

Researching the effect of new technologies on teaching practice: an approach to understanding the video conferencing classroom

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Introduction

In *Technopoly* (1993), Neil Postman provides a rigorous critique of the impact of new technology on existing cultures and social practices.

One of his central ideas is that new technologies do not add to, or subtract from, existing experience; they fundamentally change it. How, then, do teachers experience new technologies and consequently approach their teaching with them? This paper will consider this question by looking at the example of university programs conducted by cross-campus video conferencing.

In broad terms video conferencing enables real time (synchronous) communication by aural and visual means allowing a teacher(s) and students at two or more physically separated locations to see and hear each other. Video conferencing is frequently described as the

instructional environment most closely resembling the regular classroom (Bradshaw and Brown, 1989; Nahl, 1993). There are several reasons for this view. First, it acknowledges that the physical setting in which the technology is located to create a classroom environment is similar to the regular classroom or, in many instances, is a regular classroom transformed marginally for the new purpose. In addition, cross-campus video conferencing requires the teacher and students to attend scheduled classes, unlike other forms of educational telecommunications using computer or audio media. Finally, the video conferencing medium results in a form of electronic face-to-face communication allowing participants to view each other, unlike many other instructional environments where participants are physically separated.

On the other hand, video conferencing also is a more complex environment than the regular classroom. For instance, the examples of video conferencing examined in this study involve two or three physically separated student groups. Video conferencing requires the use of video and other electronic media as well as sophisticated telecommunications carrier(s), and involves the direct collaboration of more than one teacher as well as the participation of technical support staff. If teaching is primarily about 'how the content is represented to students, how they are helped to come into a relationship with that material, and how learning occurs as a consequence of that engagement' (Martin and Ramsden, 1992, pp 154), then it is likely to be a much more demanding process when it involves video conferencing for the reasons described above.

However, despite the significant differences between the regular classroom and the video conferencing environment there is evidence that teaching by video conferencing does not produce a change in established teaching practice. Observing developments in the use of various educational technologies Laurillard (1993) contends that the video

medium of video conferencing invites the delivery of information by the teacher in a one-to-many transaction where the teacher serves as presenter, thus replicating the most prevalent form of instruction in higher education (Ramsden, 1992). In their research study of how teachers teach by video conferencing Gehlauf and her colleagues (1991) found that teachers continue to use traditional classroom teaching methods even when they do not believe they are effective in the new environment. How, therefore, can we explore the relationship between the video conferencing technology and the ways that teachers teach with it? What might this tell us more generally about how researchers should frame the research problem in order to study teachers' approaches to teaching with new technologies?

Finding a starting point in previous studies

This study takes its starting point from previous work in two fields: empirical studies of video conferencing teaching in higher education; and phenomenographic research into teaching and learning in higher

education (for an account of what he terms the phenomenographic 'research tradition', see Svensson, 1997).

Previous research into teaching by video conferencing is galvanised by a view of teaching which emphasises the predominant role and influence of the technology. This perspective assumes that it is the technology, more than any other aspect of the situation, which teachers focus on. It also assumes that the technology is experienced similarly by all teachers. This perspective is reflected in Schiller and Mitchell's (1993) study which determined that video conferencing

...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 (p 50).

Most noticeably much of the previous research has paid little or no attention to the content of what teachers are teaching by video conferencing, reducing the act of teaching in this environment to the teacher's technical or media skills. This stands in stark contrast to Ramsden's view that the 'content of student learning is logically prior to the methods of teaching the content' (1992, p 8); in other words there must be something to teach before there is need for a teaching method of any description. Overall the research literature on teaching by video conferencing has focused on:

- how the technology influences the teacher's teaching methods (Dillon, et al., 1991)
- comparisons of communication processes in the regular classroom and video conferencing classroom (Treagust, et al., 1993)
- the instructional effectiveness of video conferencing compared to the regular classroom (Whittington, 1987), or other distance education practices (Simpson, et al., 1993).

The phenomenographic research approach emerged more than 20 years ago as a way of mapping the qualitatively different ways in which a phenomenon is experienced. A fundamental idea underpinning phenomenography is that human actors can only act in relation to a world which they experience. Marton (1996) explains that

...in order to make sense of how people handle problems, situations, the world, we have to understand the way in which they experience the problems, the situations, the world, they are handling or acting in relation to. Accordingly, the capability for acting in a certain way reflects a capability of experiencing something in a certain way. The latter does not cause the former. They are logically intertwined. You can not act but in relation to the world as you experience it (p 178).

