

Interactive distance e-Learning for isolated communities: Starting and finishing the jigsaw

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The audio (on satellite) is a lot clearer than radio and there is vision, being able to see the teacher; [distance education] schoolwork is now like this jigsaw coming together rather than a jigsaw with pieces missing.

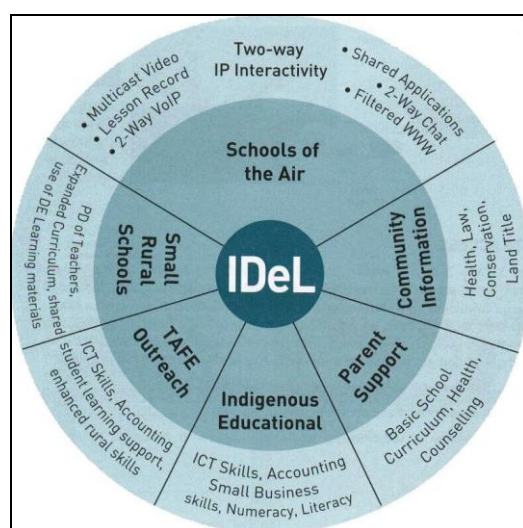
ABSTRACT

This paper provides information on the background to the two pilot investigations into ‘interactive distance e-learning’ [IDeL] following the introduction in New South Wales and in the Northern Territory of Australia of satellite-supported two-way broad-band internet services for school-age and adult distance education. The context is the expansion and reform of educational services to these communities. The IDeL service is provided to ‘School of the Air’ students and parents on isolated stations, remote schools, students and adults in isolated Aboriginal communities, and adults on isolated properties or living in small towns seeking vocational education. The shift to satellite delivery of distance education allows teachers and students to communicate using real-time video, shared computer applications, graphics, audio-conferencing, online chat, and email.

INTRODUCTION

The IDeL service is provided to ‘School of the Air’ [SOTA] students - mostly students and parents on isolated stations, students and adults in isolated Aboriginal communities, and to adults on isolated properties or living in small towns seeking vocational education. While radio is still used to some extent, the shift to satellite delivery of IDeL allows School of the Air teachers and students to communicate using real-time video, shared computer applications, graphics, audio-conferencing, online chat, and email in isolated homesteads, small towns and Aboriginal communities in NSW and the NT.

Figure 1: IDeL Users and Benefits



Source: NCF44 – Interactive Distance eLearning Initiative Annual Report 2002/2003

This presentation will provide information on the background of IDeL, the results of the study, and information about further research investigating more fully the relationships between the new technology, the participants and their educational needs, expectations and practices. The presentation will focus on some key conclusions from the 2 pilot studies

(Boylan & Wallace, 1999; Crump, Touvinen & Simons, 2005) including: significantly improved access to quality of learning and teaching for Elementary students and adult learners in regional and remote sites; the quality and variety of learning and teaching has shown new dimensions unachievable through radio and post; improved quality and reliability of distance education; the motivational effect on students from all age groups, socio-economic status and race; parents and families feel less 'remote', not only for education; parents feel more confident in supporting their child's learning; and access to the World Wide Web allows families to stay closely in touch with government initiatives and changes to policies and curriculum, as well as to explore easily and quickly educational issues and research around the world.

THEORETICAL FRAMEWORK

Extensive research has been conducted into whether new technology adds to, or detracts from, positive outcomes in schooling and for education systems. However, new technologies in Distance Education [DE] have been largely overlooked. One of the earliest critiques asked whether technology was part of the solution or part of the problem. The issues here focused on the politics of technology (Is it independent of social intentions, power and privilege?), technology and economic realities (Is the cost of technology putting teachers out of work?), and social literacy (Does new technology embody a form of thinking based on technique rather than substance?) (Apple, 1987).

Substantial themes throughout the subsequent literature can be summarised as:

Communities play an important role in e-learning because they provide active social communication and interaction;

Digital divides exist within school systems, states and nations, as well as across them;

Cultural, social and economic influences on the classroom need to be considered and understood for effective use of ICT in schooling;

ICT has become a high budget priority for schools, school systems, further and higher education;

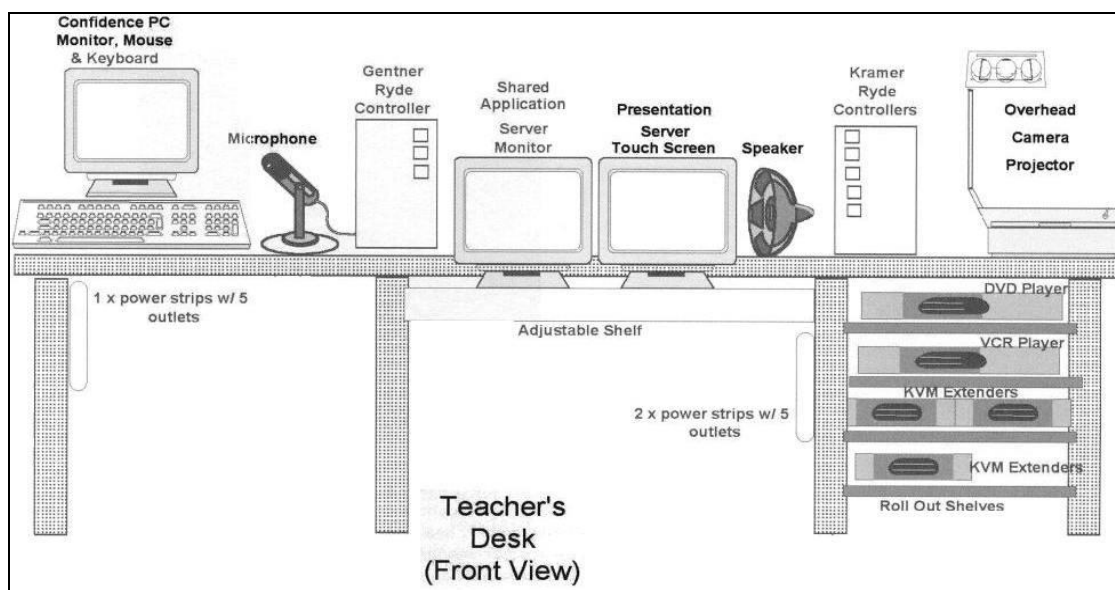
Education policy for ICT is inadequate; and

Almost anyone/any age group can be taught online, with training and support.

Extensive research has been conducted on distance education in Australia, but not so much into the impact of new learning technologies on distance education outcomes, partly given the newness of the phenomena. There is international research, notably in North America, where isolation of individuals and families is similar to that experienced in Australia. However, new technologies and emerging pedagogical practices provide a catalyst for new research. Distance education technologies do not always contextualise the learning experience, resulting in the inappropriate cultural design of learning technologies. Further, McLoughlin (1999) argues that it is essential for the educators to accept the cultural identity, participation style and consumer expectations of the learners. Some research indicates that the level of community involvement in the Distance Learning process is also a critical feature (Searle, Tomaschewski and Godfrey, 2002). Teaching practices in distance education are developing with technological innovation, as Finger and Rotolo (2001) argue, with DE now characterised by new teaching approaches made possible by new communications technologies. The development of the internet is considered as defining the present generation of DE practice, though it is here that too little is known, especially for small school or home-based learning.

