and numeracy, the use of IT in the curriculum also enables students to undertake complex and varied maths procedures, participate in virtual science experiments and produce high-level photography and CAD drawings. The Principal also commented that the Internet is an important educational tool for
research. However, students need to undertake meaningful research and learn to discriminate between applicable and non-applicable sites.

### 7.9.2 Identified Factors that Inhibit the Use of Technology/the Internet

Access speed is an identified factor that inhibits the use of the Internet at Site Nine School. Large numbers of concurrent users slows the network considerably. At times the network is not as reliable as had been anticipated with computers often dropping out of the network.

### 7.9.3 Identified Issues in Exploring the Use of Technology/ the Internet

The Principal of Site Nine School identified extending Internet access to the broader school community as an important issue in exploring the educational use of technology and the Internet. The need for school community involvement is fundamental to the equity issues the school experiences. The cost of maintaining the school's network and upgrading the hardware were also cited as school-identified issues. The Principal also commented that there needed to be a resolution to the issue of maintaining a separate administration network. The duplication of networks that occurs when schools wished to engage an independent Internet Service Provider rather than the NT Government network is, according to the Principal, unnecessary.

### 7.10 Conclusion

The case studies contained in this chapter were chosen as representative of schools in the Northern Territory. The schools involved were from the urban and remote areas of the Territory and included government and non-government schools. Primary schools, secondary schools and Continuing Education Centres were also incorporated in the case studies. A descriptive analysis of the context of each case study school highlighted the diversity of education in the Territory. Participating case study schools identified the direct educational outcomes of utilising information technology (IT) in the curriculum, issues that were important in exploring the educational use of IT and the factors that inhibited the use of IT at the school. The qualitative data obtained from the case studies was utilised to corroborate the data obtained from the 1996 and the 2000 surveys. A discussion of the research results is included in Chapter 8. The conclusions and recommendations are also included in Chapter 8.
Chapter 8

Discussion of Research, Conclusion and Recommendations

8.0 Introduction

This chapter includes a discussion of the case studies and an analysis of the 1996 and 2000 Computers in NT Schools Survey results. The current and emerging telecommunications needs of schools in the Northern Territory (NT) are placed within a broader policy context and the research question “To what extent are rural and remote schools in the NT able to access the Internet by the existing telecommunications infrastructure?” is examined in depth. Recommendations are also included in this chapter.

8.1 Information Technology in Northern Territory Schools

The acquisition of literacy was a priority of the remote schools that participated in the case studies. All participating schools acknowledged the role of information technology (IT) in helping to achieve educational outcomes across the curriculum. The most frequently used applications were, according to respondents to the 2000 survey and the schools that participated in the case studies, educational CD-ROMs, Mathematics and Language skill building and consolidation programs, word processors and authoring tools. Email, was however, the most frequently used network application (see Chapter 6.6)

As evidenced by the two surveys and case studies (see Chapter 7.1, Chapter 7.5, 7.6 and 7.9), there had been significant growth in the utilisation of the Internet in NT schools since schools established an initial connection in 1996. The growth in Internet access had, particularly in urban schools, exceeded what the Organization for Economic Cooperation and Development (OECD), described as the “…innovative educational process…” (OECD, 1967:57) to become an integral aspect of curriculum development and application. The utilisation of the Internet in rural and remote schools, however, has not been on a par with urban schools (see Chapters 6 and 7). As evidenced by the research project the disparity remote schools experienced in Internet access was due to a number of factors.
8.2 Disparities in Internet Access

As this research project indicated there had been a 24 per cent growth in the number of schools that could access the Internet since NT schools established their initial Internet connection in 1996. There had also been significant growth in the number of computers in schools with Internet access (see Chapter 6.2). In 1996 approximately 68 per cent of schools in the NT had Internet access. By the first semester of 2000 approximately 93 per cent of schools had Internet access. In 1996, forty one per cent of schools had one computer with Internet access. As the 2000 survey results revealed, by 2000 multiple computer access to the Internet was more common with approximately 55 per cent of Territory schools with two or more computers connected to the Internet. Significantly, 12 per cent of schools had 50 or more computers with Internet access (see Chapter 7.1, 7.9).

As evidenced by the research project the means by which schools in the NT accessed the Internet varied. As of 2000 Internet access included modem access either via a landline, satellite, or the microwave Digital Radio Concentrator System (DRCS). As stated in Chapter One, over 100 schools accessed the Internet via the DRCS. Satellite access and Integrated Digital Service Network (ISDN) access was also utilised by Territory schools. Whilst 76.31 per cent of schools connected to the Internet via dial-up modem connections, 14.73 per cent of schools had a 64 kbps ISDN link. Satellite access was utilised by 2.63 per cent of schools but, as evidenced by the case studies (see Chapter 7.8) and anecdotal survey comments, was under consideration by a number of schools. All schools with ISDN access were in the major urban areas of the Territory.

A demographic analysis of the survey results and a series of case studies revealed that the growth in Internet access had been predominantly in urban schools (see Chapter 6.2 and Chapter 7). Approximately 89 per cent of the schools that indicated they had one computer with permanent Internet access were located in the rural and remote areas of the Northern Territory. The seven per cent of schools that did not have any access to the Internet at all, were also located in the rural and remote areas of the NT (see Chapter 6.2). This evidence clearly suggests that rural and remote schools in the Northern Territory are disadvantaged in their capacity to access the Internet by the existing telecommunications infrastructure. As indicated in Chapter
4.5.1, in the rural and remote areas of the Territory the major Internet users were educational institutions, local government councils, government agencies and a small number of commercial consumers. According to the Manager of one of the largest ISP in the Northern Territory, the education sector was, in the remote areas, the predominant market. The National Bandwidth Inquiry (NBI) conducted during 1999 also acknowledged that that the education sector was a key driver in bandwidth demand. As the NBI argued,

The Inquiry identified the following as key industry segments which are likely to have a particularly high demand for bandwidth: retail trade, property and business services, health and community services and education. (NBI, 2000)

Research conducted for DETYA in 1999 supported the argument that the education sector was one of the largest users of telecommunications bandwidth in Australia (Moon, 1999). The report indicated that infrastructure had developed immensely over the last three years, lead by the University sector, but remained far from satisfactory, especially for schools and the VET sector. As Moon noted in the research report Bandwidth Requirements for the Education Sector “…equity of access [was] a growing issue” (Moon, 1999).

