INCREASING INTERACTIVE ACTIVITY - USING TECHNOLOGY TO ENHANCE INTERACTION BETWEEN TEACHERS, STUDENTS AND LEARNING MATERIAL

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INTRODUCTION

This article provides background information from a multi-media 'show and tell' presentation at the Ballarat conference. This presentation was aimed (1) at providing a general overview of some aspects of the NTSCS which hitherto you probably would not know, from which you can draw your own comparisons and conclusions, and (2) to whet your appetite about a few projects into which you may wish to delve.

A central theme of the presentation was that effective pedagogy requires us to treat technology as a wonderful tool to extend rather than replace competent teachers. An underlying concern was how to reconcile dramatic progress for some while other students fall further behind in technological access.

SETTING THE SCENE

The Northern Territory Secondary Correspondence School (NTSCS) was established fifteen years ago. In its early years the small number of NTSCS clientele tended to be an extension of the primary based Schools Of The Air; that is, students on pastoral properties and other remote locations such as construction camps and police stations. In recent years the clientele has extended to approximately 650 clients and now includes full-time school-age students who are : NT geographically isolated, medically isolated, socially isolated, and expatriate Territorians currently overseas. The school has a few full-time mature-age students. There is a significant number of part-time students : NT school-age and mature-age, plus expatriate Territorians currently overseas. Part-time enrolments have also been increasing through dual enrolments via NT urban and rural schools plus some interstate schools.

Considerable support is usually necessary for school-age distance education students to have a realistic opportunity to succeed. The NTSCS does conduct 'residential' and 'mini' schools on campus and/or at regional centres, undertakes a program of planned and emergency home visits to most students (though I have yet to convince the powers-that-be that I should visit our students in Fiji), encourages students to visit the school, and has staff providing a counselling and field-tutoring role. These personal interactions are extended and improved by a range of communication technologies.

NTSCS INTERACTIVE-TECHNOLOGY OVERVIEW

Print-based student materials use one of the oldest technologies and will, in the foreseeable future, remain central to the educational programs offered by the NTSCS. They are relatively cost effective to prepare and reproduce, they are robust and usually survive the various and often incredible hazards of delivery. They are accessible by clients who do not have technologies such as electricity and telephones, they provide a reliable fall-back when other technologies fail, and

they provide an appropriate media for many educational activities. Printed student materials can and should take advantage of current technologies, especially desk-top publishing and electronic transfer.

Improved technologies in recent years have enabled our teachers and most of our students to communicate and interact more effectively. High Frequency radio is used by the schools of the air for daily lessons, but the NTSCS subject and client range is more diverse and thus H-F radio is mainly used as a substitute for telephone tutorials and data transmission. On the other hand, student and teacher initiated tutorials involve many hours of telephone calls and tele-conferencing, encouraged by student access to 008 phone numbers. Additional facsimile machines have been installed to ease the flow of student draft-assignments that have become a feature of many subjects. Other projects include the provision of a computer bulletin board, which did not gain the anticipated level of use, and increasing use of electronic mail between students and their teachers. Internet access for staff and students is currently being installed.

Educational broadcast television has a relatively long history in Australia. A number of Australian States have made extensive use of dedicated broadcast television linked with audio and faxed student interaction. The Northern Territory has also undertaken a limited project in broadcast television supported by independent interaction, using some science programs modified from Western Australia's really great series.

Video conferencing provides two-way visual and audio communications via satellite between a studio at the NTSCS and classrooms located at four communities in the Western Desert. Tutorials are conducted for several hours each day using the *Tanami Network* (a $2 million satellite conference network established by the Warlpiri and Pintubi people living in the Tanami Desert communities of Yuendumu, Lajamanu, Willowra and Kintore, for improved direct links between the communities and to overcome difficulties in the delivery of services such as education and medicine). This compressed-video system does not provide the high quality images you may be used to with television stations. With care it is adequate for our purposes, though teachers and students have to avoid quick movements which come across as a series of time-lapse images akin to strobe lighting at a disco.

