Remote Student Access to Education via Satellite Delivery

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Abstract

For many years, the New South Wales Department of Education and Training has been using radio technology to deliver lessons to children in remote rural areas. Due to the expense and inherent unreliability of radio, the Department commenced looking for a replacement amongst emerging communication technologies in 1997. This paper reports on a *Trial* which was conducted by the Open Training, and Education Network - Distance Education section of the Department of Education and Training using satellite technology developed by *Gilat* of Israel, delivered and managed by *Telstra*. The 'virtual classroom' enabled distance education teachers at Broken Hill School of the Air to deliver interactive lessons to primary students at remote sites across western New South Wales.

This paper provides an overview of the technology, and outlines the processes proposed for evaluation of the teaching and learning supported by this satellite based system.

Introduction

The New South Wales Department of Education and Training has sought to extend the use of appropriate technology to support distance teaching and learning, partially as a result of the *Rural Schools Plan* (Metherell, 1989). These initiatives have included:

i) creation of the five Access Clusters, where audiographics tele-teaching has been used in the senior curriculum since 1990;

ii) introduction of video-conference teaching in the Riverina Access Cluster in 1998;

iii) upgrading of the radio network in the rural Primary Distance Education Centres; and,

iv) use of audio conferencing and audiographics tele-teaching in the Primary and Secondary Distance Education Centres.

This paper reports on the extension of these processes, and is concerned with one of the continuing challenges for the Department of Education and Training, with regard to concerns about the quality of the radio network. In particular, in the remote regions of New South Wales, the quality of radio transmission has been adversely affected by a range of factors including climatic conditions, solar activity, wildlife activity, time of day, and the vagaries of the electrical power supply. As a result, the system is unreliable and expensive to maintain, and an active search for an alternate delivery system has occurred since 1997. Through an extensive analysis of the data available on a range of options to the New South Wales Department of Education and

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Training, it was decided to trial the use of a satellite based delivery system to support teaching and learning for the most geographically isolated primary school students in the state. This trial of the satellite based technology to these remote primary students became known as the *New South Wales Outback Satellite Education Trial.* It is important to stress that the project is a *Trial* of the technology, not a pilot project with the implication that implementation will occur at a later date.

The initiative for the *Trial* came initially from the Open Training and Education Network (OTEN - Distance Education) group, who then managed the implementation of the project. OTEN provides a number of distance education services, which include:

i) the management and staffing of the primary and secondary Distance Education Centres (DECs) located around the state;

ii) the training and development needs for distance education teachers;

iii) the development of print and audio based materials for students and teachers occurs (through the Learning Materials Production Centre (LMPC);

iv) the selection and maintenance of distance education delivery systems used by individual DECs; and,

v) the evaluation of new forms of distance education delivery systems.

Participants in the *Trial*

The *Satellite Trial* is located at the *Broken Hill School of the Air.* The use of the satellite technology enabled the distance education teacher to deliver live interactive lessons to the class of twelve (12) Year 3/4 students living on remote and isolated properties within a 250 km radius around Broken Hill. The targeted Year 3/4 class received one lesson per day while their siblings received one-to-one and small group instruction by their respective teachers at other times (see Figure 1 for the location of these students).