As evidenced by the research project, Internet access in the rural and remote areas of the NT was constrained by the existing telecommunications infrastructure. However, a number of other factors also contributed to the disparities in Internet access rural and remote schools in the NT experienced.

8.3 Factors that Inhibit Internet Access

As the case studies, anecdotal comments by survey respondents and analysis of the 1996 and 2000 surveys revealed, a number of factors inhibited Internet access by schools in the rural and remote areas of the Territory. The cost associated with multiple Internet access, poor telephone connections, the lack of a dedicated telephone line, the lack of expertise on staff and the need for technical support were cited as the major inhibiting factors in Internet access by survey respondents and case study participants. The cost of implementing and maintaining multiple Internet access was cited by approximately 42.66 per cent of survey respondents as an inhibiting factor in
Internet access. The expense of internal cabling, pastoral telephone charges, the lack of commercial competition in ISPs and the comparatively high ISP rates” were cited by survey respondents as inhibiting the utilisation and expansion of Internet access throughout the school. Case Study 3 (see Chapter 7.3) also reiterated that cost was the major factor that restricted Internet access.

Poor telephone connections were cited by 32 per cent of respondents to the 2000 survey as a constraint in the utilisation of the Internet. As evidenced by case studies (see Chapter 7.2, 7.7 and 7.8) telephone connections had been, as one respondent commented “…very unsatisfactory…”. Anecdotal comments and case study evidence indicated that, for the more remote schools, sporadic telephone access was a common problem.

In 1996 the lack of a dedicated phone line was reported by 19.73 per cent of survey respondents as a factor inhibiting their use of the Internet. However, by 2000 this figure had risen to 46.66 per cent. Given the 24 per cent increase in schools accessing the Internet and the increase in the number of computers in schools with Internet capability, the rise in schools reporting the lack of a dedicated phone line as an inhibiting factor in Internet access is not surprising. As indicated in Chapter 6.3.3, with the increased number of schools requiring Internet access the limitations of the Digital Radio Concentrator System (DRCS) (for example, low access speed; a system prone to atmospheric interference, particularly in the Wet Season; and the limited number of concurrent users able to access the system) were also becoming apparent. As evidenced by Case Study 4 (see Chapter 7.4) the sharing of existing facsimile and telephone lines with a modem was the only means by which some schools accessed the Internet.

Case Study One and Case Study 5 (see Chapter 7.1, 7.5) identified lack of teacher confidence and the need for expertise on staff as significant inhibiting factors in the use of the Internet. In 1996 lack of expertise had been identified by 32.89 per cent of survey respondents as a problem. In 2000 this figure had risen to 46.66 per cent. Responses to the 2000 survey also revealed that 80.27 per cent of schools had no one on staff with any formal qualifications in educational computing. As evidenced by one anecdotal survey comment, “I am computer illiterate… I hate being computer
illiterate. Please help”, the need for professional development and expertise in the area of educational computing was clearly emerging as a significant issue.

Technical support was an urgent issue identified by 53.94 per cent of NT schools that responded to the 2000 survey. Anecdotal comments by survey respondents and case study evidence (see Chapter 7.6) indicated that the need for technical support was, particularly for remote schools, contributing to the frustration of incorporating Internet into the curriculum. As survey respondents commented,

> We have $1000's of equipment that has been practically unused since new (18months old) due to it being through a server that is still to be set up so that easy access [to the Internet] can be gained (Approx $5500 worth of Equipment). The specialists from … are often unsure of how to use it or set it up appropriately so we often book them for a day and achieve little.

> We are remote [we're] 600km to town [and] 900km to a repair store. Most pressing issues are IT backup, currently there is none. Prompt sales and service from city centres currently is poor and now cutbacks in government inservices for staff who need to learn and expand their knowledge!

As evidenced this research project, two of the most significant issues that inhibited the utilisation of the Internet in the rural/remote areas of the NT were attributed to factors beyond the control of individual schools and education systems. The reported high incidence of poor telephone lines and the lack of a dedicated telephone connections indicated that rural and remote schools were disadvantaged in their capacity to access the Internet by the existing telecommunications infrastructure. However, the urgent need for technical support, the need for professional development to assist teachers in the integration of Information Technology in the curriculum and the implementation of initiatives to offset the cost of extending Internet access in schools also needed to be addressed.
8.4 Federal Policy Issues

Historically, telecommunications access in the Northern Territory has evolved in a sporadic fashion in which the less populated areas of the NT have been disadvantaged (see Chapter 2). Since the early 1980s telecommunications issues in the NT have reiterated the need to upgrade telecommunications provision to the rural and remote areas to redress disparities in access and to enhance the social and economic well being of Territory residents. Throughout the 1980s and 1990s the key telecommunications issues identified were the need to provide adequate telecommunications access to schools in the remote areas of the Territory, finding ways to enhance telecommunications access to assist in the educational provision of distance education students and investigating the feasibility of satellite access to accelerate the deployment of enhanced telecommunications access throughout the Territory. The convergence of computing and telecommunications, the commercialisation of the Internet and growing criticism of the restrictive telecommunication regulatory regime, necessitated a liberalisation of the telecommunications industry.

As stated in Chapter Three, the privatisation of Telstra, Australia's national telecommunications carrier, commenced in 1997 amidst considerable public concern. The issues in the privatisation debate centred on fears that a market-driven approach to telecommunications growth and development would be at the expense of the less profitable social objectives of telecommunications policy. Concerns were raised that the broader social goals of consumer access, geographic coverage and social equity enshrined in the Universal Service Obligation, would not be adequately protected, maintained and enforced in a deregulated environment (Senate Inquiry, 1996:121,145). During the 1996 Senate Inquiry into the proposed sale of Telstra, fears that services to rural and regional Australia, traditionally the less profitable areas, would suffer in a competitive self regulating telecommunications environment were clearly articulated as a major issue. Equity, access and quality of service, particularly in the light of developments in digital network technology, were the issues of greatest public concern throughout the Senate Inquiry.

As evidenced by this research project the deregulated market had opened the door for competition in the telecommunications sector and assisted in the
acceleration of technological growth and development, particularly in the area of data communications. The deregulation of the telecommunications industry also coincided with exponential growth in the area of network technology, data transmission and Internet usage (see Chapter 4). The Northern Territory was not immune to the positive benefits of deregulation and also experienced exponential growth in the areas of telecommunications and Information Communication Systems (see Chapter 4.5.1).

