

Broadband videoconferencing as a tool for learner-centred distance learning in higher education

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Abstract

This paper outlines the possibilities for using broadband videoconferencing within the larger context of changing the focus for teaching from the teacher to the learners. It also explores opportunities that might be created by this technology to facilitate learner-centred engagement in learning and to provide new opportunities for collaboration and support for students studying by the distance mode. As part of the wider discussion, it presents a decision-making framework for teachers to consider when integrating videoconferencing into their curriculum. The bandwidths possible from broadband Internet connection rather than the integrated services digital network transmission increase the richness of videoconferencing to a much closer approximation of natural communication, thus creating opportunities for more creative uses for the medium. The outcomes of trials undertaken at the University of New England during the last two years provide the basis for predicting the usefulness of the technology for learner-centered interactions when the majority of students are learning from locations quite remote from the main campus.

Introduction

One technology with potential for use in distance learning in Australia and elsewhere is broadband videoconferencing using independent desktop or large room systems. Its suitability for mixed mode distance education using learner-centred teaching and learning in higher education is the subject of this paper. From a contextual perspective, this paper concentrates on presenting a decision-making framework that teachers may consider when planning learner-centred approaches to teaching distance students. From a technological perspective, it illustrates how a sophisticated information com-

munication technology can facilitate student interaction. In the discussion below, the term *broadband videoconferencing* is used to describe that generation of stand-alone videoconferencing technology comprising small- and medium-sized systems capable of facilitating high-speed synchronous, interactive visual communication between individuals, small and large groups using Internet Protocol. It does not include synchronous web conferencing using desktop computers fitted with a camera and appropriate software. These broadband systems are in use at the University of New England (UNE), which is located in rural New South Wales midway between Sydney and Brisbane. It must be emphasised that there are significant infrastructure and network costs required to utilise this potential. At the UNE, a broadband network enabling videoconferencing links between 128 kilobyte and 3 megabyte connects ten purpose-built university access centres across distances of 100–400 kilometres. The access centres are located in rural towns so that students from more remote locations can utilise the university's information technology resources to further their studies. It is hoped to expand videoconferencing provision into offshore partner institutions with similar benefits to staff and students.

Relevance to distance learning

Broadband videoconferencing technologies offer the potential for a mix of indirect and virtual communication providing opportunities to enhance distance learning because of the richness of this audio-visual media (Kock, 2001). In the distance mode, teaching, learning, the inherent motivating of students, and developing of a shared view about what is to be learned and why, is made more difficult by the relative isolation of individuals who comprise the group (Gravoso, 2002). Traditionally, communicating content as well as teaching strategies and supporting students to reach planned outcomes has relied on one-way, one-to-many communication, usually written word with some supplementation from audiotapes and most recently, online learning.

In a face-to-face situation, communicating content and strategies may be as simple as indicating the approach that the teacher intends to take and why this approach is appropriate to communicate particular content aligned to the learning objectives intended for students. The articulation of beliefs and development of a shared view of what is to be learned can be managed relatively easily through one-to-one or group discussion. Integral to this process, nonverbal communication is possible when teachers and students are colocated. Reading body language reduces the potential for ambiguity and heightens the psychological engagement of both parties potentially leading to a positive outcome (Kock, 2002). Until recent advances in videoconferencing technology, distance educators were limited in their ability to utilise nonverbal communication in this way.

As with opportunities for interactive online discussion, audioconferencing, group interaction through email, virtual learning circles and mentoring, videoconferencing is another means by which teachers can utilise the variety of information communication technologies to provide visually richer support for isolated students. The teacher's ability to integrate technology-based interaction into distance learning contexts depends

upon a number of factors including the availability of various technologies, their relative cost, and most importantly, their suitability to the teaching and learning situation. Thoughtfulness about using this technique within a teaching approach will be contingent upon this context as well as the teacher's knowledge of the needs of the learners within a particular discipline (Green, 2002; Jones & Richardson, 2002; Koenders, 2002).