The delivery of Distance Education has not only been shaped by profound technological advancement, but also by the evolution of teaching theory. The aim of incorporating new technologies into Distance Education coheres with teaching viewed from the perspective of ‘social constructivism’. According to Boethel and Dimock (1997), both constructivism and technology are receiving increasing attention in current efforts at institutional reform. However, they argue that the elements of constructivist theory, their implications for classroom practice, and the potential for technology to support instruction that is grounded in constructivist principles, are often addressed in general and superficial ways by academic researchers and by policy makers. Goodyear (2000) goes further, arguing that education is one of the last fields to learn the lesson that technology must be designed around a thorough understanding of the needs and ‘working practices’ of its intended users. In the absence of such knowledge of and from intended users, it is not surprising that poorly designed technology (and software) comes to be rejected. That is the problem addressed in this conference presentation.

Figure 2: IDEL Teacher’s Desk – Front View



Source: NCF44 – Interactive Distance eLearning Initiative Annual Report 2002/2003. NT DEET.

The initial NSW Outback Satellite Education program: The Boylan and Wallace study

HISTORICAL ORIGINS

The New South Wales Department of Education and Training has a long tradition of distance education provision extending back to the 1920’s. Starting with print based materials being mailed to students the provision of distance education has embraced a range of innovative additions to the basic print materials including the use of HF and then VHF radio from the 1950’s, the use of audio tapes, the adoption of audiographics for lesson delivery in the 1980’s through to the implementation of video-conferencing delivery systems in the 1990’s as alternate modes of delivery. Underpinning all of these developments has been the belief that all rural, isolated and remote students should be provided with equitable access to education for all students (Aquilina, 1998).

The role of technology is an essential ingredient in the provision of equitable access to educational opportunities for rural and isolated students. Willis (1993) observed that in

many distance education settings, the use of a technology based delivery system is typically the conduit through which information and communication flows.

During the 1990s, the rural and distance education section of the NSW Department of Education and Training (Chadwick, 1991, 1994) realised that there were significant limitations to the provision of high quality education through the radio network that has provided educational services for remote students in New South Wales since 1956. Drawing upon other Australian state education systems' exploration with satellite based technologies notably the Victorian Ministry of Education's interactive satellite television trial (OLTC, 1994) and the Western Australia Education Department's trial of an interactive satellite based system to remote schools in WA (Education Department of Western Australia, 1998), the New South Wales system negotiated with both a satellite provider (*Telstra*) and an educational delivery systems company (*Gilat*) to implement a trial program which was known as the NSW Outback Satellite Education program. The program was based at the *Broken Hill School of The Air*, using one class teacher and the associated existing class of 12 students.

THE NSW OUTBACK SATELLITE EDUCATION SYSTEM

The NSW Outback Satellite Education program has been undertaken with the support of *Telstra*, the largest Australian telecommunications company, 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 synchronous and asynchronous teaching and learning.

The satellite based educational delivery system was designed in Israel by *Gilat* (Ziv-Tal, 1998). The system was developed in conjunction with the Open University in Israel and was based around proprietary hardware and software, which was used to create and broadcast lessons using satellite systems. It has been developed using the proprietary name *LearnNet*, and has been operationalised in Australia by *Telstra* as *SkyConnect Tutor* (see Boylan, Wallace & Richmond, 1999 for a detailed discussion of the system). *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.

The satellite technology was essentially a computer mediated conferencing system in which one-way video, two-way voice and two-way data communications were possible between the teacher and the students. The system thus allowed students to do the following:

- hear the teacher, and also talk to the teacher via a satellite telephone system;
- receive high quality video signals from the *Broken Hill School of the Air*, including visuals of the teacher and other video resources (pre-recorded tape as well as other inputs using video and specialist document cameras located in the studio);
- utilise HTML resources, including in-house pages as well as the Internet, which were available to these students for the first time; and,
- communicate to the teacher using short text answers, email, and on-screen facilities to allow interaction with the teacher as the lesson proceeds.

The implementation of the satellite system to deliver educational experiences for the remote NSW students indicated that there were a number of advantages compared to existing radio lessons that were delivered from *Broken Hill School of The Air*. These include:

- there is no reliance upon existing inadequate telephone communications systems;
- the system offers high quality audio, video and data communications to each student site, irrespective of location or physical circumstance; and,
- the audio quality problems experienced with the current radio systems are overcome, while quality video and data communications are added.

Further it was predicted that the costs of satellite communication were likely to fall as usage levels escalate over the next decade.

THE FOCUS

The overall purpose of trialling the satellite based system was to evaluate the capacity of the NSW Outback Satellite Education program to provide *live, interactive educational experiences* for outback students. This purpose led to the generation of the following key questions:

1. How was teaching and learning influenced by the use of the new technology?
2. How easy is the technology to use?
3. Does the technology serve the educational needs of remote and isolated students in outback New South Wales?

THE FINDINGS

Data Sources

In the NSW Outback Satellite Education program, pre and post questionnaires, weekly journals and logbooks, interviews and observational records were used to gather data. 3 teachers, 12 students and 11 home supervisors were the principal participants. Additionally, 16 professional support staff located in distance education sections of the NSW Department of Education and Training, 6 Telstra staff and 5 TAFE teachers were involved in a range of support services for the program. The program operated for one school term. Site visits to *Broken Hill School of The Air* occurred on 3 occasions, each homestead (11) was visited and attendance at one mini-school were primary sources for data collection. Due to the small numbers of participants, descriptive results were the main type of data generated.

RESULTS

1. Reactions to the system

This analysis began by examining responses from the professional staff and home supervisors to two broad questions about the essential features of a good distance education. The responses to each question were remarkably similar for the groups.

The first of the broad questions asked respondents *What are the essential features of good distance education?* The largest number (29 responses or 42.7% of the sample) spoke about the learning process, using phrases such as *being able to get teaching concepts across in a better more positive manner; accessing high quality and appropriate learning materials; creating a fun learning environment, and being engaged in hands on learning;* and using *explicitly communicated outcomes*. The next largest group (22 responses or 32.4% of the sample) identified good interaction as an essential feature. This group of

comments included responses such as *good distance education requires a high and constant level of communication*; or *it requires rapport and interaction between the three parties involved*; or *good contact with class teacher - verbal and visual*. It would appear that there was indeed a sense that the technology provided an environment which supported teaching and learning, and effective classroom interaction.