Since the deregulation of the Telecommunications industry in 1997 social issues have, however, dominated the telecommunications debate. The concern over the capacity of a self-regulating, competitive telecommunications industry model to achieve the national policy objectives of serving the Long Term Interests of End Users was by the end of 1999 emerging as a significant issue. As the CER.CIT submission to the 2000 Telecommunications Service Inquiry stated (see Chapter 4.4),

There are policy tensions between the intended objectives and what is actually achieved...there is a need for the examination of new models which either avoid the tensions inherent in the current structure or incorporate straightforward ways of managing them. (C1RCIT, 2000:7)

8.5 Conclusion

As indicated in Chapter 3.2, tensions inevitably exist between stakeholders in the privatisation process. The balancing of these tensions is partly determined by the structure of the political, economic and social institution in which privatisation occurs. Consensus does not exist without tension and consensus is often the net result of conflict. However, stakeholder consensus involves trade-offs that have consequential effects on resources, the market and the stakeholders themselves. Understanding the values, objectives and expectations of the different stakeholders is essential in order to support the balancing of trade-offs between policy approaches and outcomes for alternative players.

As evidenced by this research project the deregulation of the telecommunications industry through partial privatisation of Telstra has exacerbated the disparities in telecommunications access rural and remote schools in the Northern Territory experience. The unavailability of a competitive regime in the rural and remote areas of the NT and inadequate telecommunications infrastructure have been major
contributing factors to the lack of parity in the growth and application of network technologies experienced by rural and remote Territory schools. Without direct Federal intervention the rural and remote areas of the Territory will be disenfranchised in their capacity to access the “…communications products and systems that have become essential to an individual's ability acquire, sustain and develop marketable job skills and to be an informed and active participant in society” (ACA, 1998.42).

The tension that exists between the social objectives enshrined in the Universal Service Obligation and the competitive, self-regulating telecommunications industry model that has evolved since the deregulation of the Australian telecommunications industry has become counter productive to the achievement of the national policy objective of serving the Long Term Interests of End Users. In order to reconcile the tensions inherent in the industry model and social objectives enshrined in Telecommunications policy, a revised Universal Service Obligation (USO) is needed. A USO that will address the social policy issues, serve the Long Term Interests of End Users and provide a post deregulation paradigm.

As one Darwin Telecommunications Service Inquiry participant commented,

I think…[the Universal Service Obligation] looked reasonable at [the] time [it was written] because back then people saw things like the Internet as a luxury, and I don't believe that is [now] the case. It is how people do business. It's not just a safety net. A telecommunications system is a means by which people are going to be able to do any basic function like looking for work or just carrying out their work, access to government services, health, safety. [The Internet] once was an add-on luxury and it is now a fundamental part of telecommunications. (Telecommunications Service Inquiry, 2000b)

**Recommendations**

1. **The Northern Territory Government should support an amendment to the Universal Service Obligation to subsidise the cost of telecommunications access for disadvantaged schools, public libraries and rural/remote health care facilities.**
Whilst the Telecommunications (Consumer Protection and Service Standards) Act introduced rebates for rural consumers, the cost of Internet access for rural and remote schools in the Northern Territory, as evidenced by this research project, is prohibitive. The implementation of a scheme equivalent to the discounted telecommunications services provided in the US as part of the federal E-Rate program would offset the cost of Internet access, assist in maintaining a competitive telecommunications environment and facilitate the extension of Internet access at suitable transmissions speeds to the rural and remote areas of the Northern Territory.

The education rate, or E-Rate, was introduced in the United States by the Telecommunications Act of 1966. Telecommunications earners are required to offer adequate transmission speeds at discounted rates to schools, public libraries and health care facilities. Schools and libraries are eligible for additional telecommunications discounts in the range of 20 to 90 per cent depending on their location and need. The residual cost is born by the institutions and is intended to ensure cost effective purchase and promote a competitive deregulated telecommunications market.

2. **The Northern Territory Government should continue to inform the Northern Territory Department of Education and the Catholic Education Office of the results of the satellite trials that commenced at the beginning of 2000.**

Schools throughout the Northern Territory have considerable autonomy in regard to the choice of telecommunications carriers and the means of telecommunications access. In 2000 schools throughout the Northern Territory accessed the Internet either via the Government network or a commercial telecommunications carrier. Internet access was either via a modem over the Plain Old Telephone System or the DRCS, a 64 kbps ISDN link or via satellite. However, at the time of the case study only 2.64 per cent of Territory schools had satellite access. The results of the satellite trials conducted during 2000 need to be communicated to schools in order to ensure school-based personnel make informed decisions in regard to Internet access.

3. **The Northern Territory Department of Education and the Catholic Education Office should support the implementation of an on-line centralised administration**
system to assist in the tracking of student enrolments and to monitor student progress.

High student mobility characterise the student population in many areas of the Northern Territory. The implementation of an on-line, centralised administration system to assist in the tracking of student enrolments and to monitor student progress would facilitate the basic information management requirements across all schools.

4. **The Northern Territory Department of Education and the Catholic Education Office should support initiatives aimed to increase the provision of technical support.**

The need for technical support and assistance has emerged as a significant issue in the three years since schools in the NT established their Internet connection. For many schools the need for technical advice is urgent and overwhelming and the lack of it is inhibiting the full utilisation of the technology already in place in schools. Whilst a number of schools have employed Technology Technicians, for many schools, particularly small schools and schools in the remote areas of the Territory, this is not a feasible option. Technical support at the regional level, servicing a cluster of schools, would assist in alleviating this situation.

5. **The Northern Territory Department of Education should continue to assist practising teachers to integrate the use of computers in the curriculum through the implementation of a program of professional development in the area of educational computing which contains a core body of knowledge and skills.**

The lack of professional knowledge and skills in the utilisation of computer technology in the curriculum is a significant issue for schools in the Northern Territory. The Northern Territory Department of Education currently supports a number of initiatives through the Open Learning Support Unit of the NT which are aimed to assist practising teachers extend and consolidate the utilisation of computers in the curriculum. It is recommended that the in-services conducted by Open learning Support Unit continue and be extended to enable teachers from remote schools across the Territory to participate.

6. **The Northern Territory Department of Education and the Catholic Education Office should support further research in the area of Educational Computing.**
The literature search revealed that there is a lack of literature in the area of Educational Computing as it applies to the Northern Territory. In order to support the growth and development of educational computing in the Northern Territory further research in this area is needed.

