Videoconferencing is a new and expanding form of communications technology which allows students and lecturers to interact at a distance. The purpose of this paper is to consider university lecturing staff perceptions of changes in their use of teaching/learning strategies brought about through the use of this new technology. The South Australian Department of Technical and Further Education (SA DETAFE) has been used as a case study of implementing educational change through this technology. This study has shown that videoconferencing has necessitated changes in teaching and learning techniques and strategies. It has placed new demands on lecturers and students, but it has enabled simultaneous interaction at a distance between staff and students at a number of locations.

Videoconferencing is a new form of communications technology which allows students and lecturers to interact at a distance. Its use is currently being expanded within the university sector and in Technical and Further Education Colleges. The purpose of this paper is to consider staff perceptions of changes in their use of teaching/learning strategies brought about through the use of this new technology. As a leader in Australia in exploring uses of videoconferencing for teaching purposes, the South Australian Department of Technical and Further Education (SA DETAFE) will be used as a case study of implementing educational change through technology. Videoconferencing, using compressed digital transmission, began in South Australia in February 1990 and expanded to a nine-site network in 1992 (Schiller & Mitchell 1993).

The main uses of videoconferencing at the nine sites of SA DETAFE were to:
- combine smaller groups of students across several sites to make one viable class;
- provide lecturer expertise from another college when unavailable at the site where students wish to undertake the subject; and,
- reduce the need for travel between sites for teaching and administrative purposes.

WHAT VIDEOCONFERENCING ENTAILS
Videoconferencing involves communicating using the television medium in which the conference can be one-way video, two-way audio or two-way video and audio. For one-way video, two-way audio, receive sites are equipped for audio transmission only, typically by telephone. In this case, the lecturer is seen and heard by those at the remote site, but cannot see those at the other sites. For two-way video and audio, all sites can send and receive both audio and video. The conference can be point-to-point or multipoint, involving more than two sites. Transmission options include cable (both copper wire and optical fibre), satellite and microwave.

The most popular form of videoconferencing in Australia at the moment involves the transmission of compressed digital information. This compression is carried out by a computer called a codec. The compressed signal uses less space than the traditional analog signals, so there are cost savings which are offset by a reduction in quality of the picture. The standard amongst higher education institutions is 128 kilobits per second, the equivalent of two STD telephone lines.

The most common variation of videoconferencing in the higher
education sector involves live, two-way video and audio, transmitted as compressed digital signals, along fibre optic cables, utilising Australian and Overseas Telecommunication Commission's (formerly Telecom) Integrated Services Digital Network (ISDN). In the last two years there has been rapid development of videoconferencing, particularly at universities with Distance Education Centres (Atkinson, Latchem & Davy 1991; Hansford & Baker 1990; Youngblood, Mahoney & Tonkins 1991) and in the Department of Technical and Further Education in South Australia (Mitchell 1991a, 1991b).

VIDEOCONFERENCING AS 'USER FRIENDLY' Since its inception, advocates of videoconferencing in SA DETAFE saw videoconferencing as a virtually 'invisible' technology which was 'user friendly' (Mitchell 1991b). They wanted the technology to be transparent to participants, both teacher and learner, so that the equivalent of face-to-face interaction was possible at a distance. Their vision was of an interactive system which did not require technicians to operate it and needed only minimal button pushing by the user. Through ingenious and innovative use of electronics during the pilot phase and through use of computer controlled touch screens for the learner under the current system, these visions have been achieved. The system is very 'user friendly', the sophisticated electronics are transparent to the user, and the entire system responds to the user at each site through a voice-activated switching system. Through use of Multiple Control Units at the two hubs of the network, each site can be connected to every other site in the nine-site network. This results in the lecturer at one site, with or without a group of students in front of them, being able to see and hear the students at the other sites while those students can see and hear the lecturer.