The second general question extended these issues further as it asked *What are the essential features of a successful satellite lesson?* A majority of the respondents returned to the learning process as the most important feature (59 responses or 57.1% of the sample). Their responses included: *There needs to be regular and varied methods employed to cater for different learning styles*; and there need to be *opportunities for independent learning and discovery after the lesson*. Further, the students need to have *learnt something, or enjoyed the lesson*. This might be achieved through *good visual stimulus or examples of expected work*. The next group (25 responses - 25.5% of the sample) were concerned with the need for good interaction in a lesson. Examples of written comments here included: *there needs to be opportunities for interactivity between students, between teacher and students*; *all children being involved in lessons*; and *the child needs to have some input through talking*. It is thus significant that the quality of the interaction taking place was of prime concern, and that students be engaged in quality interactions with each other, and with the teacher through the learning materials presented.

Home supervisors and the professional staff were asked at the conclusion of the NSW Outback Satellite Education program if the form of delivery promoted a positive learning environment. The results of Likert scale items for these participants are presented in the pie graph below. A total of 95% of the respondents believed that a positive student-teacher learning environment was promoted by the use of the system.

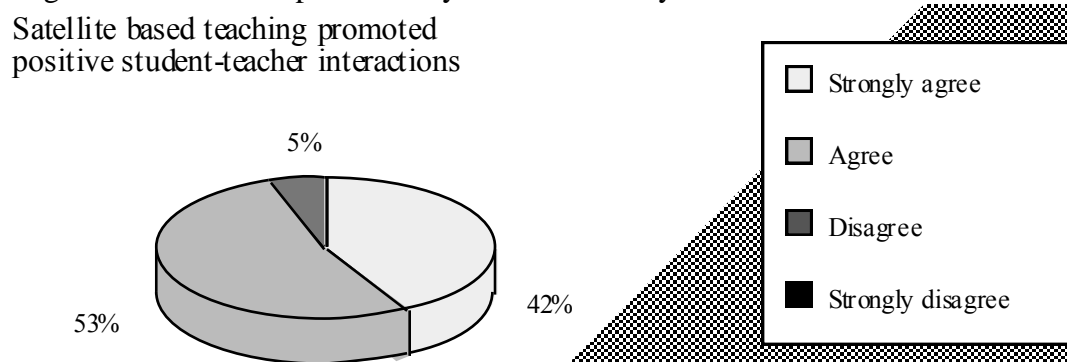


Figure 3: Positive student-teacher interactions

The nature of the learning environment was investigated as part of the final questionnaire. Respondents were asked to reflect upon the extent to which *the satellite technology created a learning environment that was more open and comfortable than was previously possible*. Responses were divided on the issue, as a number of respondents felt that the radio lessons were also successful in promoting such a learning environment. The variation in responses is illustrated by the pie graph below.

While the majority of respondents did find the learning environment which was made possible was open and comfortable, a significant minority (22%) were not convinced that the technology was better than that which was available through radio technologies.

The satellite technology created a learning environment that was more open and comfortable than was previously possible

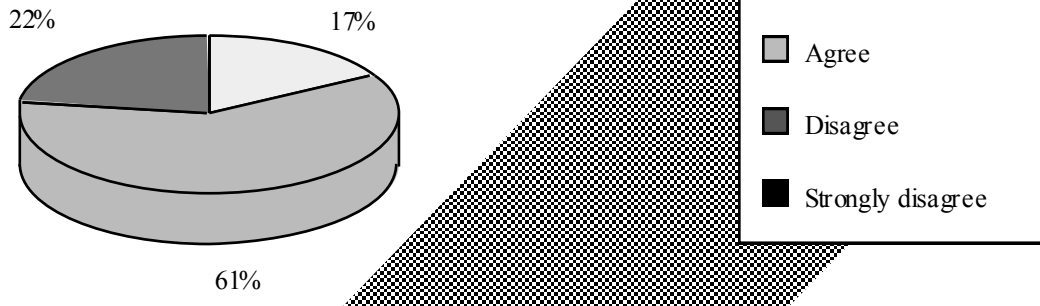


Figure 4: Impact of the technology on the learning environment

Students reactions to the learning

The views of the students were also canvassed at the conclusion to the NSW Outback Satellite Education program with nine students participating.

One question asked to the students was: *Did you learn more with the satellite lessons?* All nine students responded affirmatively to this statement. When asked to explain why, their reasons focused on two areas. Firstly, the students spoke about pedagogical matters, focussing on their improved understanding of lesson content, with comments such as:

the teacher explained it more, I could think more, and it could be put up on screen. because [teacher name] could show us things on the screen and he could tell us alot [sic] more.

Instead of telling you on the radio they actually show you.

The second area dealt with the use of the Internet as a learning resource, eg. *I could find information easily by myself on the Internet, and you get to learn about the Internet and computers.*

Reactions of the home supervisors

Issues related to the role of the home supervisor were explored in the final questionnaire, and are presented in the pie-charts below. The first was concerned with the extent to which the home supervisor was more or less engaged in working with the student during the program. Responses to this question varied between the two groups, with 67% of the professionals, but only 38% of the home supervisors believing that their role had been reduced. This disparity may reflect the extra demands placed upon home supervisors early on which may not have been fully appreciated by the professional group.

The demands upon the home supervisor were reduced with the introduction of satellite lessons.

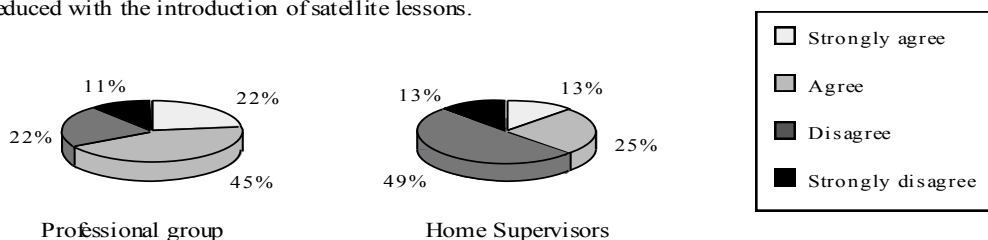


Figure 5: Demands made upon home supervisors

Home supervisors were asked specifically about the impact of the satellite technology with regard to their role in the longer term. Despite the comments just reported, all home supervisors believed that they would need to spend less time with their students in the long-term, as the initial problems with the set-up of the system dissipated, and as satellite lessons became part of the distance learning environment.