7. **The Northern Territory University and Batchelor Institute should incorporate Educational Computing into their Undergraduate Teacher Education Courses.**

There is currently very little computer education incorporated into the undergraduate Teacher Education course offered by the Northern Territory University (NTU) and Batchelor College. Prospective teachers at the NTU undertake one compulsory unit in Technology throughout the three years of their undergraduate course. An increase in the specific computer education units for undergraduate students would assist in raising the level of computer knowledge and skills of the teaching profession as well as promote an awareness of the role of computers in the curriculum.

8. **The Northern Territory University should implement a Post Graduate course in Computer Education.**

There are currently no Post Graduate courses in Computer Education available in the Northern Territory for teachers wishing to extend their knowledge and skills and gain expertise in this area. As evidenced by this research project, approximately 80 per cent of Territory schools have no one on staff with any formal qualifications in computing. The lack of teachers with formal qualifications in Computer Education is contributing to the frustration experienced by school-based personnel in incorporating computers into the curriculum as well as the technical and administrative issues associated with computers in education. An increase in the number of teachers with professional qualifications in the area of educational computing would assist in raising the level of computer knowledge and skills of the teaching profession as well as promote an awareness of the role of computers in the curriculum.

9. **The Northern Territory Department of Education and the Catholic Education Office should provide a career path for teacher with demonstrated technical competence knowledge and skills.**
In order to increase the number of teachers with professional qualifications in educational computing, the Northern Territory Department of Education and the Catholic Education Office should provide a career path for teachers with demonstrated technical competence knowledge and skills. The recognition of professional qualifications in computing through a structured career path would assist in raising the level of computer knowledge and skills of the teaching profession, provide an incentive for teachers to gain professional computing qualifications and assist in alleviating the current shortage of skilled teachers in this area.
Bibliography


The Australian. 2000, 7 March, Bush Telegraph.

Australian Bureau of Statistics. 1998, Regional Distribution of Internet Use Aged 18 Years and Over,
D3110122.NSF/66b4effdf36063e24a25648300177cd5/30e98346b9c880f44a25661100831a6e?OpenDocument


Australian Bureau of Statistics. 1999b, Demographics,
D3110122.NSF/66b4effdO6063e24a25648300177cd5/c02293a737df6dc34a2564ae00013858!OpenDocument

D3110122.NSF/66b4effdO6063e24a25648300177cd5/623a6b73a8e288f54a2565d80000f5fe!OpenDocument

D3110122.NSF/66b4effdf36063e24a25648300177cd5/623a6b73a8e288f54a2565d80000f5fe!OpenDocument


Australian Communications Authority. 2000a, http://www.aca.gov.au


Forster, M. 1981, Domestic Satellites and School of the Air, Katherine, School of the Air, Northern Territory.


Jackson, W. 1988, Research Methods: Rules for Survey Design and Analysis, Prentice-Hall, Canada


Legislative Assembly of the Northern Territory. 1985, Report of the Select Committee on Communications Technology, NT Government Printers, Darwin.


Northern Territory Department of Education. 2000, Manager of Statistics and Demography Branch, Yick, J., email “Current Demographic Data”, April 2000.


Snowdon, W. 1992, Education, Equity and the Crisis in the Rural Community, Paper presented to the Rural Education Association conference, Alice Springs, NT.


Telstra Unions. 1996, Submission to the Senate Environment, Recreation Communications and the Arts References Committee, Telstra Inquiry, June 1996


Tunstall, J. 1985, Communications Deregulation. The Unleashing of America's Communications Industry, Basil Blackwell Limited, New York, USA.


Appendix 1. The Northern Territory

The Northern Territory (NT) covers an area of 1,346,200 square kilometres. In relation to Australia's seven States and Territories the NT occupies 17.5 per cent of the total land mass “...an area 30 per cent larger than the combined areas of New South Wales and Victoria” (DEETYA, 1996).
Appendix 2. Major Population Centres of the Northern Territory

The majority of the Territory population reside in the major urban areas of Darwin, Palmerston, Tennant Creek, Nhulunbuy, Katherine and Alice Springs. The largest concentration of population is located in Darwin, the capital city of the Northern Territory. According to the NT Government 97 750 people, or 50.54 per cent, of the population reside in Darwin.
Appendix 3. Mean Maximum Temperature

The Top End has a monsoonal climate with two main seasons, the Wet and the Dry (Bureau of Meteorology, 2000). The Dry season extends from May to September and the temperature, at this time of the year, ranges from 15 degrees to 32 degrees Celsius.

The Centre, which includes the area that encompasses The Barkly, Alice Springs, and Tennant Creek, is situated in the semi arid areas of the Northern Territory. The temperature in these areas ranges from minus four degrees to forty-five degrees Celsius.

Appendix 4. Average Annual Rainfall of the Northern Territory

In the Top End during the Wet season high humidity, violent electrical storms and torrential rains characterise the climatic conditions. During this season almost all of the average annual rainfall of 1400 mm occurs.

The average annual rainfall of Alice Springs and areas around the Centre, is approximately 330 mm. Seasonal flooding also occurs in these areas.
Appendix 5. NORTHERN TERRITORY SCHOOLS
The majority of Northern Territory (NT) schools are located in the rural and remote areas of the Territory. Of the 186 schools in the NT, 46.24 per cent are located in the major urban areas and the remaining 53.76 per cent of schools are located are in the rural and remote areas of the NT.

http://www.sCHOOLS.nt.edu/staffing/regions/map.htm
Appendix 6. Telecom Telecommunications Corridors

Katherine - Kununurra Communications Corridor. Commenced construction in 1985

Darwin - Tennant Creek - Mt Isa Communications Corridor. Established in 1974

Tennant Creek - Alice Springs Communications Corridor Established in 1979

Hired capacity from the Australian National Railways

Telecom Telecommunications Corridors

Hired Capacity from the Australian National Railways
Appendix 7. Schools Outside the Telecommunications Corridor

In 1980 there were 57 Northern Territory schools outside the telecommunications corridor and, as a consequence were not connected to either a telephone, radio/telephone or a radio (IMG, 1980:2.20)

http://www.schools.nt.edu/staffing/regions/map.htm
Appendix 8. Geographic Coverage of Alice Springs School of the Air

The Alice Springs School of the Air was established in 1951 and made its first broadcast, using a HF transceiver from the Royal Flying Doctor Base in Alice Springs. By 2000 the Alice Springs School of the Air had an estimated broadcast area of 1.3 million square kilometres.

http://www.assoa.nt.edu.au
Appendix 9. Geographic Coverage of Katherine School of the Air

The School of the Air based at Katherine commenced operation in 1966 and serviced student who resided in the top half of the Territory. The “school” covered a geographic area of 800 000 square kilometres (sq km).

http://www.ksa.nt.edu.au/

Appendix 10. The Tanami Network

In 1992, at a cost of $1.8 million the Warlpiri people of the Tanami region of the Northern Territory established the Tanami Network, a satellite based video conferencing network. The satellite communications network linked the four remote
Warlpiri settlements of Yuendumu, Lajamanu, Willowra and Kintore with each other and with videoconferencing sites in Sydney, Darwin and Alice Springs.