Greater potential for videoconferencing to enhance distance learning

Many innovative teachers have been hampered by both technological and institutional limitations in their use of videoconferencing. Teachers have been encouraged to consider their choice of media as an integrated aspect of planning teaching but, for many years, videoconferencing technology did not approximate natural communication because of the time lags in audio and video transmission, and its potential was not utilised because of the costs of telephone line rental. This limited the teacher's ability to plan interactive teaching of particular aspects of a unit or course according to the:

- purpose for teaching and the needs of the learners (Laurillard, 2002);
- need for, or usefulness of, various media within the discipline;
- optimum frequency of use;
- fit of the media to the circumstances of the learners (Gilman & Turner, 2001).

The current generation of portable and wireless equipment and cheapness of connection through the Australian Academic Research Network, now make it possible for Australian university teachers to utilise the richness of videoconferencing for more learner-centred teaching. The establishment of high-speed broadband networks makes broadband videoconferencing cost effective when compared to its landline-based predecessor (Kingham, 2002). Broadband technology allows three to eight times the quality in picture and sound so that these approximate the images seen on television screens. Dual transmission of live action, enhanced with simultaneous transmission of video, PowerPoint slides, and audio tracks, is easily achieved. The use of videoconferencing technology, therefore, holds greater promise for enhancing the learning of distance students than it once did, because the newer generations of the technology are technically superior to telephone-based videoconferencing (Tandberg, 2004b). Thus, new opportunities exist to reduce student isolation and provide greater opportunities to enhance distance teaching, learning, and supervision of research.

The benefit of the Internet-based technology connected to the UNE network of access centres is that it enables videoconferencing which more closely approximates regular face-to-face communication. This is because the dedicated bandwidth is available to support high-speed transmission enabling participants' to see and hear synchronous verbal and nonverbal communications including the multiple visual and aural cues in natural language communicated in real time, body language, and intonation of speech providing immediate feedback resulting in increases in the personalisation of learning.

The opportunities for academic and teaching staff to utilise videoconferencing and integrate the new generations of the technology appropriately into the curriculum

design for the units they teach will define the opportunities available for these students to engage effectively in learning via this improved medium (Gratton, 1998; Tandberg, 2004a). Most successful teachers tend to be good adapters. They are able to take new and emerging practices and strategies and integrate them into their teaching in seamless ways that make them easily acceptable to students (Fullan, 1991). For example, the use of email, chat, Listservs, and voicemail instead of letters is now an accepted means of reducing the isolation of distance education students through more frequent and rapid communication with their teachers (Salmon, 1998; Wylie, 1998). For many teachers, the alteration of practice in this manner is quite common.

To effect more significant changes in pedagogy and practice associated with the introduction of a new media, teachers need time to investigate, discuss, trial, and reflect upon suitable approaches and strategies (Boyer, 1990; Webb, 1996). Institutional support is needed to ensure that teachers have time to:

- research and reflect upon appropriate pedagogical frameworks, technologies, and techniques (Andresen, 2000);
- trial new strategies with no risk of untoward consequences for either teachers or students;
- demonstrate successful and relevant techniques with the deliberate intention of seeking feedback from students and colleagues;
- seek pedagogical advice from educators when necessary;
- collaborate with students in the planning and management of change;
- develop a desire for continuous improvement in the outcomes of teaching and learning (Mezirow, 1991; Trigwell, Martin, Benjamin & Prosser 2000).

Fit to purpose: planning rich media experiences

Teachers' and students' views about *how* and *what* to teach and their changing roles in the educative process are becoming more informed by considerations of pedagogy (the way we teach) and epistemology (the way we view knowledge acquisition) (Grundy, 1987a; 1987b; Grundy, 1992; Mezirow, 1990; 1991). With the variety of technologies available to teachers today, it is becoming increasingly important for good teachers to understand why they do what they do well in order to make informed choices of appropriate technology aligned to their pedagogical approach. For teachers in higher education, continuous synergising of developments in discipline-based knowledge, practice, and understanding is one part of enhancing their teaching. Keeping abreast of fundamental shifts in educators' understanding about how learning and teaching take place is another. This knowledge lies at the heart of improving the outcomes from students' learning (Biggs & Collis, 1982). However, deeper reflection on their primary motivation for teaching the way that they do is less common than routine reflections on practice, simply because they are not given sufficient time to reflect, move forward, reflect, and move forward again (Adelman & Walking Eagle, 1997).