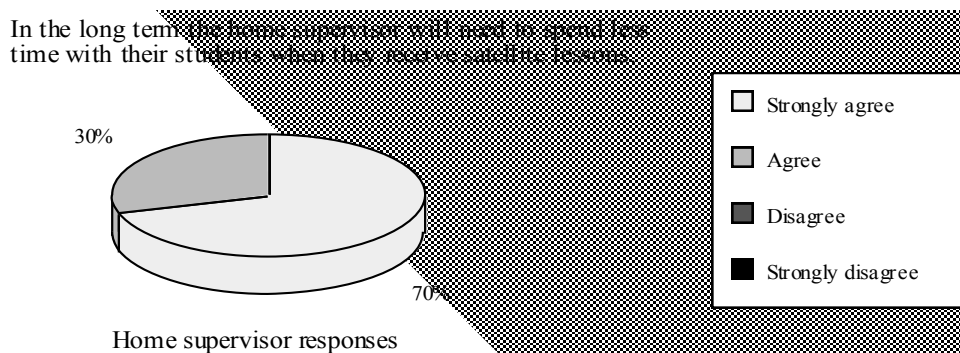


Figure 6: Long term demands on home supervisors

2. Classroom interaction analyses

For a three-week period during the NSW Outback Satellite Education program, the every lesson analysed to identify the nature of the interactions occurring. These daily lessons varied in duration from 30 minutes to 60 minutes, with an average of 45 minutes.

Drawing on Henri and Parer (1993) expansion of Moore's (1989) ideas, a theoretical framework was further refined by Oliver and McLoughlin (1997b) that was specifically designed for application in Computer Mediated Conferencing (CMC) environments. This framework was employed in this study. This interaction framework consisted of two dimensions, these being:

- a) the direction of interaction; and,
- b) the type of interaction that occurred during a lesson.

a) The direction of interaction

This dimension focused on the originator and recipient of the interaction. This was done to explore the extent to which the lessons were teacher or student centred. In the following Table 1 the overall direction of interactions during the lessons are reported.

Table 1: Direction of lesson interactions

Direction of interaction	Total number of interactions	Percentage of total interactions	Average interactions in each lesson
Total Teacher initiated	1459	92.3	112.3
Teacher ->class	785	49.7	60.5
-> student	674	42.6	51.8
Total Student initiated	122	7.7	9.3
Student -> teacher	98	6.2	7.5
-> student	6	0.4	0.5
-> class	17	1.1	1.3
Total	1581	100	121.6

The following generalisations regarding the direction of lesson interactions can be made:

- there was considerable interaction occurring within each lesson;
- most of the interactions that occur were initiated by the teacher (92.3%); and,
- few student initiated interactions were recorded (7.7%).

From the students' viewpoint:

- approximately half of all lesson interactions involved the teacher initiating whole class interactions (49.7%);
- about 2 in 5 of the teacher initiated interactions were directed to individual students (42.6%); and,
- only 7.7% of the interactions originated from the students. Most of these concerned student interaction with the teacher (6.2%) rather than with the class (1.1%) or an individual class member (0.4%).

The majority of the interactions documented in these lessons were teacher centred. These interactions were not just a reflection of the nature of the communication possible with the technology, but also of the impression held by the teacher that he should direct and be in control of the lessons, due mainly to his perceptions of the expectations of the large external audience viewing these classes from the Window sites across the state.

Comparisons with interaction research based on face to face elementary classrooms were favourable. As indicated in the review of the literature, Susskind (1969) reported that 97.67 percent of face to face elementary classroom interactions were teacher initiated (compared to 92.3%) while only 2.33 percent were student initiated (compared with 7.7%).

b) The type of interaction

The second dimension used for lesson analyses on the nature of interactions within the virtual classroom concerned with the intellectual context of these interactions. This dimension focused the substantive content of the dialogue that occurred between the teacher and the student(s). There were five categories of lesson interactions used to examine the quality of the interactions occurring (Oliver & McLoughlin, 1997b). These categories were:

- social interactions – where talk served to establish and develop rapport within the class;
- procedural interactions - involving information exchange on lesson requirements and procedural instructions;
- narrative or expository interactions – dealing with either the general ‘teacher talk’ associated with introducing new concepts, skills or ideas into the discussion, or the student or, in a few cases, the teacher, demonstrating knowledge or skill in response to direct request, normally from the teacher.;
- explanatory interactions – occurring when the teacher seeks student responses to explain knowledge and develop content during a lesson; and,

- cognitive interactions - dealing with interactions in which the teacher provided constructive feedback to a student's response causing the student and the class to reflect and to consider an alternate perspective/reality.

The lessons were analysed using the five categories discussed as a framework. The results of the lesson analyses are reported in Table 2.

Table 2: The types of lesson interactions

Types of interaction	Total number of interactions	Percentage of total interactions	Average interactions in each lesson
Social	296	18.7	22.8
Procedural	513	32.5	39.5
Narrative / Expository	617	39.0	47.5
Explanatory	132	8.3	10.2
Cognitive	23	1.5	1.8
Total	1581	100.0	-

From Table 2, the following conclusions about the type of lesson interactions can be made:

- narrative and expository interactions were the single largest type of interaction (39.0%);
- approximately one-third of all interactions were procedural interactions, dealing with routine class management issues (eg. the use of appropriate data communication buttons within the system), and organisational matters (eg. the assignment of lesson follow up work) (32.5%); and,
- about one in six lesson interactions were social interactions (eg. greetings at the beginning of the lesson, or a farewell at the end of a lesson) (18.7%).


It thus appears that the lessons were very teacher centred, with narrative and expository dominating over cognitive interactions. These findings would seem to support the evidence provided in the literature (eg. Barker, 1991; McHenry and Bozik, 1995; Education Department of Western Australia, 1998). Further, the findings revealed a low level of student initiated interactions that are generally supported in the literature (eg Dillon, 1988; McHenry & Bozik, 1995; Oliver McLoughlin, 1997b; Susskind, 1969).

3. Ease of operation

The ease with which students engaged with the learning tools present in the system changed over duration of the program. Table 3 below provides a summary of patterns of usage as reported in the *Daily Diaries* kept by the students. These indicate usage patterns and problems based on daily reported data.

Table 3: Daily Diary data on the uses of the system in the lessons (presented as a percentage of total responses for each week)

	I used the <i>Plus/Minus</i> button	I used the <i>Hands-Up</i> button	I used email today	I spoke to the teacher today	I had no problems hearing other students	I liked the lesson today	I found the system easy to use today
Week 2	100.0	100.0	24.0	40.0	80.0	100.0	98.0
Week 3	97.7	100.0	41.9	51.2	88.4	95.3	97.7
Week 4	96.4	100.0	20.0	56.4	98.2	100.0	100.0
Week 5	82.5	100.0	40.4	57.9	100.0	100.0	98.2
Week 6	80.4	100.0	21.6	62.7	98.0	98.0	96.1
Wk 2 - 6	91.0	100.0	29.3	53.9	93.4	98.8	98.0



The following trends were evident from an examination of Table 3.