Appendix 11. SURVEY OF COMPUTING IN NT SCHOOLS, 1996

To be in the draw for the ‘thank you’ prize, this completed survey must be returned to Open Learning Support Unit on or before 4 pm on 24 October 1996.
1. **Identification**

   School name: _____________________________________

   Phone: _____________________ Fax: _____________________

   electronic mail adr: ____________________________ Number of teachers on staff: ____

   Region: ______________________________ Official enrolment Feb 96: _____

   Contact re computer matters: ______________________________

   Phone if not same as above: ______________________________

   When answering the following questions, if an exact answer is not possible, please select the nearest fit. If nothing fits, add your own comments in the margins. If you don't understand a question, put a big question mark next to it.

   **Some general questions**

2. How frequently are computers used by all or most classes…

   □ everyday
   □ two or three days a week
   □ occasionally
   □ some use them a lot, some very little

3. What subject areas use the computers most? (list two or three if you wish)

   ..................................................................................................................

4. How are your computers organised?

   □ distributed evenly around the class rooms
   □ mainly centralised in computer ‘laboratories’
   □ we have some in classes, and some in a laboratory setting
5. If you have computers in your class/subject area, please indicate briefly how you organise them to maximise student access to relevant educational materials. You are invited to attach samples of class access rosters, floor plans, whatever.

6. Did your school receive any computers, compact disk player, and/or modem under the 1995/6 Improve Access, Improve Opportunity (IAIO) Project? **If YES, please ensure you answer questions 64–72.** YES / NO

7. Is most of your computing equipment generally in good working order this year? YES / NO

8. In the experience of your school, have you found the computing equipment to be generally reliable? YES / NO

9. If your school has several computer brands/operating systems, please comment if you have found one or more brands/systems significantly more or less reliable than others. You may limit your comments to a particular component, eg printers, or to whole systems.

10. Have computers helped to reduce your preparation time, for example by enabling you to quickly update and reprint last year's worksheets, etc?

    If yes, please indicate how they have helped.

11.a. Please identify any specific **positive** educational outcomes arising from personal and student use of computers in your class/subject?

    b. Any **negative** outcomes?

12. In six or twelve month's time what do you see as the role of computer supported learning in your class/subject area?

13. Rate your competence with your school's computers. For multiteacher schools, provide us with your assessment of the average competency level (**low** is reluctant to use, **OK** is usually able to start up computers and programs and find your way around, **high** is extensively experienced in networking, Internet, and troubleshooting.)

    low----------OK----------high

14. How highly does your school rate the usefulness of computer technology in supporting the educational experiences of the students in your school?

    low----------OK----------high

15. Please comment briefly on your rating in the preceding question.
16. Do you involve parents/wider community in supporting computer use in your school?
   If yes, please give an example: YES / NO

17. Listed below are some common factors that may act as constraints in using computers in the classroom. Indicate those which affect your school and rate their importance on a sliding scale:

<table>
<thead>
<tr>
<th>Area</th>
<th>Seriousness of factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff lack confidence in use of equipment</td>
<td>(minor)---------------(major)</td>
</tr>
<tr>
<td>Technical difficulties (as distinct from lack of staff confidence)</td>
<td>(minor)---------------(major)</td>
</tr>
<tr>
<td>Lack of relevant software (applications)</td>
<td>(minor)---------------(major)</td>
</tr>
<tr>
<td>Limited amount of hardware</td>
<td>(minor)---------------(major)</td>
</tr>
<tr>
<td>Not enough time to fit computer access into program for all students</td>
<td>(minor)---------------(major)</td>
</tr>
<tr>
<td>Limited access to, or lack of funds for repairs</td>
<td>(minor)---------------(major)</td>
</tr>
<tr>
<td>Limited funds to expand or update resources</td>
<td>(minor)---------------(major)</td>
</tr>
<tr>
<td>Lack of access to professional development</td>
<td>(minor)---------------(major)</td>
</tr>
</tbody>
</table>

18. What is the total number of phone/fax lines in your school? □

19. How many computers in your school have permanent access to a phone line - ie they are always connected via a modem? □

20. How many phone lines are used occasionally for computer/modem links? □

21. This question seeks an overview of computers in NT schools. When counting, please include ALL computers - classroom, laboratory, office, library, and perhaps computers away for repair or on loan to staff or students at home:

   □ Number of desktop PC's running Microsoft Windows (ie not Macs) and excluding laptops?

   (Optional: provide breakdown by 286, 386, 486, or later)

   What Windows operating system do you run?

   □ Windows 3.1
□ Windows for Workgroups
□ Windows 95
□ Windows NT
□ Macintosh, all models excluding laptops (don't count Apple 2e)
□ Number of Unisys Workstations?
□ Non-Macintosh portables (‘laptops’)
□ Macintosh portables (‘laptops’)
□ Number of OTHER (old) computers, eg Apple 2e, Commodore, BBC (Count only units in working order)

22. Ideally, how many modem workstations would be required to meet the needs of: the following (note: ‘modern’ is defined as a colour computer with sufficient memory to meet routine admin/class needs, and for classroom computers the capacity to replay sound).

  teachers □ office staff □ students □

23. Are some/all of your computers networked, ie, linked for program, file, and/or printer sharing? YES / NO

24. If networked, is it
  • ethemet □
  • Localtalk □
  • both of above □
  • other (specify) …………………

25. What network protocols (software) are used?
  • Appletalk □
  • IPX/SPX □
  • TCP/IP □
  • Other (please specify):

26. If you have more than one local area network (LAN):
  • How many LANs? Give brief details: □

27. Do you have a File/Print server? YES / NO

  If yes, How many? □
What type of server hardware?