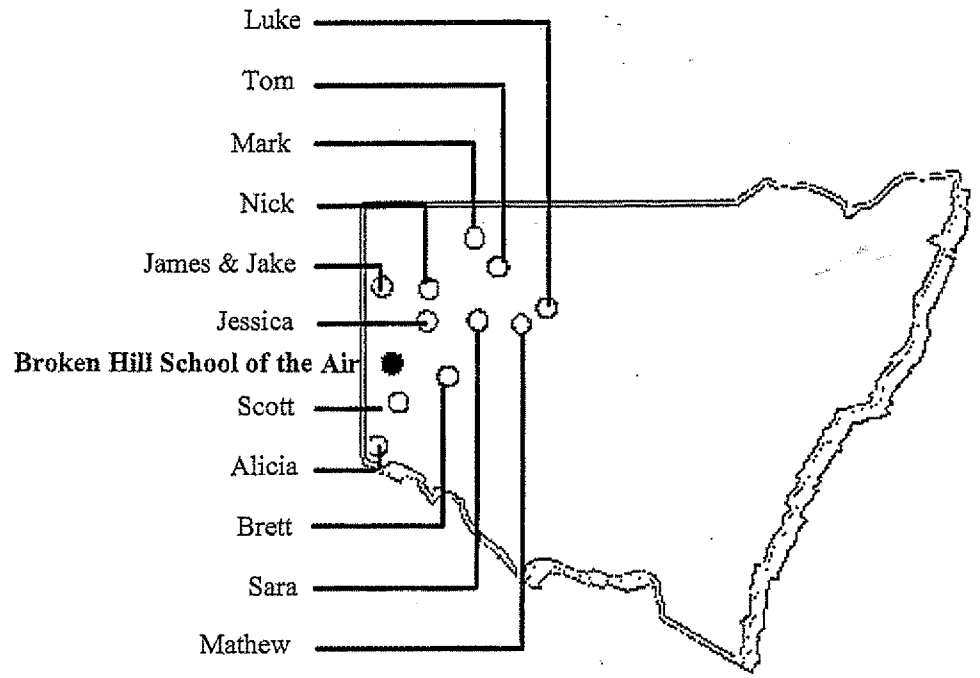
The evaluation collected data from the students, home supervisors, teachers at Broken Hill School of the Air, support teachers located at other Distance Education Centres, staff working at the Learning Materials Production Centre (LMPC) within OTEN, and key senior management personnel within the Department of Education and Training.

The *Trial*

Following a planning and training phase, the *Trial* proper took place over a period of 6 weeks (3 + 3 with a week in between) in April and May. However, various informal trials and technology tests continued until the end of Term 2.

The evaluation then involved analysis of the data collected during the *Trial*, and periods of reflection on the program by all of the key participants.

Figure 1: Students Engaged in the NSW Outback Satellite Education Trial



Evaluation of the *Satellite Trial*

The *Trial* sought to develop a dynamic learning environment where all participants were comfortable using the technology, and where opportunities for interactivity were created to enhance learning at a distance. As part of the *Satellite Trial*, an external and independent team from Charles Sturt University (Colin Boylan and Andrew Wallace) was contracted to conduct the evaluation. The overall focus of this process was:

> *To evaluate the capacity of the New South Wales Outback Satellite Education program to provide live, interactive educational experiences for outback students using the satellite - computer based system.*

The evaluation was to take cognisance of the differing perspectives of each of the key participants, including teachers, students, home supervisors, materials developers and support staff. Five major areas were seen as appropriate for the study, these being:

- The pedagogy developed using the technology.

  How was teaching and learning influenced by the use of the new technology?

- Materials development - implications of the use of the technology.

What are the implications for print based support materials and the LMPC?

- Training and development - implications for the adoption of this technology.

  How might professional development for staff be implemented?

- Engagement with the technology.

  How easy is the technology to use?

- Appropriateness of the technology.

  Does the technology do what has been claimed?

Collection of information

A variety of methods were used to gather information about the implementation of the *Trial.* These included:

i) before and after questionnaire;
ii) face to face interviews with all participants;
iii) telephone interviews with home supervisors, and teachers; and,
iv) lesson observations.

Satellite technologies

The *Satellite Trial* has been undertaken with the support of *Telstra*, using satellite technology developed by an Israeli company *Gilat.* This company provides satellite services for private companies, banks, government agencies and academic institutions, allowing them to conduct live and off-line teaching and learning.

Gilat is presented in their own literature as the dominant domestic and regional provider of sophisticated satellite communication services in Israel, and is a significant provider of one-way and two-way VSAT technologies across the globe. Their systems allow communication between a central location and a large number of geographically dispersed sites using terrestrial transceivers and disk antennas. *Gilat* uses the technology to provide a wide range of satellite-based communications services including voice communications, data, and digital video broadcasting using IP multicast systems.

The systems utilised in this *Trial* were developed by *Gilat* in close cooperation with the Open University of Israel, who have considerable experience in Distance Education, especially Interactive Distance Learning (IDL), and Digital Video Broadcasting (DVB). The Open University sought to reach students in their own homes, rather than to use more traditional classroom based systems for the delivery of educational services. The solutions developed by *Gilat* to meet these needs involve proprietary hardware and software which are used to create, broadcast, and conduct educational and training sessions.