- The *Hands-Up* button was used by all students in every lesson as the major means to communicate with the teacher;
- Usage of the *Plus/Minus* button declined throughout the period of the NSW Outback Satellite Education program. These buttons were largely used for procedural matters as indicated by the clarificatory comments above, and declined as the NSW Outback Satellite Education program proceeded, and as the lessons became more student centred;
- Email usage tended to vary over the passage of the NSW Outback Satellite Education program. A partial explanation for this variability involved some confusion concerning the use of the typed response option included within the *Hands-Up* button used synchronously during the lesson, and the separate email facility that permitted asynchronous communication within the learning environment;
- A significant finding was that the number of students who spoke over the telephone system to the teacher rose as the weeks passed. This has probably occurred as the teacher became more aware of strategies which might be used to enhance student participation in the lesson. Thus the opportunities for students to speak rose from an average of twice per week per student at the beginning to three times per week per student at the completion of the NSW Outback Satellite Education program; and,
- Students developed their facility with the features of the system quickly, and satisfaction levels remained high.

4. Teaching and learning outcomes

From the variety of data sources collected over the duration of the program, a number of important teaching and learning outcomes directly associated with the program were identified. These are listed in point form below:

Participants identified the following educational advantages in the interactive lessons made possible by the technology:

- improved quality of the audio signal compared to the radio systems;
- the addition of the video screen allowing students to see their teacher and other studio presentations;
- students had access to the Internet for the first time;
- improved learning outcomes were reported by teachers, students, and home supervisors;
- the creation of a whole class identity; and,
- the positive impact of the lessons on student motivation and engagement in learning.

The *SkyConnect™ Tutor* software provided the teaching and learning tools which created greater levels of interaction than might have been anticipated. This resulted from the following attributes of the system:

- the visual display features including the teacher video, HTML pages, and video signal from the document camera. All these features were used to enhance teaching and learning;
- students had improved access to resources outside of class time for research (e.g. Internet and Course Map information, as well as email with the teacher and with other students);
- the ability to screen capture and display student work for all other students and home supervisors to see. This enhanced motivation for students, and was an important support of the home supervisors;
- as the NSW Outback Satellite Education program proceeded, the teacher talked to an increasing number of students during each lesson, using the satellite phone. Further, the teaching tools (eg. *hands-up* button, email) available within the software did enhance interaction within the classroom, though the lack of interaction between the students themselves was a major concern;
- the teachers employed a more diverse range of teaching strategies;
- home supervisors and teachers recognised the improved methods of evaluating student understanding of concepts, and their level of performance though the satellite system; and,
- staff at the LMPC and at Broken Hill were able to develop HTML pages which enhanced teaching and learning. Expertise in the development of these resources grew during the NSW Outback Satellite Education program.

All participants described the NSW Outback Satellite Education program as a success, being superior to existing radio systems.

However, some concerns remained. These were:

- lesson planning and preparation practices were more demanding for a satellite lesson, especially in the early stages of the NSW Outback Satellite Education program;
- lesson interaction analyses revealed there was considerable interaction occurring within each lesson. However, most interactions were teacher initiated, and few student initiated interactions were recorded; and,

- though there were several problems with the technology, these were largely overcome and the system proved to be robust and reliable. Problems included audio and telephone transmission, those associated with log on, and the operation of some of the functions incorporated within the technology.

Limitations within the system

The teaching and learning tools offered through this technology provided significant improvements when compared with existing delivery systems (print, audiotape and VHF radio). However, there were a number of recommended changes to the system, which included:

- the need for an audio conference function to facilitate greater interaction within the group, particularly between student and student;
- the inclusion of an interactive electronic whiteboard;
- a variety of enhancements to the teacher system to facilitate superior access to email systems, teaching learning resources, and to streamline on-air interactions;
- the studio should be larger and include auto-prompt equipment to prevent the current conflict between the need to watch the teacher computer screen, and at the same time, look into the camera. A good quality high resolution document camera is also needed; and,
- the student site might be enhanced by improved browser and email facilities, improved window controls, and an appropriate hands-free telephone.

All participants recognised the need for a comprehensive training and development program to support the use of the technology. Such programs should include:

- a program delivered by a teacher with expertise and experience with the technology;
- the creation of a support network for new teachers as they begin to use the technology, composed of professional mentors, other practising distance education teachers, and materials development personnel;
- a program which incorporates a break early in the implementation of satellite technologies would seem essential for teachers, and also for materials developers, to allow reflection and planning for the next period of teaching and learning;
- the development of multi-media and web-based skills for the integrated learning resources which were available through the technology.

THE CONCLUSIONS AND RECOMMENDATIONS

Returning the overall focus of the NSW Outback Satellite Education program, the findings from the evaluation of the program clearly supported the innovation as being an effective and rich learning resource for remote and isolated students.

The lessons were *live* in ways that were not possible with the radio system. They were daily and synchronous.

The lessons were *interactive*. The analyses of the 3 week block of lessons taught to the class of 12 students revealed the high frequency of interactions between the teacher and the students as well the varied nature of interaction and the varying degrees of intellectual demands associated with these interactions. As noted above there were some limitations within the software platform that restricted the range of interactions possible – especially student to teacher and student to student.

The lessons were an *educational experience*. All Home supervisors, students and professional staff recognised the significant improvement in quality and quantity of learning experiences that occurred during the program.

The educational ‘FIRSTS’ from the NSW Outback Satellite Education program

Through the trialling of the satellite delivery system, a number of educational firsts for the NSW department of Education and Training occurred. These included:

- Remote students seeing their teacher live during their class time;
- Students received sustained teaching from their teacher;
- Students believed that their learning was being facilitated and guided by their teacher;
- Students had access to the internet as a regular part of their learning; and
- Students saw photos of each other class member for the first time and were able to link the voice to the photo of their class members.

From the teacher perspective, a number of important educational first were identified:

- Teachers believed that there was a sustained focus on lesson content
- Teachers valued the ability to provide immediate feedback to their students;
- Teachers were able to diagnose learning difficulties with content as they happened;
- Teachers and home supervisors asserted that the lesson delivery provided a quality learning experience for the students.

Based on the successful implementation and evaluation on the New South Wales Outback Satellite education program, the NSW Department of Education and Training commenced a three year journey that sought to convince both state and federal governments of the educational value associated with adopting a satellite based delivery system for remote and isolated students. The culmination to the journey saw a joint NSW and NT submission to the Australian federal government for significant funding to establish a new approach to educational provision in outback Australia that replaced the radio network with a modern efficient and effective delivery system. The outcome of this new system is *IDeL system* that Stephen Crump discusses in the next section of this paper.

CRUMP, TUOVINEN AND SIMONS STUDY

DATA SOURCES

Towards the end of 2004, surveys were drawn up for seven groups (small by definition):

‘School of the Air’ teachers, Elementary students and parents (N = 265);

Adult education students and teachers (N = 16);

Remote teachers (N = 13); and

Education delivery facilitators (N = 13).