The motivation for enhancing learner-centred practice stems from growing realisations that the actions of learners have a more important influence on the outcomes that they

achieve, than the actions of teachers (Biggs, 1999). Learner-centred approaches to teaching and learning in higher education are emerging as more suitable strategies to promote deeper learning (Trigwell & Prosser, 1999) so it follows that a teacher's decision making about the choice of media and technology can hinder or advance student engagement and progress towards deeper learning (Laurillard, 2002). Because a learner-centred approach is a pedagogical style underpinned by epistemological or conceptual views, which place learning rather than teaching at the core of teaching practice (Fosnot, 1996; Foley, 2000; von Glaserfeld, 1995; Ramsden, 2003), the choice and use of videoconferencing should also be approached from this perspective.

Desirable elements of media richness distilled from recent literature (Dennis & Kinney, 1997; Gilman & Turner, 2001; Kock, 2002; Smyth, 2005) concerning information communication technologies can be demonstrated in the use of broadband videoconferencing. The visual richness of the medium permits access to the multiple cues of natural language and its synchronicity makes it suitable for activities such as role plays, interactive group work, simulation games and practical demonstrations as well as more traditional activities such as guest lectures and tutorials (Benbunan-Fich & Stelzer, 2002; Blake & Taji, 1997; Gilman & Turner, 2001). The immediacy, flexibility and visual richness of the medium as well as its increasing reliability (Scanlon, 2002; 2003a) enhance possibilities for learner-centeredness and interactive learning.

A decision framework

If we accept that learner-centred approaches to teaching are desirable, the adaptation of such approaches to videoconferencing will require thoughtfulness, reflection, and planning so it is probably wise to consider the use of a planning framework. Figure 1 presents my attempt at developing a conceptual framework (Smyth, 2004) for deciding which types of interactions might appropriately be planned using broadband videoconferencing. A concurrent analysis of the disciplinary context, time, place, synchronicity, and pedagogy should ensure appropriate alignment between the needs of the learner, the learning context, the costs of available technology, and the purpose for teaching and learning (Benbunan-Fich & Stelzer, 2002; Collis & Moonen, 2001; Laurillard, 2002).

In presenting a series of possible interactions that could be facilitated by broadband videoconferencing the matrix in Figure 1 attempts to fit them along a continuum of increasing learner-centeredness across the cells from left to right allowing for transitions in practice and the selection of interaction based on the fit to the teaching purpose. The descriptors used in the first column indicate the type of interaction while remaining cells present examples of teaching and learning strategies that might be appropriate for the type of interaction and the degree of learner-centeredness appropriate to a desired teaching context. The range of examples is intended to indicate how the richness of the videoconferencing medium provides opportunities for increasing learner-centred approaches to learning via broadband. It illustrates strategies from the more traditional teacher-directed lecture through to dominantly student-directed activities as I am attempting to illustrate the choice and flexibility that the richness of the medium sup-

Fit of videoconferencing media to purpose described by example:				
Type of interaction	Increasing interactivity and learner-centeredness →			
Instructive pedagogy moving towards constructive pedagogy ↓	One-to-many: Lecturer/student to many in single or multipoint link	Guest lecture or timetable class; Students' assessable presentations; Practical demonstration without interaction.	Formal tutorial or class; Practical demonstration or practice presentation with asynchronous interaction.	Practical demonstration with synchronous interaction, questioning, and feedback; Study skills tutorial.
	One-to-one: Lecturer/student to student in single point link	Remote practicum observation; Oral/practical examinations.	Postgraduate supervision; Master classes.	Student-to-student mentoring, teamwork, or collaboration; Peer learning.
	One-to-some: Lecturer/student to several students in single or multipoint links	Tutorial discussions; Dissertation viva; Assessment tasks; Group presentations.	Student group leader working with others on joint project; Facilitated discussion; Practical experiments.	Students developing presentation skills with self-initiated practice for feedback; Teamwork.
	Some-to-some: Students to other students in a multipoint link	Project team meetings; Mandatory group work; Post graduate supervision including cross-institutional collaboration.	Teamwork; Self-guided real/virtual practical/field work; Role plays; Project collaborations; Discussions.	Student-initiated self-help groups, action-learning circles; Rehearsals; Real-time action or problem-based learning.
Diagonal arrow indicates increasing student autonomy and control of learning.				
This framework extends work originally reported in (Smyth, in press)				