Background to the satellite system

The *Trial* at Broken Hill was predicated upon the assumption that satellite technology was appropriate for the delivery of lessons to remote isolated students in outback New South Wales. The existing radio system is expensive and unreliable. At the same time the current telephone systems (land based and radio/microwave) are inadequate to provide even base level access to facilities which are fast becoming accepted as the norm. These facilities include access for all students to the Internet and the World Wide Web. There appears to be no cost effective means in the foreseeable future to improve the telephone system to these remote properties, where current systems are unreliable and operate at low transmission speeds.

The development of satellite systems to deliver educational experiences for remote students would appear to have a number of advantages. These include that:

- there is no longer a reliance upon existing inadequate telephone communications systems;
- the system offers high quality sound, video and data communications to each student site, irrespective of location or physical circumstance;
- the sound quality problems experienced with the current radio systems are overcome, while quality video and data communications are added; and,
- costs of satellite communication are likely to fall as usage levels escalate in the next decade.

The research literature

The literature on the use of technology and learning has grown exponentially in recent years, though the major area of concern involves the use of computers in traditional classrooms. The impact of technology upon distance education has also grown through the past decade. In this regard Barker (1991) succinctly analysed the educational advantages and disadvantages of a range of telecommunicated distance education technologies, including satellite based delivery systems for teaching and learning. His analyses have direct relevance to the New South Wales Outback Satellite Education Trial. Barker (1991) identified a comprehensive set of advantages and disadvantages for satellite based delivery systems, which were:

Advantages

i) Students can see their teacher.
ii) Real time video images are presented.
iii) Student - teacher interactions are possible.
iv) The satellite signal can cover a large geographical area.

Disadvantages

i) The teacher cannot see the students.
ii) Little student - student interaction.
iii) Audio 'echo' can be a problem when students talk.
iv) Often programs are centrally controlled with little local input.
v) Some satellite receiving dishes are weather sensitive, while Ku band reception may be affected intermittently by 'sun outages'.
vi) Large class sizes are not normally possible.
vii) Establishment costs and on going annual fees are high (Barker, 1991: 5-6).

The *Satellite Trial* in New South Wales is not the first in the use of satellite based technologies within Australia. An interactive satellite television trial (OLTC, 1994) was conducted by the Victorian Ministry of School Education during 1992 and 1993. This program used a one way video and phone / fax return to the television studio to deliver lessons around the state. This particular trial sought to provide better access to professional development for teachers, and to explore the strengths and weaknesses of the technology. In the resultant report, OLTC (1994) claimed that the educational benefits of the interactive satellite television system for teacher professional development were:

i) no costly and time wasting travel;
ii) no filtering of information by numerous consultants and colleagues;
iii) quality of access to inservice programs;
iv) better use of scarce resources; and,
v) maximised participation by cutting out quotas and lessening the time release necessary for teachers to attend programs (OLTC, 1994: 2).

Significantly, the evaluation of the Victorian trial identified that quality learning had taken place, and that teachers readily accepted satellite delivery mode. As a result of this trial more teachers participated in professional development activities, and the need for staff training in the methodologies associated with the delivery of programs via the interactive satellite television system was established.

More recently, a trial of video-conference teaching through the South Australian Open Access College, as part of the *Telstra Learn-IT* program, identified a number of issues that have direct application to the use of the satellite based delivery system in the *New South Wales Outback Satellite Education Trial.* The South Australian experience identified positive outcomes which include:

i) students were able to see their teacher and receive immediate feedback;
ii) students developed better communication skills;
iii) teachers were excited by the potential of the technology to permit them to teach in ways not possible before; and,
iv) teachers were able to use the system for professional development session after schools hours, bringing distance education teachers from Port Augusta and Marsden together in ways that did not exist before.

There were however some negative outcomes identified by the *Telstra* researchers, including:

i) a doubling of lesson preparation time;
ii) teachers needed 'to be very organised' for a lesson; and,
iii) there was a need to further consider the ways in which technology would be integrated into the learning process (*Telstra*, 1997).