Site visits were made in 2004 and 2005 to regional and remote communities at Dubbo, Broken Hill, Alice Springs, Port Macquarie and Katherine to collect documentation on the implementation and development of *IDeL*, interview the school leadership, view the studios, sit in on school and adult education lessons (including the last of the radio lessons at Katherine), and participate in a school staff meeting. A representative sample of views, from all the main current user groups, collected by survey, interview, site visits, school and departmental documentation, was analysed. There are multiple

findings for each group that provide detailed information on each item, for each question, of every survey group, that forms the basis of the presentation.

Figure 7: IDeL Technology & Data Flow Chart



Source: NTOEC LearnScope IDeL Project Presentation: Marcia Harvey (Project Manager) & Megan Spiers (Project Facilitator).

The data analysis was designed to provide a description of the participants' perspectives in specific categories and at particular levels of responses. This data was compared to explore relevant group differences and similarities, positive or negative, to enable some elementary inferences regarding current practices and program development. The data set includes individual question frequencies for each group surveyed, T-test and cross tabulations that highlight significant differences as well as similarities for the larger groups (where statistical analysis was meaningful), supported and extended by qualitative and documentary data including written comments from the survey groups.

Qualitative data was grouped into themes and patterns for interpretational analysis to test against the quantitative data, and to partially triangulate with the site visit and documentary evidence included in this presentation.

RESULTS

The data from the pilot project is instructive in relation to the operations and policy footprint discernible for the IDeL. It opened our eyes to the changes taking place, and to some of what is being lost in the abandonment of radio and, to a lesser extent, telephone, print and post. The key findings are based on the questions common across all the survey groups as well as significant results for particular questions from each group and have been grouped under themes. Not all areas will be covered in this presentation, but can be found at <http://www.newcastle.edu.au/locations/central-coast/about/pvc-profile.html>

Theme One Acceptance of IDeL

- How students accepted IDeL
- How teaching and learning compares to previous experience using radio

Theme Two Learning and Teaching with IDeL

- How well students, teachers and parents use IDeL equipment and software
- How hard students felt it was to learn to use the IDeL system
- How well, or not, students and teachers, parents thought learning was occurring using IDeL
- What assisted learning using the IDeL system
- How well students, teachers and parents were trained to use IDeL
- How well students, teachers and parents were supported in using IDeL
- How teachers and parents rated the reliability of the IDeL system
- What impact IDeL had on each group: students, teachers, parents and facilitators

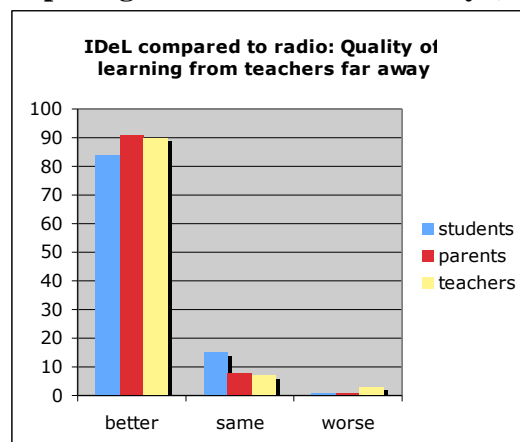
Theme Three Challenges and improvements for IDeL

- Student, teacher and parent concerns with IDeL
- Student, teacher and parent suggestions to improve IDeL

Students showed a very high level of acceptance of IDeL. Question 10 asked them to complete this sentence - ‘I like using IDeL because...’. Nearly every student response started with a comment on liking IDeL because they are able to *see* their teachers. The first survey analysed contained the following comment, which is a fair summation of the views of the majority of students in praise of IDeL.

One student wrote: *‘I can see my teachers and their reactions to my answers. It makes it easier to see Science experiments, art lessons and brainstorming ideas. It’s really hard to do this on radio’*. Students, teachers and parents were then asked to compare radio and satellite delivery with respect to three categories: for teachers who are far away, students who are far away, and lessons from far away.

Figure 8: Comparing satellite to radio delivery (from teachers)



Teacher using radio at Katherine SOTA



Source: Author (SJC) photo April 2005

Figure 9: Comparing satellite to radio delivery (from other students)

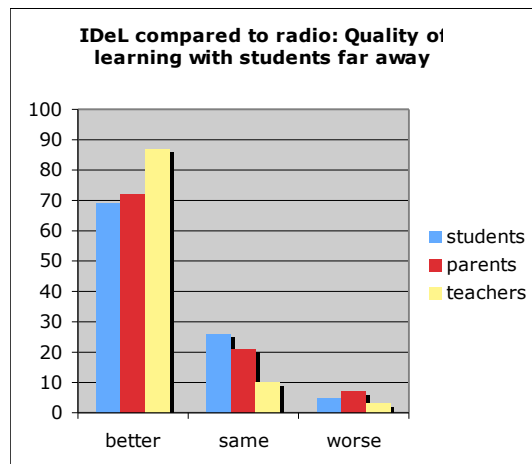
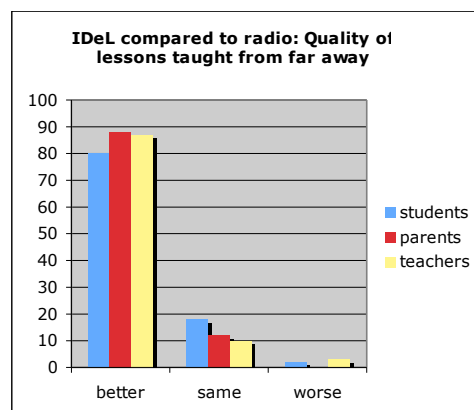


Figure 10: Comparing satellite to radio delivery (lessons taught from far away)



Parent Comparisons between Radio and Satellite delivery.

“I grew up on SOTA in the ‘70s and this new system is something I though I’d never see happen. The minor audio problems we are having is nothing compared to the problems we had on radio.” [P466]

“We always had problems with radio reception and transmission, so IDeL is more reliable and more fun.” [P412]

“The new system is so far ahead of radio is can't be compared. Apart from teething problems, the system is magic.” [P457]