Figure 1: An example of a conceptual framework for planning learner engagement using broadband videoconferencing capable of single and/or dual video transmission

ports. All forms of interaction are equally legitimate teaching strategies, and the intent of the framework is to illustrate how a range of teaching strategies could be facilitated using videoconferencing.

The richness of the medium makes it possible for students to be involved in experiences extending from a traditional lecture to dialogue and virtual participation in practical work so the vertical downward arrow is intended to indicate increasing constructivist pedagogy. Choosing the experience and the level of interactivity will reflect the teacher's approach to utilising the new medium and teaching techniques. It is really a case of thoughtful analysis of learning needs where the teacher plans the level of student engagement and empowerment according to the limitations of the task itself, the suitability of the medium, its appropriateness to the content, the students' needs, and the accessibility for students within their learning environment. Each form of experience can have differing levels of interactivity and student freedom or control, according to the ways in which the teacher plans or negotiates the students' engagement with

learning materials, content, and experiences (Laurillard, 2002). The diagonal arrow is intended to indicate increasing student autonomy, empowerment, and control of learning. In the UNE context, this occurs via automated conference-booking systems and zero cost for students videoconferencing from one access centre to another or to other sites within the UNE network.

My intention in presenting the framework is to signpost opportunities for future research rather than to present established practice.

One-to-many

By its description, this form of interaction will necessarily limit the scope and variety of strategies that a teacher might plan because its focus is akin to a traditional lecture situation. The examples provided in the adjacent column reflect the teacher-centredness of this form. Moving from left to right across the cells, alternatives are suggested as the level of student centredness increases across the row. At its most limited, a presenter imparts a significant amount of content without a great deal of interaction while at its most expansive, a presenter might manage interaction to collaboratively impart content and provide opportunities for questions and so on.

What variety of approaches might be available if the teacher's purpose is suited by a one-to-many interaction? Most obviously, enriching students' learning by introducing an eminent colleague to present a particular aspect of the subject from his or her office elsewhere in Australia or overseas, for minimal cost, is tempting. Alternatively, student-led presentations could be an example of this form. What then are some of the issues? Once the appropriateness of the interaction for the teaching purpose has been established, the teacher needs to decide on practicalities such as the synchronicity that is required, including the logistic possibilities for students to attend. For UNE students who are unable to get to an access centre, it is currently possible for them to access audio-only via regular or mobile phone communication. This has occurred between Groote Island and Armidale when students of community medicine were linked to an Aboriginal health worker. To enable more flexibility, the teacher might seek advice about asynchronous interaction such as video streaming on demand. Similarly, the teacher may need to consider the timing of the conference, particularly where local or international time zones are concerned.

In the past, teachers at UNE have experimented with videoconferencing to engage remote school and university students learning about a diverse range of activities such as the physiology and life cycle of fish (using live animals), the aspects of wool science and tissue culture (Blake & Taji, 1997), for tutorials, post graduate supervision and vivas. These were useful experiences but they were generally infrequent and constrained to a teacher-directed rather than a learner-centred form of interaction because the costs were too high to allow time for extended interaction. Now, with the aid of a large room system on the main campus and smaller systems in access centre tutorial spaces, the teacher conducting a practical class could expect remote students to participate actively in their location and through questioning, activity, and discussion. For

instance, library information skills have recently been taught using broadband videoconferencing with dual video streams allowing the teacher to incorporate PowerPoint presentations while teaching students who were working synchronously in a computer lab, located 200 kilometres away from the main campus.

Yes, the medium lends itself particularly well to the one-to-many application (Laurillard, 2002) but its future potential lies in increasing the learner-centred interaction that is becoming possible with low-cost broadband infrastructure and sophisticated stand-alone equipment.