To determine staff perceptions of changes brought about through their use of the new technologies of videoconferencing, selected staff at the nine SA TAFE sites were interviewed as part of an exploratory study (Schiller 1992; Schiller & Mitchell 1993). This study found:

- the use of videoconferencing was increasing in terms of hours of usage overall
- that staff appreciated the reduction in travel time made possible through videoconferencing,
- the most common form of videoconferencing involved a 'talking head' in which the lecturer presented material mainly through talking with the students at the same site and to other groups of students at one or more other sites, or to other sites but with an empty room at the lecturer's site; and,

videoconferencing is used effectively, comments from both lecturers and students indicated that this was achievable and high level interaction occurred between people who may be separated by many kilometres. However, comments from staff and students during the study also indicated that this level of transparency, when the technology virtually disappears from the interaction process, did not occur as often as was anticipated due to technical problems. Equipment malfunctions and concerns about the lack of synchronisation between movement and voice, due to the slow transmission speed, cause sufficient concern as to inhibit effective face-to-face interaction. In addition, teaching techniques used during videoconferencing sessions were limiting the potential of the system.

An example of a teaching technique which can be inhibiting is the use of lecturers. There was clear evidence from interviewees, both staff and students, that videoconferencing was being used mainly for lecturing (i.e. one-way transmission of content). A 'talking head' image, with little or no chance for interaction, leads to boredom, dull presentations using an expensive technology. Use of a videotape of a lecture or an audiotape would be preferable and much cheaper. At the current level of technology, videoconferencing is markedly different from broadcast quality television. On a continuum, compressed digital video is closer to audio than broadcast television in that it lacks the clarity and clear reproduction of movement and sound which is possible on broadcast television. Therefore, considerable effort has to be put into teaching and learning via videoconferencing.

Videoconferencing it is not merely another version of face-to-face teaching. Major modification of teaching strategies is essential so that focus is on interaction.

CHANGES BROUGHT ABOUT BY VIDEOCONFERENCING

A major conclusion from this exploratory study was that videoconferencing, using compressed digital video, requires a different teaching methodology from any that lecturers have used previously. The technology itself necessitates different ways of interacting, different ways of moving, different ways of presenting information and different ways of judging the meaning of the messages going in both directions.

At first impression, videoconferencing appears to be a substitute for regular classroom interaction and is, therefore, appealing as a teaching medium as it promises face-to-face experiences for teaching at a distance. If the technology is transparent, interaction takes place as if the individuals are in the same room.
 VIDEOCONFERENCEING

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have not studied for some time, and as a result, lack confidence. Getting responses from such a group using a voice-activated system was seen as particularly difficult.

Fourth, another major difference with using videoconferencing techniques is that the nature of interaction itself is influenced by the current state of compressed digital technology. Although a voice-controlled switching system is desirable in that it is a reflection of a true, open interaction system in which all participants can have input, and the lecturer is not in control of the interaction, the current limitations of the technology and of lecturer's skills in facilitating open exchange of ideas and comments, form some of lecturer control over which images transmitted appears to be necessary. The majority of lecturers interviewed expressed the need for some form of control over the switching of images from site to site as they felt they needed to orchestrate responses from students, particularly the younger, less mature students and from students who

techniques within videoconferencing sessions. If a lecture strategy is necessary, the 'talking head' component of the lecture should be kept short, it should be broken up with use of graphics and other visual material to emphasise and illustrate, and questions should be asked frequently to challenge the students and to check for understanding.

Third, the capability of transmitting close up images of small, two and three dimensional objects via the graphics camera at each site, enables videoconferencing to contribute a unique element to teaching and learning. For example, progressive disclosure of the points being made during a lecture add variety to a presentation as well as giving a conceptual overview. Postcards, photographs, diagrams and illustrations in books can be transmitted by the graphics camera to a class on site, via their TV monitor, as well as to classes at remote sites more effectively than if they were used in a face-to-face situation. For example, a lecturer who taught an LPG Gas Conversion course, explained in interview that close-up views showing how to connect hoses, pipes and other fittings could be shown more effectively to a group via videoconferencing than in a face-to-face situation.

Fourth, another major difference with using videoconferencing techniques is that the nature of interaction itself is influenced by the current state of compressed digital technology. Although a voice-controlled switching system is desirable in that it is a reflection of a true, open interaction system in which all participants can have input, and the lecturer is not in 'control' of the interaction, the current limitations of the technology and of lecturer's skills in facilitating open exchange of ideas and comments, some form of lecturer control over which images transmitted appears to be necessary. The majority of lecturers interviewed expressed the need for some form of control over the switching of images from site to site as they felt they needed to orchestrate responses from students, particularly the younger, less mature students and from students who

be collected and prepared for use on the graphics camera. Lecture material had to be restructured so that different modes of student interaction could be built into the presentation. They also pointed out that student activity material and resources had to be prepared in advance and distributed to other sites and modified to make it appropriate for videoconferencing. These procedures involved additional work. In most cases, lecturers spoke of the significant changes they had to make to their presentations which had been prepared for the traditional three-hour presentations of lectures and seminars in a face-to-face situation. Some lecturers used distance education packages prepared specifically for external students but modification of approaches and resources was still necessary as an additional delivery strategy had been injected into the system when using videoconferencing.