Audiographics use telephone lines to provide computer and audio links between a teacher and individual or groups of students. The students might be sharing a computer or be using several computers at different locations. Typically this technology has been used to enable isolated students to participate in class activities at a school elsewhere. The recent article by Oliver and Wilson (1995) in 'Open Education' provides an explanation and review of the use of audiographics (telematics) in Western Australia to improve access between schools to post-compulsory schooling subjects. The NTSCS has adopted the less common approach of a distance education teachers at their desks dealing directly with isolated students for individual or group lessons or tutorials. Since 1993 the school has mainly been using Electronic Classroom™ software and Macintosh computers. This software selection was significantly influenced by the relatively poor quality of telephone services for its remote clients. While the Digital Radio Concentrator System (DRCS) provides a more reliable access than the radio-telephone system, it is still a long way behind the quality of service available to most Australians. The Electronic Classroom software can operate at low transmission speeds (300 baud rate) and is reasonably sympathetic to 'dirty data' (no - I are not referring to the pornography problems faced by Internet!). Using modern modems, the software automatically tracks and selects the highest baud rate possible at that time between the teacher and students.

Desk-top video systems can be simply described as combining audiographics and video-conferencing. Imagine, if you will, your normal computer screen with a very small video camera sitting on the top taking pictures of you, or being able to swivel the camera to view 2D and 3D items on your desk. These pictures plus audio are then transmitted to, and received from, other computer/s on the same communications line as the other computer signals thus to be shared by

other users in real-time interactive sessions. Screen manipulation enables users to split the screen thus to enjoy vision and/or other computer data. Jones (1995) reported that "some observers still say [desk-top] video-conferencing is looking for a market rather than responding to a need." Our experience with both video-conferencing and desk-top video suggests there is an education need that may be satisfied by desk-top video, especially now that a world-wide industry communications standard (H320) has been negotiated. My own view is that desk-top video will become as common in distance education as facsimile and electronic mail. A desk-top video pilot-study by the NTSCS in 1994 was encouraging for locations with good Integrated Services Digital Network (ISDN) telephone communications, especially via optic-fibre lines, but was less than successful with DRCS and thus unavailable for most remote clients. Following that pilot-study, the NTSCS has recently commenced (as a Registered Provider) an eighteen-month trial use of desk-top video to support students (at their workplace) enrolled in National 'office skills' modules. For this project we are using Unisys PCs and 'ShareVision' software.

Computer Based Learning has been available for several decades and is now gaining new ground through improved multi-media formats and performance. In particular, changes in CD-ROM technology has enabled the Northern Territory Department of Education to develop a new teaching format for students — interactive lessons on CD-ROM. This is no longer pie in the sky wishful thinking technology; thirty percent of Australian homes now have computers and sixty percent of new computer sales are for home use. Seventy percent of home computers sold in the last year included CD-ROM (Rolley, 1995).

It would appear that until recently the status of CD-ROM was not dissimilar to the status of print materials five centuries ago — lacking an effective distribution system and restricted to the rich and literate. Akin with the introduction of printing, the flexibility and freedom of CD-ROMs will enable educators to develop richer and more meaningful lessons. Thus far, however, the main use of CD-ROMs in education has been student reference and motivational materials; some of which are really good but much of which are rubbish or inappropriate. I have not conducted a proper search of the literature but it appears to me that little has been done by teachers, schools and education systems to utilise CD-ROM material beyond that commercially produced. I am aware that some education systems are using CD-ROMs in administrative and support areas to update and replace handbooks and catalogues. Brad Smith has an interesting article in the latest 'Open Education' describing the use of CD-ROM for professional development in Queensland. The remainder of this paper describes a current project, in the Northern Territory, to provide student lessons on CD-ROM.