One-to-one

This form of interaction suits many teaching purposes from higher-degree supervision and examination to drama rehearsals, project planning meetings, and expert tuition. In the past, the lack of opportunities for interactive and hands-on experiences without the significant expense of attending intensive, on-campus classes or supervision meetings has been a disadvantage (Rowntree, 1994) for students studying at a distance. Particularly for students who require additional teacher or peer support, nonvisual means of communication were often less than satisfactory because nonverbal cues were absent.

Broadband videoconferencing provides a viable and cost-effective alternative for non-compulsory residential schools, rehearsals, and higher research degree supervision. For many students, the time and expense of attending noncompulsory residential schools or intensive weekend schools limit their ability to participate. Videoconferencing is an alternative where students can attend an access centre or partner institution. In addition to these benefits for students, teachers workloads might be spread more evenly during the semester if short, regular videoconferences replace intensive schools. Time spent in reading and rehearsing dramatic works at residential schools might also be reduced if students engage in preliminary rehearsals via videoconferencing. Preliminary trials around the UNE network indicate that audio lag is not a significant impediment to this type of activity.

Postgraduate research students can discuss their research with their supervisors, present findings using data sharing or practice presentations more frequently than would otherwise be feasible when either the student and/or a supervisor is located overseas or interstate. Similarly, it is not difficult to envisage practicum supervisors viewing their students in situ during a practicum and providing confidential, interactive feedback using tools such as digital imaging document cameras and video replay.

The quality of the image and sound using Internet-based broadband has been demonstrated frequently over the last two years at UNE (Scanlon, 2003b). Music master classes for students of woodwind and strings have been taught on a weekly basis between UNE and the Sydney Conservatorium of Music, 600 kilometres away. In the case of the woodwind students, the teacher in Sydney instructs his students, listens to their play-

ing, comments on their technique and models appropriate wind, sound, intonation and fingering. His ability to discern fine detail is reflected in dialogue such as:

Your face is not red enough! I can hear that you are running out of breath at the third note. (Mr Mark Walton, Senior Woodwind Teacher, Sydney Conservatorium of Music)

Most importantly, person-to-person feedback and discussion are possible at minimum cost and inconvenience to many more students than was previously the case. In the future, we aim to link regional conservatories, music teachers, and students together for professional development, expert tuition and examination. Technology trials aimed at facilitating transmission rates of 3×30 megabytes (Scanlon, 2003c) were conducted between Sydney, Perth, and Armidale in 2003.

One-to-some

Although the descriptor for this form might seem to imply similar limitations to the *one-to-many* descriptor, this form has more characteristics aligned to constructivist notions of pedagogy. There is no assumption that the teacher will be in control nor is there necessarily a need for the teacher to participate. Generally, teachers have been using this form to engage students in interactive tutorials in Economics, Cotton Production, Agronomy and Languages. In conversations with lecturers involved, it has been reported that students involved in these activities have engaged well and have requested more videoconferencing. When students practice presentations to gain valuable feedback from peers, initiate peer mentoring to support learning of difficult concepts, conduct higher degree research interviews and focus groups or invite the teacher to shed further light on controversial topics, they are increasing control of their learning.

Examples of recent trials are indicative of the medium's potential both for teaching and assessment. The mock assessment of graduate student presentations referred to in detail in the Some-to-Some section, below, also illustrated how an adjudicator could synchronously observe student presentations on a desktop system while a larger audience of the presenter's peers watched and listened to the presenter discuss PowerPoint slides and materials illuminated on a document camera. In response to the question "What are your feelings about using the technology?", feedback was generally positive from the 16 students in this trial and included comments such as:

As an observer seeing five presentations in a row, I found it surprisingly easy to watch and understand the presentations. (Student A)

Had a fair bit of trepidation initially as I was concerned about the lack of control over how I came across. But that changed when I realised that personality could easily be imposed. (Student G)

Should be made a compulsory in distance education. (Student C)

I am always nervous about the "technical hitches." Especially with students in remote areas with limited technical support (Student H)

A pilot program of Moot Court assessments is to begin shortly in order to save international students the expense of flying into Sydney to be assessed face-to-face.