The *Gilat* satellite system literature

The *Gilat* satellite system is a recent technological innovation. It was first implemented at the Open University of Israel in 1995 (Kurtz, 1999). For the first implementation the system was based on a one way satellite video image delivered to a large television screen located in student study centres spread across Israel. Two way audio communication occurred via the telephone system. In 1997, a one way video and two way audio and data communication system was trialed by *Gilat*, again at the Open University of Israel, which was based completely

on satellite delivery for both reception and transmission. This system incorporated HTML based communications and presentations systems.

Kurtz (1999) reported on the 1998 evaluation of this *Gilat* system with a group of 20 participants, including 14 students and 6 staff from the Centre for Information Technology in Distance Education at the Open University of Israel. Her findings revealed that the participants found the lessons more interesting as they integrated both lecturer presentation and audio visual aids, and that the asynchronous access to lesson material was valued. However there were concerns at the lack of social interaction between participants, and a perception that the learning environment was less concentrated than was the case within the face to face classroom. For the teacher, the preparation of web based materials and the management of the course demanded significantly more time and effort. Overall, Kurtz (1999) concluded:

> *The [learning] environment is user-friendly and is suited to distance education. This new environment has clear advantages, [as] it allows students to study independently and to be active learners* (p.6).

During 1998 the *Gilat* system was trialed by the Western Australian Department of Education through the School of Isolated and Distance Education (SIDE). In this trial, the purpose of the educational component was to support those isolated students studying traditional distance education subjects who would benefit from as greater level of interaction. The teacher was located in a high quality television studio contained within the SIDE complex at Leederville in Perth. The lesson transmission was delivered to two schools in the far north west region of Western Australia, one school was based in the very small remote community, while the other was a District High School in a large country town.

In the evaluation report on the Western Australian trial of the *Gilat* system (Education Department of Western Australia, 1998), the authors focussed on three areas. These areas and their conclusion based in the trial are presented below:

- Adequacy of teacher training.
  - i) the short time line before the start of the trial impacted negatively on its effectiveness;
  - ii) the one day teacher training session provided by *Gilat* was inadequate;
  - iii) the teachers needed time to 'play' with the system to become familiar with its operation; and,
  - iv) additional training on the production of HTML format support materials was needed.

- Ease of operation of the system.
  - i) all teachers found the system easy to use;
  - ii) students found the system ease to use; and,
  - iii) the system was an effective way to deliver professional development to teachers in remote locations.

- Suitability of the technology.
  - i) the teachers identified the visual aspect as beneficial;
  - ii) teacher preparation time was significantly greater;
  - iii) teachers started off in a 'lecture' mode of delivery and as they became more comfortable with the technology they used the technology to include more interaction with their students;
  - iv) students and teachers in the remote locations had good access to the Internet; and,

v) there were technical support requirements at both the studio and school end which would require system level support.

Equipment used in the *Trial*

Originating Site (Broken Hill SOTA)	**Home Sites** (All communication via satellite)	**Other Sites** (Return data and voice via land systems).
Landline connection to a satellite dish in Bendigo - to send video, audio and data and to receive audio and data	*Satellite dish* - to receive video, audio and data and send audio and data	*Satellite dish* - to receive video, audio and data
PC – displaying what the students see *PC*– used for lesson management	*PC*– to view video, hear audio, see and interact with data	*PC*– to view video, hear audio, see and interact with data
Microphone and earphone for aural communication with students	*Telephone* – connected to the IDU (In Door Unit) wired to the satellite dish	*Telephone* – connected to the normal telephone system
Video camera – to capture image of teacher *Document camera* – to capture printed images and other 'live' objects *Microphone* – to capture voice of teacher *Video player* – to play pre-recorded video tapes during lesson *Cassette Player* – to play audio cassettes during lesson	*Surge protector* – to minimise damage from unstable power supplies.	*Landlines* – to send back data, either through DET's *SchoolsNet* network or via independent ISDN lines.