According to Marton (1996) the basic principle of phenomenography is that a phenomenon can only be experienced in a limited number of

qualitatively distinct ways due to the capacity, and structure, of an individual's awareness of the critical aspects of any phenomenon they experience. He goes on to explain that differences in how a phenomenon is experienced reflect 'different combinations of the aspects that we are focally aware of at a particular point in time' (p 184) and phenomenography aims to show the variation and the structure of the variation 'in terms of the different aspects which define the phenomenon' (p 186). By immersing her/himself in the collective descriptions of individual's experience of a phenomenon, the phenomenographic researcher identifies the qualitatively distinct ways that the phenomenon in question has been experienced. In phenomenography these differences are expressed as 'categories of description'. Ultimately, the categories of description are mapped out in what phenomenography terms an 'outcome space' which depicts the logical relationships between the identified categories (Marton and Booth, 1997).

Used primarily in educational research, phenomenography sees learning as being "a change in the ways in which one is capable of experiencing some aspect of the world" (Booth, 1997). Initial studies in student learning established that the qualitative differences in learning outcomes stem from students' qualitatively distinct approaches to their learning. What emerged from this early work, Dall'Alba (1996) concludes, was

...a conviction that investigations of learning must take into account

how the learning content was understood and how situations which involved learning were perceived by the learners (p 7).

More recently studies undertaken within phenomenography have addressed teachers' approaches to teaching in higher education in the regular classroom (Martin and Balla, 1991; Trigwell, Prosser and Taylor, 1994).

These studies point to relations between teachers' approaches to teaching and how they perceive the teaching environment (Martin, et al., 1997). What they do not address, however, is that teaching (and learning) takes place somewhere and that the physical setting of the classroom and the consequent arrangement of participants and the relations between them is a critical element of the teaching environment, affecting what teachers do and how they do it. The present study is a phenomenographic exploration of teacher' approaches to teaching in the context of the cross-campus video conferencing classroom which takes these aspects of the situation to be problematic.

Method

A phenomenographic approach has been adopted in this study which is primarily concerned with mapping the variation in the ways teachers experience and approach teaching in the cross-campus video conferencing classroom. Teachers' approaches to teaching in this situation will be described in terms of categories of description drawn from the collective pool of data. The categories represent phenomenography's

fundamental interest in the structure and the essential meaning of the different ways of experiencing the phenomenon under investigation (Marton and Booth, 1997), and do not describe any single teacher's experience.

Semi-structured interviews were conducted with university teachers in ten situations across a range of disciplines. Prior to teaching by video conferencing all the teachers' most recent teaching experience was in the regular classroom. Video conferencing was introduced in each case to achieve institutional goals of extending classroom-based

teaching practice. In each case the teaching function was performed by two or more teachers in various working relationships. Pre-interviews relating to a specific lesson were conducted with all teachers involved in the teaching (all the teachers were not involved in every lesson), and the lesson was observed. The pre-lesson interviews featured questions about:

- what the teacher intended to teach
- what the teacher would have the students do to learn the content
- comparisons between teaching by video conferencing in the cross-campus classroom and in the regular classroom
- the teacher's working relationship with the other teachers involved in this class
- how the teacher saw the relationship between the physically separated

student groups

Later a post-lesson interview was conducted to determine the teachers' views on the outcome of the lesson and how it related to their intended approach to teaching.

Categories of Description of Teachers' Approaches to Teaching by Cross-Campus Video Conferencing

Nine preliminary categories of description have been identified representing the qualitatively distinct ways in which a selection of university teachers approach teaching by cross-campus video conferencing. The categories of description are described in terms of "What is the teachers' focus when teaching by cross-campus video conferencing?" and "How do they experience teaching by cross-campus video conferencing? For the purpose of this paper only the broad dimensions of the phenomenographic outcome space will be described in the form of three of the nine categories, although the full extent of the range is represented.

How teachers experience the situation

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_Loss of personal control

_Desire to replicate previous practice as far as practicable

_Future potential of developing situation and technology

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_What teachers focus on

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_Setting

_A

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_Teaching

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_F

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_ Learning

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_ I

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Before addressing the limited outcome space presented above, let me make a few illustrative comments concerning the more complete finding. For instance, like Category A the Categories B to D each focus on an aspect of the physical setting (in Category B it is the technology; and in Categories C and D it is the multiple student groups existing at separated campus sites). Within the complete outcome space Categories A to D are closely clustered around one another. This is because the physical setting and the technology are integrally related in the cross-campus video conferencing environment as it is only through the technology's operation that the physically separated campus sites are linked for the teaching and learning process. Categories E and G share the teaching focus of Category F; whilst Category H has a learning focus like Category I.