28. What server operating system?
   - □ Netware
   - □ Windows NT
   - □ MacOS
   - □ Unix

29. Do you have separate LANs for office staff/ teachers/ students? If yes give details YES / ON

30. Who has access to school computers?

<table>
<thead>
<tr>
<th>Networked computers</th>
<th>Stand alone computers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers</td>
<td>□</td>
</tr>
<tr>
<td>Support staff</td>
<td>□</td>
</tr>
<tr>
<td>Students</td>
<td>□</td>
</tr>
<tr>
<td>Authorised parents, visitors</td>
<td>□</td>
</tr>
</tbody>
</table>

31. Other computer accessories and add-ons: How many of each of the following items are in your school and normally in working order:

- □ Black and white computer printers, such as ink jet and laser writers
- □ Black and white dot matrix printers such as Imagewriter and Epson (these are easily distinguished from ink jet and laser: the dot matrix letters made up of a series of small dots clearly visible to the eye)
- □ Colour computer printers
- □ Compact disk players, either built in to the computer (eg Mac 575, 580, 630), or separate players attached by cable to the computer
Removable hard drives, eg Apple, Connect, Syquest

(The next two questions will be very valuable for advising schools on useful applications. Please give them special consideration.)

32. What applications (eg ClarisWorks, MathBlaster) in your school are used most frequently by teachers/students for educational purposes?

33. What if any educational applications in the school have turned out to be unsuitable for class use?

34. Please comment briefly: In what ways does the use of CD ROMs enhance student learning outcomes?

35. Do you have a Strategic Plan for the use of computers in your school? YES / NO

   If Yes, does the Strategic Plan address

   • Educational use of computers, ie for teaching purposes? YES / NO
   • Administrative use of computers, including the library? YES / NO

36. Is your school connected to the Internet? YES / NO

   If No, please answer the following, then go straight to question 53

   • Is there any particular reason or reasons you have not considered the Internet as an educational tool?
   • Is there any particular reason that you have not tried a link to the Internet?

37. How do you connect to the Internet?

   □ Dial-in, using a modem and phone line
   □ Govt MPR Network

38. Name of your Internet Service Provider (ISP):

   □ NT Government (for Govt MPR Network users only)
   □ Topend.com.au (for most IAIO Project schools)
   □ Katherine High School (all/some Katherine Region schools)
39. How many separate modems are actively used in your school? □

Don't forget to count the following, if applicable:

□ modem connected to Unisys in the office
□ modem used for electronic mail
□ modem used for accessing the Internet
□ modem used by the librarian
□ modem used for Electronic Classroom students (AEP 16)
□ other classroom based modems

40. Do you have at least one 28,800 bps modem in the school? This is its speed rating and is usually marked on the front as 288 or 28.8. All IAIO Project schools should have at least one. YES / NO

41. How did you first link to the Internet?

□ Using the package supplied by the IAIO Project
□ Via the NT Government network
□ Other method: ……………………

42. Which Internet facilities do you use?

<table>
<thead>
<tr>
<th>Service</th>
<th>A lot</th>
<th>A bit</th>
<th>Never</th>
<th>Don't Understand</th>
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<tr>
<td>World Wide</td>
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<td>□</td>
<td>□</td>
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<tr>
<td>Web (WWW)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Electronic Mail (electronic mail)</td>
<td>□</td>
<td>□</td>
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<td>□</td>
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<td>FTP</td>
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<td>Gopher</td>
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<td>□</td>
<td>□</td>
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<td>Netscape</td>
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<td>□</td>
<td>□</td>
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<td>Eudora</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Service</td>
<td>A lot</td>
<td>A bit</td>
<td>Never</td>
<td>Don't Understand</td>
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<tr>
<td>Search engine, eg Infoseek</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>chat</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Telnet</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

43. If you commonly use any other Internet applications, please list here:

44. Approximately how many weeks/months/years since your school started to use the Internet? □ wk/m/yr

45. For single access point users only: Approximately how many hours per week is the school accessing the Internet? □

46. For networked schools using multipoint links: Approximately how many student/teacher hours per week on the Net? □

47. Who are the main users?

- □ teachers
- □ students
- □ If students, which year levels are the main users? □

48. Please prioritise the main uses the school makes of the Internet? 1 is most, 7 least, with 0 (zero) for not at all:

- □ Surfing the Web [WWW], ie random browsing
- □ Specific Web topic searching for classroom use
- □ Administration
- □ professional development
- □ electronic mail for administrative messages
- □ e-mail for educational use, eg student inter-school links
- □ chat sessions

49. Which curriculum areas use the Internet most frequently?
50. What factors, if any, inhibit the use of the Internet in your school?

- None
- Lack of dedicated phone line
- Poor quality phone line (e.g., noisy DRCS), and/or - for larger schools in particular - lack of bandwidth for speed/multi access
- Access costs (e.g., Telstra charges, membership fees)
- Lack of access to training in its use
- Lack of expertise
- Other (please specify)

51. Does your school have a WWW home page? If yes, please write its URL here: (If you don't understand this question, the answer is probably no.)

52. Deleted

53. How many staff have formal qualifications in computing, e.g., a diploma, degree, or at least a couple of completed units? □

54. How many staff have participated in a computing/Internet professional development workshop within the past year? □

55. What would be your priority in the computing support area right now?

- Internet inservice
- Home page design inservice
- Other computing inservice (please specify): ………
□ On line (ie telephone and/or electronic mail) help
□ On-line discussion groups and/or professional associations
□ Other (please specify) ………………

56. How many hours experience have you personally had on Internet? (If you are completing this form as a team effort, please give a rough guide as to the average level of experience) □ weeks/month

57. On the basis of your experience so far, please summarise your perception of the potential educational uses of the Internet/electronic mail in your class/school:

58. On the basis of your experience so far, please list your perception of the failings of the Internet/electronic mail in your class/school:

59. Assuming your school already has a computer configured to link to the Internet, if we asked you right now, could you….