Some-to-some

This form of interaction represents the greatest potential for constructed, autonomous student-centred learning because there are no limits on learners initiating interaction to enhance their own learning.

Through meeting more needs of the diverse body of students enrolling in higher education by opening up possibilities for clarification, negotiation, collaborative feedback, and thoughtful evaluation of teaching and learning (Laurillard, 2002) via easier access to a means for personalised dialogue and collaborative teaching and learning, broadband videoconferencing can be a useful tool for improving student outcomes. Because it approximates face-to-face interaction, distance students will benefit from the increased opportunities for engagement and interaction with each other, the teacher, and electronic resources. For instance, remote students could participate in routine group or practical work as well as on-campus activities and field trips, arrange student learning groups, engage in self-initiated support networks or practice presentations, and receive informal peer feedback prior to assessment. In a trial at UNE two years ago, a student on a life-support system in Adelaide, several thousand kilometres from the Armidale campus, participated in a two-day residential school where Law students were actively engaged in problem-based learning in groups. This student interacted constantly with peers and effectively led one group because he could observe his fellow students in the lecture theatre, see the internet sites that the teacher was demonstrating, and respond to questions in real time (Scanlon, 2002). In addition to positive outcomes from his formal learning, the student discovered two peers who had travelled to Armidale from Adelaide. These students formed a learning circle with the student and offered to assist him by returning books for him to various local libraries.

The bandwidth capacity of broadband technology illustrates the capacity for newer generations of videoconferencing equipment to allow data, dual video, and audio transmission in multiple streams of images to be conveyed between multiple sites simultaneously with minimal audio lag and thus, to reduce some of the untoward technical intrusions into learning contexts (Fillion, Limayem & Bouchard 1999; Motamedi, 2001; Pitcher, Davidson & Goldfinch 2000). Videoconferencing can be used to enhance distance students' experiences by engaging them with their peers in interactive tutorials, practice sessions or group work as a regular part of their learning (Blake & Taji, 1997; Gratton, 1998; Scanlon, 2002; 2003a). These virtual tutorials or activities could involve both distance and on-campus learners and be autonomously initiated by one or more students supporting each other in shared learning. In problem-based scenarios, students share data as they interact with each other and the teacher, make presentations to several remotely located class groups simultaneously, utilise computer-based simulations, view videotape of practical or fieldwork, and even demonstrate techniques to each other. Sessions can be videotaped so that students who are unable to participate

synchronously can access archived sessions later. To maintain flexibility of time, place, and space, remote students could view streamed video of previous years' activities and participate in the planning of current activities so that their learning needs are met in virtual rather than real time. This technique approximates project planning trials and team meetings that regularly take place between UNE and external sites.

Comparable techniques have been tested at UNE using a document camera and dual video stream to identify a helianthus caterpillar from a remote location, for medical assessments in early intervention situations, and during multipoint links for international student symposia. Similarly, remote students acting as members of a virtual learning circle, which includes on-campus members, participate in their cohort's presentations of work-in-progress, view and direct complex experiments, or walk with students' videoing a field trip. A trial of peer-mediated presentations in the Graduate Certificate in Higher Education recently demonstrated that students in three locations could synchronously interact with, and provide feedback to, colleagues presenting research proposals for assessment.

Making decisions

Because the term pedagogy, defined as *the way we teach* represents evolving practice rather than fixed ideals, teaching practice is most generally regarded as action characterised by continuous subtle change (Fullan, 1991). In deciding to try videoconferencing, the teacher has the freedom to make minor or significant changes in their pedagogy when they choose or support any interactions that meet the needs of learners, the purpose for teaching, the disciplinary context, and the institutional boundaries.

Most teachers' approach to pedagogy is grounded in personal beliefs about knowing and knowledge acquisition that they may or may not be conscious of. These beliefs influence how they approach their teaching, their views on student involvement in teaching and learning, and their scholarship about teaching (Smyth, 2003). Realising that knowledge may be constructed by individuals as they go about their daily living and the increasing interest in the *situated* nature of learning has refocused thinking about teaching and learning towards knowledge acquisition being an aggregation of social experiences rather than an aggregation of imparted wisdom (Gibbs, 1995; Grundy, 1987b; Laurillard, 2002). From this perspective, the framework in Figure 1 above could be a starting point for teachers to reflect, trial, and plan improvements in the outcomes for distance learners, aided by those students currently able to access videoconferencing.