Now, let me turn specifically to the limited outcome space presented in this paper. Category A is primarily concerned with the use and impact of the technology of video conferencing, and the situation is experienced as a loss of personal control over the teaching and learning process in comparison to the experience of the regular classroom. In Category F the focus is on teaching and the teacher, and the situation is experienced as an inclination to replicate previous practice from the regular classroom environment. Category I has a learning focus with respect to both student learning and the teacher's own learning about how to improve their professional practice in the new environment.

From another perspective, Category I stands apart from the other categories on the basis of its distinctive temporal dimension. This is the only category which is about the future situation, whereas categories A and F (and the other six categories not expanded upon in this paper) are about the present situation as experienced by the teachers.

The categories of description identified in this study do not represent any single teacher's experience of teaching in the cross-campus video conferencing classroom but, rather, the range of possible experiences found within the complete set of interview data. It is not the purpose of this type of analysis to categorise any single teacher as belonging to a specific category of description. In order to show the evidence on which the Categories A, F and I have been identified, and to compare

their distinctiveness and reveal their relationship to one another,
this paper will provide examples of data drawn from the interviews.

Evidence of Category A (with a focus on the setting):

In this category teachers are focused on the technology and, in particular, their dependence on its role in mediating the link between participating campus sites. The following comment is illustrative of the concern with the technology:

I will probably break out into a cold sweat because of the video conferencing environment, because we've had a great deal of trouble with the technology. When you walk into a lecture theatre you've no idea actually whether or not the thing's going to be up and running.

And it's been like that all year. So there have been a lot of technical difficulties...

In this category a critical aspect of teachers' technological dependence is their reliance on the participation and support of technical staff within the institution who assume a primary role in operating and maintaining the video conferencing technology, and sometimes training teachers in its use. A teacher said:

...the bugbear has been the machines, and the fact that there has been no co-operation between the people who are providing the technology and me...I don't know who they are, that's part of the problem. Nobody is responsible for everything. There are at least three different bodies sort of involved in installing the software and running the machines and all the rest of it. I have been unable all year to find out someone who will sit down and say, "yes, I am responsible for this". And nobody has asked me what I need to teacher the students...

But if you go to a workshop or something on video conferencing what they do is tell you what colour of paper to use, and what size of font you need to use, and what kind of clothes to wear and that sort of stuff. And what they're teaching you, what they taught you about is how to be a newsreader. They seem to lose sight of the fact that what your primary objective here is to teach. You're not putting on a presentation. I mean people use it for that and people use it for actually conferencing. But for me conferencing is not a part of the teaching, my classes are too big, the material is too technical. We're not there to chat about an idea we're there to write down equations and you know definitions and so on and get through a lot of material. I'm not interested in holding a conversation with the students. I mean that's not the place to do it in the lectures...

I would like to know before I walk into the lecture room that everything was going to work, exactly the same way as it worked last time, which I have been unable to do most of this year. I mean every

week when I have gone into the lecture theatre I have not known one; whether it would work, two; whether or not they'd made changes to the way it worked, or rather the way it didn't work. People would install features to the thing which are totally contrary to the way I present the material.

Evidence of Category F (with a focus on teaching):

In this category the focus is on what teachers teach to students; in other words what content the teachers see themselves as providing to students. Teachers' intentions are that this be equivalent to what they teach in the regular classroom setting, and they experience it as wanting to replicate their existing practice in the new environment despite impediments to achieving this. For instance, one teacher reflected:

Well I think that I use a fairly similar approach in both in that I try and present material directly to the students so most of the time is spent absorbing that knowledge. I try and present material that's fairly closely described in the text book so that they can follow that up with their own efforts but I think probably the main difference is brought about by the two disadvantages of the video link and the first one I've sort of described is that it is more difficult to induce interaction and hence force people to keep alert and follow the material that I'm talking about and the second one is that it is more

difficult to display the material.