□ Connect without asking for help
□ Open and use a search engine such as Infoseek or Yahoo
□ Enter a URL in the appropriate spot
□ Download a picture
□ Download an application
□ Make a bookmark
□ Create and send an electronic mail message
□ Enclose a document with your electronic mail message
□ Read a mail message
□ Create a basic school home page for the Net

60. In the following list, rate your requirements according this scale

1. need yesterday
2. will need to meet short term goals
3. will need to meet long term goals
4. nice to have but not critical
5. don't need

6. I don't understand what this item is

- Shared file and print services
- Internet access
- Intranet access (same principle as Internet, but available only within a department or business - eg Education)
- electronic mail access to rest of Government
- Government Mainframe
- Local electronic mail (electronic mail)
- Electronic document management systems
- Imaging (paper documents] management system
- Access to local databases (eg Filemaker Pro etc.)
- Access to corporate information (eg. Education-Act, PolicyManual etc.)
- Shared discussion databases/ knowledge bases.
- Electronic delivery of education curricula/ teaching.
- Electronic publishing.

61. Tick the item in the following scale which best matches your school's overall comfort level with or perception of information technology for administration, including but not limited to student and/or staff records, electronic mail, accessing government or Education Department records via electronic Links, publishing, printing, letter writing:

- we're doing fine and have everything we want. Thanks!
- we know exactly what we want but would like more resources.
62. Tick the item in the following scale which best matches your school's overall comfort level with or perception of information technology for classroom/curriculum support including but not limited to student/teacher learning about computers, using drill type or student focus development applications such as Writing Machine, ClarisWorks, MathBlaster, etc, and accessing online references such as encyclopaedias or the internet and electronic mail:

- □ love it but need occasional help/guidance on its use.
- □ nice idea, we use it if and when we have to.
- □ dread it and avoid it - give me back my slide rule!

63. Were you aware of computer support services within the Department? Tick the ones below which you knew about before you read the list:

- □ Information Technology Services (ITS), Westpac Building (focus: Administrative computing applications & systems, computer futures, WAN, LAN, Internet and Intranet, Departmental systems policy planning)
- □ Open Learning Support Unit (OLSU). Rapid Creek (focus: computers in the
classroom, classroom, school networking for accessing online educational services, Internet and electronic mail, special computer projects such as Electronic Classroom)

□ Professional Development Calendar, usually published twice per year (contains good range of computing courses for administrative and educational purposes, which are usually run by ITS or OLSU)

□ PEO Computer Technology, Curriculum and Assessment, NML Building, Darwin (focus: computer curriculum)

□ Education Adviser Computing, Education Centre Alice Springs (focus: educational computing support to Southern Region schools)

□ Curriculum Advisory Support Unit, Winnellie (focus: special projects, occasionally one or more with a computing theme)

Appendix 12.
Ms. S Bandias

P.O. Box 274

Sanderson

NT 0812

Ph: (08)89270529

susanb@octa4.net.au
Principal, Head Teacher

I am a student at the Northern Territory University currently undertaking research for my Master of Education (Hons). The focus of my research is to investigate the current and emerging telecommunications needs of urban, rural and remote schools. I have permission from the Northern Territory Education Department to conduct this research.

Your school is invited to assist me in this research project by completing the attached questionnaire. It is anticipated that this study will be of assistance to the Northern Territory Education Department in regard to the growth, development and application of network technology in Northern Territory education. There are no specific risks associated with this study and full confidentiality will be kept by the researcher. The results of the research will be made available once the study is complete.

To ensure the confidentiality of replies and to assist in the collation of results all survey documents have been allocated a code. The code will also assist me in following up returns. Individual schools will not be identified by name in the thesis, only aggregate results will be published.

Your assistance, by either you or your designate, in completing the questionnaire by the 30 April 2000 and returning it in the prepaid envelope would be greatly appreciated.

Yours sincerely

Susan Bandias

2000 Computers in Northern Territory Schools Survey

Thank you for your time and effort in completing the survey.

Please return the survey in the prepaid envelope by the 30 April 2000

If you have any queries in regard to this survey please contact Susan Bandias on 89270529. Queries can also be emailed to
SECTION 1

1. School Name
   School phone
   School Fax
   School email
   Student enrollment as of February 1999
   Number of teachers on staff □
   Number of administration staff □
   Number of teaching support personnel on staff □
   Does your school have a designated computer specialist? Yes/No
   How many teachers on staff have formal qualifications in educational computing? ie Grad. Dip etc. □

2. In the past 12 months how many teachers and support staff have participated in one or more computing inservices
   conducted at the school by a staff member? □
   conducted at the school by a NT Department of Education Computing Advisor? □
   at Open Learning Support Unit? □
   Others? (please specify)________

3. In the past 12 months how many administration staff have participated in one or more computing inservices
   conducted at the school by a staff member □
   conducted at the school by a NT Department of Education Computing Advisor □
   at Open Learning Support Unit □
   Others (please specify)________

4. Specific questions for the person completing the questionnaire
   Gender Male/Female □
   Age
   >21……..<30 □
   >31……..<40 □
   >41……..<50 □
   >51 □
5. Highest Formal Qualifications

6. Computer specific qualifications/training
   University (Year obtained__________, Qualification__________)
   Tafe (Year obtained__________, Qualification__________)
   Inservice □
   Self taught □

7. Position on Staff__________

SECTION 2 HARDWARE AND SOFTWARE

1. How many computers for student use situated
   In classrooms? □
   In the library? □
   In a computer Laboratory? □
   Comments__________

2. How are the classroom computers utilised by students

<table>
<thead>
<tr>
<th></th>
<th>Frequently</th>
<th>Occasionally</th>
<th>Rarely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessing floppy discs?</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Accessing CD Roms?</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Internet access?</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Others (Please specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. What software programs are used most frequently by students?