Operation of the *Gilat* software

All sites 'lock' on to the satellite and stay connected permanently (24 hours a day). This allowed satellite access to the lesson material and to the Internet during and between lessons. The student screen had the following features:

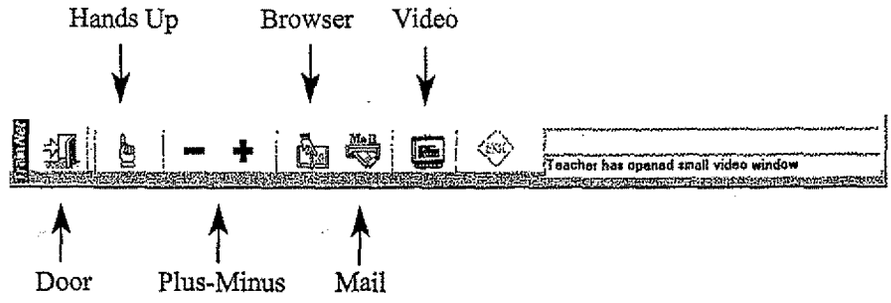
- Video window
- Main Toolbar
- Browser window (including its own Toolbar) / Course map window

The video window

This window is used to provide a video image of the teacher, or it can be used to display other images taken from the document camera or video player.

The main Toolbar

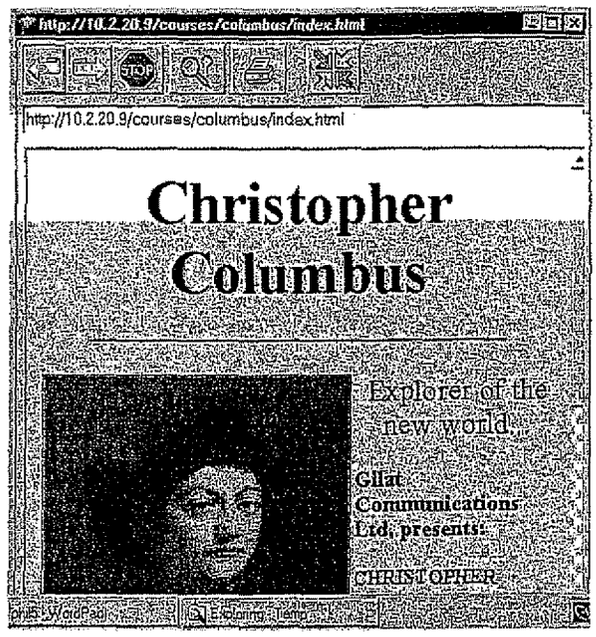
Most of the features to be found on the student screen are controlled via the main Toolbar or Menu Bar, which is located at the top of the screen, and is illustrated below.



Door	by which students gain entry to the lesson (ID and password protected).
Hands Up	to allow the student to ask permission to talk to the teacher and class over the satellite phone, or to write a brief e-mail, which then appeared on the teacher's screen, and which could then be captured and re-broadcast to all of the students.
Plus-Minus	giving students the opportunity to answer YES/NO questions.
Browser	to open the HTML page onto the screen.
Mail	e-mail to the teacher.
Video	to open the video window and control the size of that window.

The Browser

The browser window allows student access to the Internet, controlled by the Tollbar located at the top of the window. This Tollbar allows the student to go backwards as well as forwards between Internet sites, to stop the loading of pages, to get help, to print the current window, or synchronise the screen with that which is currently being used by the class. The students may also uses this window to access HTML pages prepared and displayed for the class at the studio site (through the Course Map).



What support has been provided?

The teachers and departmental support personnel were trained in the use of the technology and a network was established to provide support to all participants in the learning: students, supervisors and teachers.

The HTML materials for use within the lessons were produced, in consultation with the teachers, by staff at the Learning Materials Production Centre at OTEN. The materials were sent directly to the web server in Broken Hill using FTP over *SchoolsNet*. During the period of the *Trial*, some materials have been produced by the teachers at Broken Hill.

Outcomes

At this stage of the evaluation, the report is still to be written, and it is too early to draw any implications and findings. Once the final report has been submitted, it will be used as part of the process to determine if this particular configuration of the satellite technology is the most effective means of providing a high quality distance education program to primary aged students in rural New South Wales.

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