Tensions created by institutional and workload contexts

It is worth emphasising that changing the practices of teaching and learning to adopt videoconferencing should not be regarded in isolation from the context of the broader disciplinary and institutional environments (Fullan, 1997a; Hargreaves, 1997; Laurillard, 2002). The balance between improving learning outcomes and the cost of doing so has been of concern because of the likely impact on the quality of provision of information communications technologies used as pedagogical tools (Kirkpatrick &

Jakupec, 1999; Quality Assurance Agency, 2000; Twigg, 2002). With the continued support of the Australian Academic Research Network, infrastructure costs related to providing broadband videoconferencing will remain manageable in the near future. At an institutional level, improvements in student outcomes from videoconferencing distance learning are unlikely to benefit the institution financially through increased efficiency and productivity in the short term, as discussions about the implementation of online learning have shown (Calvert, 2001; Herrington & Bunker, 2002; Lockwood, 2001).

Workload is a serious issue for both the individual academic and the sector. Consideration of the educational change literature provides core strategies that can underpin successful change on micro and macro scales. On a micro level, individuals may consider an action research approach to making changes in practice (Gibbs, 1995) that enable them to think creatively about *how much* they teach as well as *how* and *what* they teach via videoconferencing. On a macro level, appropriate strategies include vision building, evolutionary planning, leadership, and engaging participants intellectually and emotionally (Cooksey, 2000; Fullan, 1997b; Hargreaves, 1996) in formulating achievable advances towards inculcating videoconferencing as a core practice in distance education. Showing explicitly how the contributions of both teachers and students will be valued and included in the dialogue about videoconferencing can encourage a sense of community and engage this as a source of positive emotion and hope (Sergiovanni, 1998) for success. Including time and space for trialing changes in practice without consequences, for teachers or students, enabling authentic collaboration, developing respect for teachers as learners and learners as teachers (Mezirow, 1991), and providing time for values to be explored, reflected upon, and discussed are essential processes that require some form of institutional support.

Having an institutional expectation that adopting videoconferencing may be a difficult yet exciting process could make it easier for staff to embrace the technical and pedagogical challenges that videoconferencing brings and to see them as a source of creativity and motivation to continue (Gunter, 1997) reflecting on practice, trialling, and researching new teaching approaches using emerging technology.

Conclusion

This paper has explored some of the potential for broadband videoconferencing as a rich medium that is able to enhance teaching and extend traditional approaches beyond one-to-many delivery of content towards student-to-student engagement in learning. Some of the challenges and issues arising out of the drive to change tertiary teaching towards learner-centred approaches to teaching and learning involved examining pedagogical and epistemological influences on the potential of broadband videoconferencing as a means of enhancing mixed-mode delivery. Based on extant research, there is great potential for broadband videoconferencing to add richness and flexibility to learning environments for distance students and to provide greater opportunities for teachers and students to engage interactively in their disciplines. If broadband videoconferencing opens up possibilities for engagement and control of learning previously

unavailable to students, it similarly enables teachers to engage in experimentation, collaboration, research, and reflection about potential teaching techniques. For distance teaching and learning, the greatest potential seems to be the ability for broadband videoconferencing to:

- improve teachers' and students' access to other teachers and students, thereby reducing the isolation of remote learners by facilitating the development of support networks;
- enhance the experiences of full-time students by providing them with opportunities to interact with peers or experts working professionally in the field;
- empower students by increasing the flexibility of learning situations so that students can choose to participate in real-time, archived or face-to-face activities as their needs and finances allow;
- engage remote students more fully, intellectually and emotionally, in their learning by combining videoconferencing with traditional learning activities and information communication technologies (Koenders, 2002);
- become more inclusive for students with disabilities or limiting geographical/familial circumstances.

Nevertheless, the innate potential of broadband for videoconferencing should not overshadow the importance of sound pedagogy to facilitate interactive learner-centred learning (Herrington & Bunker, 2002; Herrington & Oliver, 2002).

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