As you can imagine a subject like biological chemistry I'll be using a lot of structures, showing these molecules, showing reaction schemes, it's all very descriptive, chemistry sort of has a language of its own,

it's all very pictorial and so in order to display that normally in a regular teaching situation I'd use an overhead which has the advantage of being able to show say a whole A4 sheet which is a typical size of an overhead and enlarging it, so that's able for everybody to see quite well whereas a document camera I would estimate really only shows about a quarter of an A4 sheet and shows it on the size of the TV so it really is a lot smaller and a lot less material is able to be visualised at any one time. Now I've tried to partially overcome this problem by preparing all my notes on a computer program, I use Chemdraw to draw my structures and that enables it firstly to be, I think, quite clear and secondly enables one to expand it to whatever size will sort of best overcome those problems. But nevertheless I certainly don't think that's a complete solution and it's my opinion that the document camera is one of the main limitations to teaching chemical subjects and probably most subjects by this method.

Could I ask you what you think you'll be doing tomorrow that is different, specifically different in this situation, with your teaching compared with a regular face-to-face classroom?

...I think that I'll be spending... a little more time say ten, twenty percent more time going through specifically what I have written on the overheads. So in some cases I'll actually even read out sections of text if there are any on those overheads whereas if it was clearly visible in sort of an overhead type fashion they will be easier for the students to glimpse straight away, but so in order to once again to overcome this problem of material being difficult to see I'll be trying to go through it a lot more thoroughly than I would otherwise....

...I think that with the actual material I would certainly be trying to get the same message across whether it was in either mode, talk about exactly the same subject matter.

Evidence of Category I (with a focus on learning):

In this category the focus is on the future possibilities for the teaching and learning process. The potential for improvement is seen to lie in the various aspects of the situation including the technology itself, how it is actually used, and the improved skill of the teacher.

This category differs to all of the others due to its distinctive temporal dimension concerned with the future teaching and learning process which may be enacted in the context of a potentially more effective form of cross-campus video conferencing. Unlike the other

categories where the point of comparison is with teachers' experience of the regular classroom environment, in this category teacher's experience is in juxtaposition to their current practice in the prevailing video conferencing situation. A teacher described his experience thus:

There are lots of things, good things we could do with the technology but we haven't done at the moment because we need some more money spent on it.

Like what?

Well there are two or three major things I could think of doing here. One is you could bring in outside experts and you can spend half an hour of somebody that could grab their attention or someone who's really expert on something that we think they should know about.

Where might they be located?

They could be anywhere in the world really if we could afford it.

So you're not talking about bringing them into either of the two existing locations?

No. That's one thing that we've talked about or I've talked about with some people and well the first thing is that I get is, of course

there's no money...for people to appear and we haven't got really the money to set up that link. If the money was there I could certainly see that would be a good thing to do. The other thing I would like to do is to plug in some other things into the technology, for example being able to use computer displays, particularly if we had an SVGA screen which is big enough for classrooms, or lots of little ones so they'd all be able to see. The SVGA screen is a better screen, shows more on it and we could also put in things like video and, well even given the present technology the things we could do which we haven't really done at the moment is using more demonstrations because the video camera can allow you to get up close to things and you can actually see it better than if you're in a real life classroom...

You can show just three dimensional models for example or you can show chemical reactions. Yes, you could probably show a lot of other things too in the other context, for example in Biology you might be able to show or demonstrate a dissection or something like that. So those sort of possibilities are things that I've thought about and talked about but we haven't really acted on...

Well I think I'm limited by the quality of the technology. I think the sort of things that I would like to put in, which I've mentioned before, aren't there yet and what I'd really like to do in the future is actually now go through a series of doing this in much shorter bursts and just doing it much better and then try and get on top of it from that way. And one hopes that in the process one could, I could

probably teach some of my colleagues or encourage some of my colleagues to learn more correctly about how to do it as well.

Discussion

The present study reveals that the relationship between new technology and teaching practice is much more problematic than previous studies of video conferencing teaching have assumed. Teachers see teaching in this situation as being more than using the technology. In fact, the teachers experience the technology of video conferencing in fundamentally different ways. For instance, in Category A (where it is the primary focus) it is experienced as creating the teacher's dependency on the technical device and its operation. On the other hand in Category I (where it is not the primary focus) it is experienced in terms of its capacity to empower the teacher to teach in new and better ways. Where the technology of video conferencing is the teacher's primary focus, and where teaching in this situation is held to be predominantly about using the technology, those teachers describe a less sophisticated approach to the teaching and learning process than is expressed in other categories.