INTERACTIVE CD-ROM

A CD-ROM provides an optical storage system with a capacity for enormous volumes of information. A standard 'floppy disc' typically holds about 1 megabyte of data, while desk-top computers have experienced an exponential increase in hard-disc capacity with 250-500 megabytes now a common default capacity. These data capacities, although very generous compared to a decade ago, restrict the ability to distribute and use complex computer based learning programs, especially when the programs contain sound, graphics and moving pictures. The present availability of CD-ROMs with more than 600 megabytes of data has significantly changed all that to the extent that a CD-ROM could reasonably contain a term's work in one subject including references, video and audio clips plus animation sequences and full coloured graphics. Imagine future prospects when the present 600 megabyte capacity is replaced by the next generation of CD-ROMs which are currently being developed with 3.5 to 10 gigabyte capacity (Cole, 1995).

As with most technology, access to user-friendly systems is improving at a rapid rate. This access has been accompanied by dramatic real-cost benefits. I admit that such observations are relatively subjective; for example, Feeley and Stefenac (1995, 36) commented that "although

desktop [compact disk recordable] products have progressed admirably in the past year - to the point where they can now be considered by a wide range of users, not just the pioneers - the process is hardly that simple or speedy". They went on to examine a range of desktop compact disk recordable systems in the $5000 to $10000 price range (down from $30000 six years ago) as an alternative to using professional mastering houses. A product review (Weibel 1995, 49) published a month later noted that "most inexpensive recorder prices have only recently dropped to less than $4000." (These two product reviews provide a detailed but not overly technical explanation of what is involved in preparing CD-ROMs, and thus may be useful reading for novices in this domain.)

While $4000 to $10000 is beyond my financial resources for personal archiving or CD production; it is a very attractive option for schools of distance education seeking to produce and distribute large volumes of material, especially that which needs to be regularly updated or distributed to a limited clientele. Even for larger distributions, desktop CD recording systems can play a critical role in producing test copies to ensure that audio visual components work as effectively on CD as from the developer's hard disc (the physical characteristics of CD and HD differ and thus identical playback should not be presumed).

The initial cost of preparing computer based learning materials is quite high, especially if the material is more than simply transcripts of existing print materials (indeed, even archiving current documents to CD-ROM is not simply a matter of dragging files between icons). The cost includes the provision and training of specialist staff, supply of high powered computers and storage media, associated software, plus video and sound recording equipment. However, the expense of this training and equipment is usually offset by a reasonable life that should cover several projects and have other uses.

Despite improvements in software and hardware, expert staff are required to optimise the technology, let alone to optimise student learning outcomes. Put simply, preparing computer based learning materials, even from someone else's work, is not for everybody and anybody. Technical expertise with the systems is important but so also is pedagogical expertise thus to ensure that the learning materials are truly interactive with appropriate pathways. It is all too easy for computer based learning, like other teaching and technology, to degenerate into 'talking heads' providing a lecture. Lessons via interactive compact disks must be more than electronic pages with occasional sound effects or QuickTime movie clips.

Interactive CDs provide the opportunity for students to learn at their own pace independent of other students and the teacher. Computer based learning is predominantly student controlled, allowing progress at individual rates coupled with interaction, colour, sound, graphics, video clips and animations to encourage learning in a non-threatening and positive environment. For distance education students in general, and many Aboriginal students in particular, this is the preferred learning style allowing, inter alia, repetition and imitation without shame.

The current Northern Territory project was established in 1993 with three staff utilising Commonwealth funding under the national Aboriginal Education Project (AEP). The interactive CDs that are being produced are based on existing print materials to facilitate development, retain print materials for back-up use, and also provide an appraisal base. Year eight, nine and ten courses in English, Mathematics and Science are replicating current materials and thus the full potential of interactive CDs has not been achieved yet. At the very least, however, the use of multimedia techniques and inclusion of interactive activities has taken the lessons way beyond the scope of the original print materials. As an extension of the current contents, the CD-ROMs are to have aspects of Computer Managed Learning incorporated into them by writing to a floppy or hard-disk the time and date of use plus all of the interactions and responses the student made.