Figure 11: Ability to use the IDeL equipment

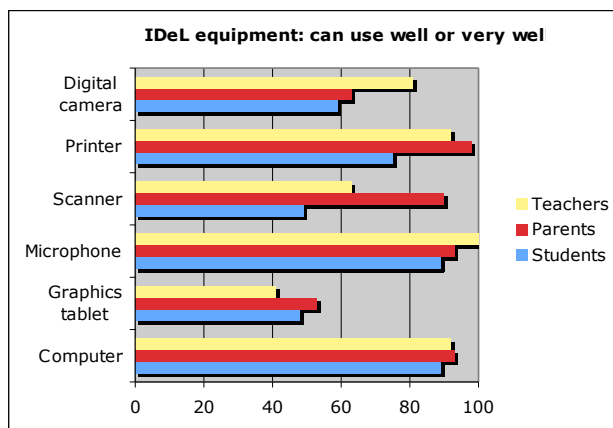


Figure 12: Ability to use the IDeL software

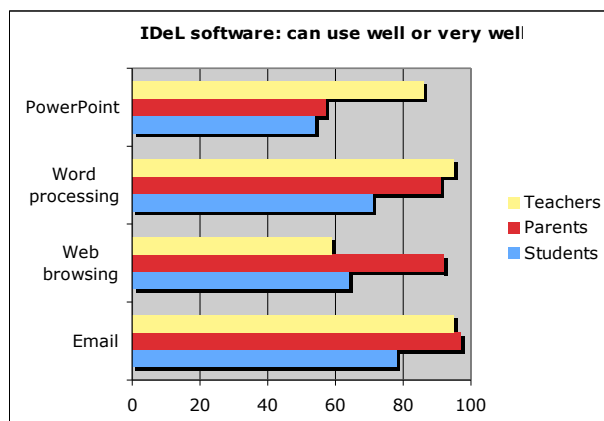


Figure 13: Students' difficulty in learning to use IDeL

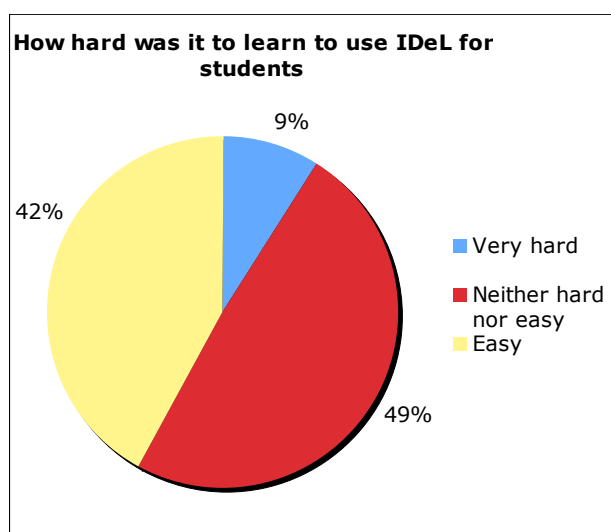
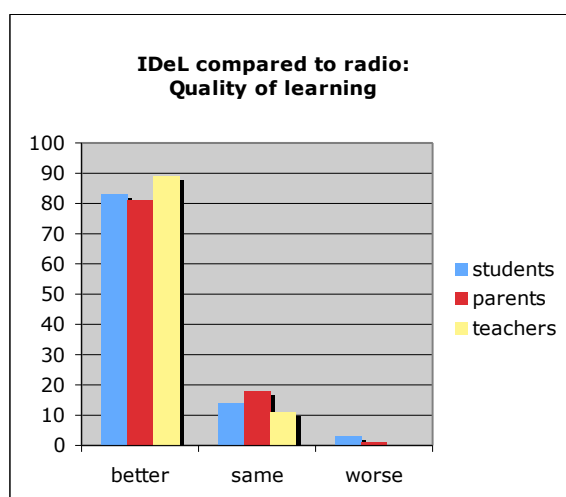


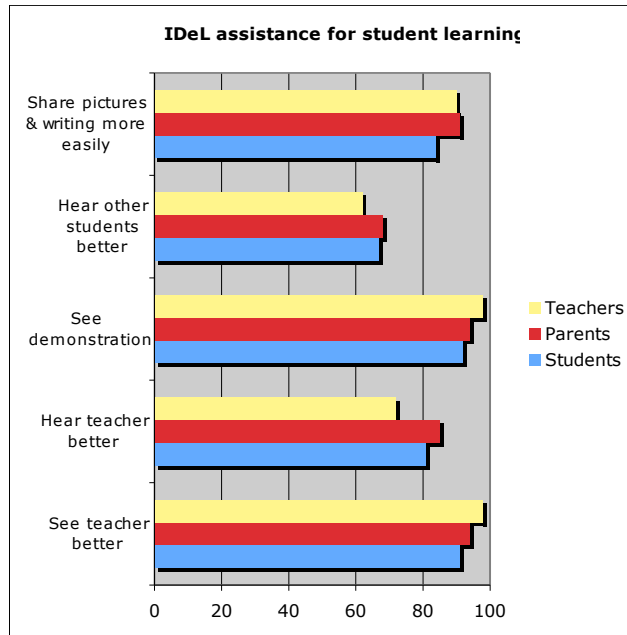
Figure 14: How 'well' learning with IDeL compared to previous lessons.



In terms of how well these teachers' students are learning with IDeL compared to previous lessons, none of the teachers indicated their students were learning 'worse' with IDeL than previously. There was no difference in how well the children are learning with IDeL as compared to before in the NT and NSW. This is one of the key findings from the teachers' survey, as it suggests teachers have a very good idea of how well the students are learning and in all of the cases the IDeL system is either better or the same than previous modes of delivery.

The broad range of new factors influencing teaching and learning in the IDeL system included vision, sound, modelling, sharing work, sharing ideas, and so on, in a very immediate way. **All participants** felt strongly that these new factors assisted student learning greatly (Figure 15).

Figure 15: What assists students to learn in IDeL?

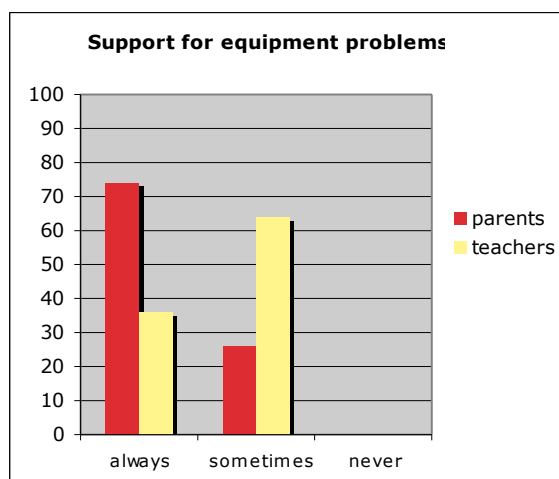


Confirming the above results, SOTA **students** were asked, in Questions 16, “Which of the following help you to learn?” The results are:

- 95% - Picture and sound
- 93% - The Internet
- 87% - Written materials
- 79% - Phone calls from teachers
- 86% - Visits from teachers

Also of interest was how well the students, parents and teachers felt they had been supported using IDeL system, and how reliable it was. In addition to being well-trained to effectively use the hardware and software provided through the IDeL innovation, participant perceptions about the reliability of the system are crucial to understanding the extent to which the IDeL system is rigorous and has long-term benefits and options for expansion. Support for the new technology and reliability of the system were reported to be acceptable, especially for an innovation within the first two years of operation.

Figure 16: Can you get help quickly for equipment problems?