The present study shows that teachers are focally aware of aspects of the situation other than the technology of video conferencing, such as the act of teaching, or student learning. The phenomenographic outcome space resulting from this study depicts hierarchically the focus of

teachers' concerns when teaching in this environment; in other words it moves from less sophisticated to more sophisticated central concerns. Thus, a concern with 'setting' (which includes both the technology and the multiple student groups) reflects a less sophisticated understanding than one focused on 'teaching' which, in turn, is less sophisticated than one focused on 'learning'. Within each of these hierarchical levels there are further distinctions (which this study has made but which have not been presented in this paper). From a

phenomenographic perspective, each of these stages, and the individual levels within them, are logically related and inclusive of the preceding ones. Marton and Booth (1997) explain that the categories of description represent a series of progressively complex subsets of the totality of the qualitatively distinct ways of experiencing the phenomenon in question.

Laurillard (1993) sees a direct relation between video conferencing as a presentational media type and the subsequent didactic form of teaching which is most commonly conducted in higher education with this technology. This is what Ihde (1978) in his phenomenology of technology refers to as technology's 'latent telic inclinations' which are present in the use of instruments, that is their essential orientation towards certain uses; and what Postman (1993) sees as technology's

...predisposition to construct the world as one thing rather than

another, to value one thing over another, to amplify one sense or skill or attitude more loudly than another (p 13).

However, this perspective places far too much importance on the teacher-technology relationship. Instead, researchers need to reconceptualise the research problem of how teachers teach with new technology. Moving beyond a simple technology focus, researchers need to address the teachers' experiences of a teaching and learning process situated in a context (involving technology) where critical aspects of the instructional environment (such as the physical separation of teacher and student) will be more or less familiar to that teacher. The question is, in this situation what aspects are at the fore of the teachers' awareness?

In their study of teachers teaching by audio conferencing, Kirby and Chugh (1992) show a relation between what teachers focus on in the instructional environment and their approach to teaching. One group of teachers were concerned with the technology to be used, the skills required to use it, and were more sensitive to the type of mediated instruction which it generated. Alternatively, a second group of teachers were concerned with issues generally associated with teaching in the regular classroom and were 'more firmly embedded in a traditional paradigm of instruction' (p 36). This research points to the need to address the way that teachers' experiences of a new instructional environment (and a new technology) are affected by their previous experience.

The teachers in the present study come from backgrounds in regular classroom teaching and they are not instantly divested of this experience when engaging with a new situation. Rather, the former experience is a powerful device for framing their latter experience. A critical aspect of any teacher's previous experience is their individual approach to teaching and how they understand their role as teacher. The phenomenon of the cross-campus video conferencing situation, and the various aspects within it which they are focally aware of, is experienced in terms of the teacher's intention to teach something to students in a particular way. As Ramsden (1992) reminds us, to teach means to teach something to someone. In other words, prior to encountering the new situation (cross-campus video conferencing) the teachers in this study have an intention with regard to how they understand their role as a teacher in a discipline with specific content to teach.

Rather than determining their approach to teaching, the cross-campus video conferencing situation presents the teachers in this study with an environment which accommodates their existing approaches to teaching. That is, it is a sufficiently familiar experience, despite its distinctiveness, for teachers to be able to adopt their existing approach to teaching in terms of what they teach and how they teach it.

In comparison, it is unlikely that any of the teachers in this study

would have found the traditional distance education environment, with its reduced interactivity and reliance on printed materials, as instantly familiar to them and therefore as accommodating of their prevailing approach to teaching. In other words, some instructional situations involving new technology are more able to sufficiently accommodate the teacher's previous practice than others by requiring fewer new operational or media skills on the part of the teacher, or by being less confronting to their approach to teaching. Therefore, if didactic teaching is the predominant form of instruction in higher education's regular classrooms (Ramsden, 1992), and the video conferencing environment most closely resembles the regular classroom (Bradshaw and Brown, 1989; Nahl, 1993) then it is little wonder that it is the most common (reproduced?) teaching method conducted by video conferencing, as Laurillard (1993) reports.

The question of how previous experience frames the way in which individuals encounter new experience has been discussed by Prosser and Trigwell (1997) in considering ways of understanding individual acts of teaching and learning. They state

...a teacher with some prior experience of teaching in a teaching situation will perceive the situation in a certain way because of his/her prior experiences, and adopt a certain approach to teaching, with related outcomes. All aspects of this situation will be a part of the teachers' awareness at all times, but some components may be more to the fore than others at any instant (p 250).