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

4. How many computers are equipped with a CD player? □

5. How many removable Hard disc's in the school? □
6. What are the schools networks used for (ie administration purposes, Internet access)_________

7. Do teaching and support staff utilise the schools computers for

<table>
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<th></th>
<th>Frequently</th>
<th>Occasionally</th>
<th>Rarely</th>
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<tbody>
<tr>
<td>Lesson preparation?</td>
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<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Administration tasks?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Research?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Others (Please specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. Do authorised parents and visitors utilise the schools computers for

   Research? ☐
   Word processing? ☐
   Accessing CD Roms? ☐
   Internet access? ☐
   Others (Please specify)___________________

SECTION 3 INTERNET

1. How many computers at your school can access the Internet simultaneously?

2. On average how frequently would the Internet be utilised at your school

   By students?
   Less than 1 hour a day ☐
   2–4 hours a day ☐
   > 4 hrs per day ☐

   By teaching staff?
   Less than 1 hour a day ☐
   2–4 hours a day ☐
   > 4 hrs per day ☐

   By Administration personnel?
   Less than 1 hour a day ☐
   2–4 hours a day ☐
3. If your school has multiple Internet access how is this achieved
   A number of independent connections ie separate accounts? □
   Router? □
   Software? □
   Via the server? □

4. How does your school currently access the Internet
   Modem Connection? □
   Direct ISDN link? □
   Satellite □

5. Do you connect to the Internet via
   An independent service provider? □
   The government network? □
   Others? (please specify) ________________________

6. Does your school currently have its own domain name? Yes/No

7. What would the schools average Internet access costs be per month? □

8. How is the Internet utilised by your school

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<tr>
<th></th>
<th>Frequently</th>
<th>Occasionally</th>
<th>Rarely</th>
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<tbody>
<tr>
<td>Research?</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Educational applications?</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Access NTDE information?</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Email?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others (Please specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. Does your school have a Home Page Yes/No
   Who designed the schools Home Page? __________
   When was it placed onto the Internet? __________
   Who maintains the schools Home Page? __________
What is the URL of the Home Page? __________

10. What factors, if any, inhibit the schools use of the Internet
   Access cost? □
   Access speed? □
   State of current hardware? □
   Poor telephone connection? □
   Lack of dedicated phone connection? □
   Lack of trained personnel? □
   Others/None (please comment)?__________________

11. On a scale of 1 to 10 how would you rate the Internet as an educational tool? □

   (1 Poor……….10 An excellent educational resource) □

Comments

12. If you prioritized the computer support your school needed what would your current
    priorities be

<table>
<thead>
<tr>
<th></th>
<th>Urgent</th>
<th>On going need</th>
<th>Not a priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inservicing</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Increased funding</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Technical Support</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Others/None (Please</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>comment)</td>
<td></td>
<td></td>
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</tbody>
</table>

Comments

Please feel free to comment.

Thank you for your time and effort in completing this survty.

**Appendix 13.**

Ms. S Bandias

P.O. Box 274
Dear Principal, Head Teacher, Computer Coordinator,

At the beginning of term one I posted a survey to schools in the Northern Territory seeking information in regard to computer hardware, software and networks currently utilised in education.

The information I requested is to assist me in the data collection phase of a research project I am undertaking through the Northern Territory University. The aim of the research project is to examine the current and emerging telecommunications needs of schools in the Northern Territory.

Thank you for your assistance if you have already responded to the survey.

If your school has not, as yet, responded to the survey it would be appreciated if the survey could be completed and returned in the prepaid envelope prior to 30 April 2000. The results of the research project will be available to schools once the project is complete.

Your assistance is appreciated.

Yours sincerely

Susan Bandias

Appendix 14.

Ms. S. Bandias

P.O. Box 274

Sanderson

NT
The Principal

(Name of School),

At the commencement of term one I distributed to schools in the Northern Territory a questionnaire in regard to computer use in schools. The questionnaire was to assist me in the data collection phase of a project I am undertaking through the Northern Territory University for my Master of Education (Hons.) The purpose of the study is to examine the current and emerging telecommunications needs of urban, rural and remote schools in the Northern Territory.

I am seeking the involvement of a representative range of schools to act as case studies in order to provide qualitative data for the research project. Participation in the case studies would involve a member of your staff participating in an interview. The interview will be of approximately half to three quarter hours duration. The questions participating schools will be asked are concerned with the educational implications of technology for teaching and learning.

Full confidentiality will be kept at all times and information provided during the interview will be coded to protect the confidentiality of participants. There are no specific risks associated with this study and all information will be stored in a secure location. Your acceptance to be involved in the case studies aspect of the project would be appreciated.

I anticipate that the case studies would be completed by the end of the first semester. I will contact you within the next two weeks to confirm your involvement.

Yours sincerely

Susan Bandias

Appendix 15.

Ms. S Bandias
Dear Matthew,

I am writing to you seeking the permission of the Tiwi Land Council to approach the schools on the Tiwi Islands to invite them to participate, as case studies, in research I am currently conducting. The purpose of the research is to examine the current and emerging telecommunications needs of urban, rural and remote schools in the Northern Territory.

I have permission from the Northern Territory Education Department, the Catholic Education Department and the Northern Territory University to conduct the research.

Full confidentiality will be kept at all times and information provided during the case studies will be coded to protect the confidentiality of participants. There are no specific risks associated with this study and all information will be stored in a secure location.
The case studies will be conducted during June 2000 and the results of the study will be made available to the Land Council once the research is complete.

Yours sincerely

Susan Bandias

(3.5.00)

Appendix 16.

Managers:  

Walter Kerinaiua - Nguiu
Tel: (08) 8978 3755

Matthew Wonaeamirri - Milikapiti
Tel: (08) 8978 3711

Cyril Rioli - Pirlangimpi
Tel: (08) 8978 3788

Jimmy Tipungwuti - Wurankuwu
Tel: (08) 8978 3709

File: 18-0-0

Susan Bandias,

P.O.Box 274.
SANDERSON. N.T. 0812.

Dear Susan,

Thank you very much for your letter last month. As conveyed to you by phone, we are pleased to have heard from you and learn you are still involved in Aboriginal Education and research. Our Management Committee has been pleased to support your interest and those case studies required. We would value a copy of your thesis when completed.

You will need to make your own arrangements with School Principals and Staff for appropriate consents and assistance. Your experience will have already suggested these processes to you.

We wish you well with your research and look forward to a copy of your work.

Yours sincerely,

Matthew Wonaeamirri.

Chairman.

21 June 2000.

Appendix 17.

Case Study Interview Questions

1. School name
2. Phone
3. School Fax
4. School email
5. Contact name
6. Student Population
7. Number and description of grades
8. Special programs
9. Brief history of technology in school
10. Number of computers able to access the Internet and how is access achieved?
11. Is there a technology committee and if so who is on the committee?
12. What factors, if any, inhibit the use of technology/internet in your school?
13. What are the direct educational outcomes of the utilisation of technology in the school?
14. What does the school envisage in terms of technology implementation in the next few years?
15. What issues do you think are important in exploring the educational use of the Internet in schools?
16. How are teachers encouraged to utilise technology?
17. How do teachers incorporate technology into the curriculum?