As far as IDeL delivery influencing student learning positively, 39% of **teachers** felt it went ‘beyond expectations’, 54% felt it achieved ‘as well as was expected’, and 7% felt that it ‘partly’ achieved their expectations. The extent to which the intended learning outcomes were reached went ‘beyond expectations’ for 28% of teachers. The change to IDeL was thought to be educationally appropriate by 80% of teachers, while 21% thought it was only partly appropriate. Learning produced via the IDeL system was ‘definitely’ transferable to other contexts according to 66% of teachers, 23% thought it was ‘only partly’ transferable and 9% thought it was ‘not at all’ transferable.

The benefits of moving to IDeL delivery were ‘definitely’ worth the investment costs to 69% of teachers, with 23% believing that IDeL was ‘only partly’ worth the costs, and 9% reporting that IDeL was ‘not at all’ worth the costs. Nearly all (98%) of teachers agreed that they had been willing to try new methods and content with IDeL, while the remaining 2% neither agreed nor disagreed with this proposition. Three quarters (75%) of the teachers agreed that the technology had promoted pedagogical risk taking, while 22% neither agreed nor disagreed and 3% disagreed.

Of the teachers surveyed, 65% felt they had to change their teaching practice developed for previous distance education practice, while 27% neither disagreed nor agreed and 9% disagreed with this. The vast majority (95%) of teachers agreed that they enjoyed teaching via IDeL, while 5% neither agreed nor disagreed with this sentiment. This is an important finding, as it indicates teacher satisfaction with the extra capability the IDeL system provides for teachers to achieve their professional goals.

One topic of discussion for **parents** during site visits was the extent to which IDeL had improved or weakened the relationship between home and the school. In many cases, it was felt that IDeL had made a dramatic improvement to the medium, style and quality of communications, with school assemblies, P&C meetings, expert and celebrity visitors, and some public events brought to life over IDeL. In some cases, there was a sense that aspects of the school’s community life had been lost, such as all singing together over radio, and in some cases radio lessons have been continued for this purpose, especially for younger students.

However, the introduction of IDeL was accompanied by the re-arrangement of many aspects of the students’ learning, so that things once only possible during residential school can now be done online, and things once done over radio, like choir, have been shifted to when the students are all together for mini-school, camps and sport events.

Students enjoying the warmth of the morning fire on a SOTA Mini-School



Source: <http://www.schoolair-p.schools.nsw.edu.au/sotaupdatedsite/Frames/index.htm>

The IDeL appears to work towards creating more intimate learning relationships, largely through the addition of vision, but also through the immediacy of the educational exchanges between teachers and students. Audio quality has been vastly enhanced, enabling richer and more broadly shared interactions, and this interactivity is a strong foundation for higher order learning interactions achieved through satellite delivery. For isolated learners, the essence of the change being brought about by the technology is the addition of visual modality, fast (and in some cases initial) access to the resources of the internet, and the opportunity to direct some of their own learning.

GENERAL FINDINGS

This project explored the extent and effectiveness of the implementation of the Interactive Distance eLearning innovation in NSW and the NT during the implementation phase. What follows are some conclusions, qualified by the limitations on the ability to access and reach so many provider and user groups across vast areas of NSW and the NT.

- The IDeL innovation has significantly improved access to quality of learning and teaching for Elementary students and adult learners in regional and remote sites.
- The quality and variety of learning and teaching has shown new dimensions unachievable through radio and post.
- More Elementary students, from a broader social and cultural base, appear to be participating more often in their lessons because of the improved quality and reliability of distance education.
- IDeL has had a huge motivational effect on students from all age groups, socio-economic status and race.
- IDeL is redefining what is meant by ‘distance education’.
- Parents and families feel less ‘remote’, not only for education.
- Parents feel more confident in supporting their child’s learning.
- Parents highly value being able to access adult education courses from home to improve IDeL skills as well as gain qualifications for work and career development, enhancing the skills base in rural communities.
- Remote school teachers feel less remote from their Distance Education colleagues.
- Parent use of IDeL has allowed Parent and Teacher groups, and other meetings, to be interactive and multi-faceted compared to radio.
- Access to the World Wide Web allows families to stay closely in touch with government initiatives and changes to policies and curriculum, as well as to explore easily and quickly educational issues and research around the world.

SYNTHESISING SOME FINDINGS FROM BOTH STUDIES.

Through both sets of data spanning 8 years, there are a number of emergent themes that resonant from the data. In particular, we highlight the following outcomes:

- Students quality of learning has been enhanced via the implementation of satellite based systems;
- Home supervisors believed that there are significant learning outcome benefits associated with the satellite based system that were not possible other forms of distance education;
- Teachers valued the greater levels of interaction with their students present with the system(s);

- Teachers were able to design learning experiences more suited to their students needs;
- Students and Home supervisors had access to the internet in ways that did not exist before and valued the learning opportunities it provided.

As the project has expanded into other sites and to different groups (for example, TAFE classes in NSW, and now trials for secondary level students), a number of options are appearing. The introduction of return video / vision is something argued for by many teachers so that they can see the student and how well the student is engaged and actually doing their work. This is especially important for special education and remedial situations. Overall, however, most of the early findings continue to be the key outcomes.

REFLECTIONS

The last decade has seen a rapid growth in the scientific study of socio-technical systems – in education and elsewhere – but most of this work has been carried out in urban and industrial settings. This research focuses on socio-technical systems distributed across vast spaces and remote communities. The research hopes to contribute to scientific understanding of the experience of new communications technologies in remote communities, and the ways in which working practices evolved by people in those communities may benefit teaching and learning more generally.

Different forms of representing innovative working practices and accounts of participants' experiences include different combinations of video, audio, textual and statistical data. It is important to note that such representations have the potential to confront and destabilise existing conceptions of what the organization needs to know, and to reveal internal tensions whose resolution can lead to progress and sustainable innovation (Argyris, 1999; Blackler, 1993; 1997; McElroy, 2002; Wenger, 2000).

Based on the breadth and depth of data from both the initial trial and the IDeL study - looking at what people do with delivery system – we suspect that it is fundamentally 'multiple'; that is, that there are multiple realities and numerous specific practices surrounding the implementation and expansion of IDeL. Put another way, the opportunity is there to study the practices which are brought into being, sustained, or allowed to wither away in the common, day-to-day, socio-technical context of IDeL (see Mol, 2002, for an example in medical practice). As Mol notes for hospitals, although there is no underlying singularity, the complexity seems to hang together somehow, despite the tensions and fragmentations.

We recognise that not all that happens within ICT and e-learning is educative (see Crump, 1999). A focus on changing learner needs and experiences helps to map ways in which learning is different (or not) to how it occurred under radio/paper technology. It also facilitates an exploration of what this means for the learners, and for the appropriateness of the learning experiences within which they are being asked to engage, or generating for themselves, given the breadth of scope available through the use of ICT that has been revealed in our pilot studies.

Note: The views expressed in this paper are our own.

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