Therefore, for researchers addressing the way that teachers teach with new technology the critical relationship is not the teacher-technology one which has dominated previous research. Rather, it is the relationship between a teacher's previous experience of, and approach to, teaching and learning (and the situation in which it takes place) and the new situation they are confronted with, where the technology is but one of a number of key aspects in their focal awareness.

References

- Booth, S. (1997) On phenomenography, learning and teaching. Higher Education Research and Development, Vol. 16, No. 2, pp 135-158.
- Bradshaw, D. and Brown, P. (1989) The Promise of Distance Learning (Policy Briefs, No. 8), Far West Laboratory for Educational Research and Development, San Francisco.
- Dall'Alba, G. (1996) Reflections on phenomenography - An introduction. In Dall'Alba, G. and Hasselgren, B. (eds) Reflections on Phenomenography, toward a methodology?, Goteborg Studies in Educational Sciences 109, pp 7-17.
- Dillon, C., Hengst, H. and Zoller, D. (1991) Instructional strategies and student involvement in distance education: A study of the Okalahoma televised instruction system. Journal of Distance Education, Vol. vi, No. 1, pp 28-41.
- Gehlauf, D., Shatz, M., and Frye, T. (1991). Faculty perceptions of interactive television instructional strategies: Implications for training. The American Journal of Distance Education, 5 (3), pp 20-29.
- Ihde, D. (1978) Technics and Praxis, Reidel Publishing Company, Boston, USA.

Kirby, D. and Chugh, U. (1992) An investigation of instructors' perceptions of elements in the audio-teleconferencing environment. *Journal of Distance Education*, Vol. vii, No. 1, pp 25-38.

Laurillard, D. (1993) *Rethinking University Teaching, a framework for the effective use of educational technology*, Routledge, London.

Martin, E. and Balla, M. (1991) Conceptions of teaching and implications for learning. *Research into Higher Education*, 13, pp 298-305.

Martin, E., Prosser, M., Benjamin, J., Trigwell, K. and Ramsden, P. (1997) Heads' of academic departments conceptions of leadership of teaching. In Rust, C. and Gibbs, G. (eds) *Improving Student Learning, improving student learning through course design*, Oxford Brookes University.

Martin, E. and Ramsden, P. (1992) An expanding awareness: How lecturers change their understanding of teaching. In Parer, M. (ed) *Research and Development in Higher Education*, Vol. 15, pp 148-155.

Marton, F. (1996) *Cognosco ergo sum - Reflections on reflections*. In Dall'Alba, G. and Hasselgren, B. (eds) *Reflections on Phenomenography, toward a methodology*, Goteborg Studies in Educational Sciences 109, pp

163-187.

Marton, F. and Booth, S. (1997) *Learning and Awareness*, Lawrence Erlbaum Associates, New Jersey.

Nahl, D. (1993) Communications dynamics of a live, interactive television system for distance education, *Journal of Education for Library and Information Science*, Vol. 34, No. 3, pp 200-217.

Postman, N. (1993) *Technopoly, the surrender of culture to technology*, Vintage Books, New York.

Prosser, M. and Trigwell, K. (1997) Towards an understanding of individual acts of teaching and learning. *Higher Education Research and Development*, Vol. 16., No. 2, pp 241-252.

Trigwell, K., Prosser, M. and Taylor, P. (1994). Qualitative differences in approaches to teaching first year university science. *Higher Education*, 27, pp 75-84.

Ramsden, P. (1992) *Learning to Teach in Higher Education*, Routledge, London, 1992.

Schiller, J. and Mitchell, J. (1993) Interacting at a distance: Staff and student perceptions of teaching and learning via videoconferencing. *The Australian Journal of Educational Technology*, Vol. 9, No. 1, pp

41-58.

Simpson, H., Pugh, H. and Parchman, S. (1993) Empirical comparison of alternative instructional TV technologies. *Distance Education*, Vol. 14, No. 1, pp 147-164.

Svensson, L. (1997) Theoretical foundations of phenomenography. *Higher Education Research and Development*, Vol. 16, No. 2, pp 159-171.

Treagust, D., Waldrip, B., and Horley, J. (1993) Effectiveness of ISDN video conferencing: A case study of two campuses and two different courses. *Distance Education*, Vol. 14, No. 2, pp 315-330.

Whittington, N. (1987) Is instructional television educationally effective? A research review. *The American Journal of Distance Education*, Vol. 1, No. 1, pp 47-57.