The development team followed a cooperative model amongst themselves and with the NTSCS teachers to prepare and pilot sample lessons prior to field trials with students. Lessons were prepared using 6100/60 AV Power Macs with 24 megabytes of RAM and 5 gigabytes hard disk to provide quick access to databases of audiographic data. The main software used has been Authorware Professional, Adobe Photoshop, Macrominder Director and SoundEdit 16. Single CDs have been produced in-house on a Sony 900 CDW-900E and cost $23 for each blank CD-ROM media. For longer 'print runs' the CDs may be sent for commercial production where the cost of a master disk is $2500 and each CD-ROM $2.50

The initial courses each took about a person-year to produce, a similar time span as print based courses. Staff competence in Authorware required training and experience to optimise the software and thus CD-ROM course output has been slower than originally anticipated, but is improving with experience. The initial translation of materials from print to multimedia format involved more than copying text and graphics files between media - not the least because the print graphics were all black and white and rarely digitised. There have also been the unplanned but inevitable delays associated with 'Murphy's Law' and dealing with change in a changing environment.

However, all this is but only interesting if students do not have access to computers and CD-ROM players. Macintosh computers had already been provided for Aboriginal students from fifteen communities across the Territory, as part of an AEP project involving audiographics and electronic mail. It was a relatively easy exercise to provide CD-ROM players for some of these computers and other students in the project.

So what have we achieved with all the resources that have gone into this project? A major feature of computer based learning is the design of programs to provide immediate response to student interaction, and at a level that surpasses most classroom situations! The programs are not designed to replace teachers, rather to change the role of teachers from 'sage on the stage' to 'guide on the side'. We think that the CD-ROM project has been successful in achieving this feature which is by default a key aspect of distance education. Hands-on demonstrations of the lessons for SPERA conference participants is anticipated to elicit the same enthusiasm as staff and students in the project have demonstrated. Such enthusiasm is well founded as the project has been nominated for the 1995 Australasian Interactive Multimedia Industries Association education category award.

EVALUATION

Communication technologies enabling interaction between teachers and students will not alone, but can go a long way, to tackling the problems faced by isolated students. There are other technologies that we have yet to try, such as the increasingly sophisticated interactive whiteboards, and the NTSCS hopes that other schools of distance education will share their experiences of such technology with us.

This project has the potential to be another example of the 'visionary trap' (Collins cited Oliver and Wilson 1995, 2) in which the success of project planning and implementation presumed educational benefit of the concept. Mind, I have also encountered the reverse; ie, problems with project implementation denying educational benefit of the concept. A preliminary evaluation of these projects was conducted last year and included some positive indications regarding student learning outcomes, such as attendance and participation. Later this year there will be a more detailed analysis of student progress. There is no single best-practice, not the least because there is no single set of problems, and the following comparisons are only intended to summarise the features of some of our current projects. The hardware and software is different but the key element remains the same — using technology to improve the level of personal contact and

interaction between teacher and student, and between the students. They all have educational benefits but any cost-benefit analysis will vary between time and location.

Voice contact : Telephone or H-F radio

Location requires access to telephone or radio
Suitable with individual or classes of students
Direct audio but no visual interaction with teacher
Interaction with teacher rather than equipment
Audio but not visual material possible
Independent support material and student work can possibly be transmitted (fax)
Off-lesson link with others
High and low set-up costs, ongoing salary costs, high and low communication costs

Tanami Network : Interactive television

Location requires satellite communication equipment
Suitable with classes of students
Direct audio visual interaction with teacher
Interaction with teacher rather than equipment
Audio visual material possible
Independent support material and student work cannot be transmitted
No off-lesson link with others
High set-up costs, ongoing salary costs, high communication costs

Electronic Classroom : Interactive computing

Location requires telephone communication and computer
Suitable with small groups of students
Indirect audio visual interaction with teacher
Interaction with teacher using the equipment
Audio visual material possible
Independent support material and student work can be transmitted
Off-lesson link available through electronic mail
Low set-up costs, ongoing salary costs, low communication costs

CD-ROM : Interactive lesson material

Location requires computer with CD player
Suitable with individual students
No audio visual interaction with teacher
Interaction with material using the equipment
Audio visual material possible
Independent support material and student work cannot be transmitted
No off-lesson link with others
High set-up costs, low ongoing salary costs, minimal communication costs

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