In all cases, lecturers stressed that a significant amount of additional work was required to present their course via videoconferencing, regardless of whether they used existing packages or modified their own material. Although the actual time involved in the videoconferencing session was less than the regular face-to-face commitment, their total involvement time exceeded what they had previously spent on traditional face-to-face teaching.

THE NEED FOR STAFF DEVELOPMENT

Because of the need to restructure existing material, to learn new techniques and to change approaches to teaching and learning when using compressed digital videoconferencing, an emphasis on staff development is critical. Videoconferencing confronts staff and challenges teaching-learning methodologies. It demands a reassessment of
the ways in which a lecturer interacts with students and poses different limitations on students interacting with students at other sites. Because videoconferencing requires a closer examination of teaching strategies, it can play an important staff development role in leading lecturers to experiment with new and different approaches and to question existing practices. Of the different delivery and organisation systems available for teaching at a distance, videoconferencing is most like traditional face-to-face teaching and yet it also has the appeal and glamour of a high technology approach which is 'user friendly' in its operation.

Discussions with staff of SA DETAFE 'TAFE Channel', Open Learning Managers at each site, and with lecturers, indicated that there was a clear understanding of the need for extensive staff development about videoconferencing. It appears, however, from this exploratory study that the emphasis had been placed on providing in-service programs at the initial use stage rather than in developing an ongoing staff development strategy and program. Excellent resources, such as the Lecturer's Guide to Videoconferencing (Rixon 1991), and associated programs, have been implemented to prepare lecturers for first use of videoconferencing. If participation is not possible in 'hands on' workshops at videoconferencing sites, the Procedures Manual (Mitchell 1992) and printed material prepared for staff in-service provided excellent overviews of basic operation of the system. However, what was needed were additional staff development programs in which users of the system could exchange ideas, challenge each other, discuss concerns and explore the challenges of videoconferencing. This must be an ongoing process of staff development. The literature on implementation of change highlights the nature of change as a process rather than an event, that change takes time and persistence, that individuals go through stages in the change process and have different needs at different stages, and that change strategies are most effective when they are chosen to meet people's needs (Hall & Hord 1987).

IMPLICATIONS FOR THE USE OF VIDEOCONFERRING

A major implication from this exploratory study is that the use of videoconferencing needs to be carefully planned and the rationale for its use clearly identified. It is not merely an electronic means of transmitting lectures to other sites. When used as one of a range of 'mixed mode' strategies and techniques, including use of intensive face-to-face workshops, distance education print packages, email, teletutorials, and other means of teaching and learning at a distance, videoconferencing becomes a powerful medium for interacting at a distance. Through new technologies, videoconferencing enables use of familiar face-to-face teaching-learning strategies with students at other locations. However, it also necessitates variations in teaching style and methodology to accommodate the characteristics of the technology. Therefore, initial use needs careful planning and considerable support. Induction workshops are essential as lecturers will have initial anxieties about its use. These workshops should focus on the actual operation of the videoconferencing system with an emphasis on 'hands on' operation and should highlight the major, essential teaching strategies for effective initial use. 'Information overload' at this initial stage sometimes occurs when experienced users of videoconferencing try to alert the new user of all the variations and even the pitfalls of videoconferencing they have experienced, sometimes forgetting that the neophyte user's needs are quite basic as they focus on 'survival' strategies during initial use.

Finally, development of any new subject in which videoconferencing could be a component, should be developed as a 'mixed mode' subject in that a variety of distance education techniques should be planned and implemented. Videoconferencing should be used in those elements of the subject in which interaction is important. Different distance education strategies should be used for other components of a subject.

In conclusion, videoconferencing has necessitated changes in teaching and learning techniques and strategies. It has placed new demands on lecturers and students, but, most importantly, it has enabled interaction at a distance between staff and students at a number of locations simultaneously. As its use expands more exploration of its unique attributes will need to be undertaken.

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