**Interactivity in telelearning environments: Using communication and dialogue meaningfully in the learning process.**

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## Introduction

New technologies using telecommunications capabilities are providing many opportunities for distance education and open learning. The term, *telematics*, is often used to describe delivery media that employ telecommunications to achieve real-time interaction. Two forms of telematics learning environments that are currently being used in Western Australian schools are *audiographics* and *live interactive television*.

Audiographics involves, at a minimum, two telecommunications links, one which connects computers via modems and a second link which provides an audioconferencing medium through a normal telephone connection. Live interactive television involves the combination of a one-way television signal with a toll-free callback telephone enabling students to communicate directly with the teacher during program transmission. Both these technologies provide heightened opportunities for interaction and communication in distance teaching and learning programs. The actual communications and interaction that occur with these technologies demonstrate in many instances an underutilisation of the opportunities. In this paper we describe some studies of the use of these technologies in Western Australian schools and outcomes from research into the nature and forms of interactivity evident in telematics teaching.

## Communication and Learning

The use of telematics as a delivery medium for distance education and open learning appears to hold many advantages over conventional delivery forms. The principal advantage appears to come from the forms of communication which are supported. With telematics, students and teachers have a heightened capacity to communicate and interact. The importance of the teacher-student and student-student interactions in successful teaching episodes is attested to by a considerable body of research (eg. Webb, 1991; Bennett & Dunne, 1991). Laurillard (1994) describes learning as comprising a number of interactive processes without which concepts, skills and knowledge tend to be inert and lacking in the generalisability needed for transfer and application to other domains. The teacher-student interactions in many teaching situations can occur for reasons other than providing cognitive support to foster deep learning (McLoughlin and Oliver, 1995).

The recognition that learning and everyday cognition are tied to social interaction has lead theorists to pay close attention to the influence of social interaction on learning (Resnick, Levine and Teasley, 1991). Effective models of teaching and learning (Brown, Collins and Duguid, 1989) have been shaped by sociocultural theory which sees learning as highly social and culturally embedded (eg. Vygotsky, 1978) . This theory emphasises the role of social interaction in cognitive development and thinking processes. According socio-cultural theory, dialogue in a learning setting plays an important part in helping learners to internalsise ideas and knowledge from the social plane. Whereas much of the research applying Vygotsky's work has been based on the asymmetric interactions of a teacher and learner, contemporary research is also investigating the interactions in more symmetrical learning environments involving learners working collaboratively (John-

Steiner and Mahn, 1996). Interaction among peers offers opportunities and support for cognitive development. When learners have to explain ideas to each other, irrespective of the relative abilities of those involved, a more explicit and organised understanding can result (Mercer, 1996). This form of co-construction leading to cognitive change is a critical part of Vygotskian learning theory.

If it is accepted that learning is a socially organised educational activity involving talk, interaction and dialogue between learners and adults or expert teachers, it follows that there are different ways of conceptualising learning in directions that connect it with the social world, with language and with culture. For Laurillard (1993) this means the adoption of a communicative model of education, in which knowledge is a negotiated commodity. Like socio-cultural theory, Laurillard's conversational framework provides a social and communicative perspective on teaching and learning. Learning is culturally influenced and a social rather than an individual process. Vygotsky believed that " human learning presupposes a specific social nature and a process by which children grow into the intellectual life of those around them" (1978, p. 89). Language plays a vital role in enabling the learner to participate and communicate with others, and so talk and interaction are therefore essential to learning (McLoughlin and Oliver, 1997).

In technology-supported telematics classrooms these elements are vital to the success of the lesson, and are recognised in the socio-cultural framework of Vygotsky. The second theoretical concept associated with the socio-cultural framework is the use of tools and signs to mediate learning about the world. According to Vygotsky (1978) signs include language, mnemonics, mathematics language, art, diagrams etc. Tools on the other hand, mediate forms of interaction with the environment and support problem solving and development of understanding. Such technologies as computers are part of the communication process in many classrooms, and they are also part of the social fabric of learning as they support interaction and provide a focus for discussion through shared screens, problem-based collaborative tasks and communicative activities.

Adopting a socio-cultural view of learning has several implications for how technology is viewed. Once we accept that cognition is socially grounded, the various communicative and interactive technologies may no longer be seen as merely supporting individual achievement. This has implications for:

- the role of the technology in learning;
- the role of the teacher in relation to how the technology is used; and
- the social organisation of the classroom.

Nastasi and Clements (1993) suggest several reasons for the influence of social processes in facilitating learning and cognitive change. They suggest that cognitive change may result from the explicit interpersonal conflicts that occur as individuals solve problems collaboratively. In addition, they argue that it is through engagement in reciprocal sense making in which different perspectives are coordinated and ideas generated that social processes mediate learning. This line of reasoning is supported by the research of Kutnick and Rogers (1994) who show that both cooperation and conflict are effective in facilitating cognitive change. Both studies found that a critical component of the discourse leading to cognitive change was students' negotiation of cognitive conflicts as they explored alternative views on an issue.

The place of communication and talk in educational settings is growing in status. Mercer (1996) asserts that talk is now recognised as more than a means for sharing thoughts: it is a social mode of thinking, a tool for the joint construction of knowledge by teachers and learners. He qualifies this statement with the observation that talk and

collaboration, while useful classroom activities, do not necessarily guarantee learning. Their effective use must follow some general principles and procedures associated with particular forms of student participation and planned instructional contexts.

**Telematics Learning Environments**

We have reported in the past years on a number of investigations of teaching and learning in telematics learning environments. In a recent study (Oliver & McLoughlin, 1997), we observed and studied six classes where audiographics was used to support teaching and learning in language programs in rural communities in Western Australia. This study used a form of dialogue analysis to examine the nature and forms of interactions in the learning environment. The observations revealed that the interactive technologies played a critical role in the lesson delivery. There were, however, a number of behaviours evident across all classes which provided some interesting insights into how teachers were using the technologies.

The audio link was clearly the principal interactive element and it was used to deliver lessons with many of the characteristics of face-to-face teaching. The computer link was rarely used in the lessons in ways that took advantage of the interactive capabilities of the technology more than its display capability. The potential role of the computer in the audiographics teaching appeared not to be fully recognised or appreciated and it was evident that few teachers were aware of instructional strategies and practices that might enable the computer to contribute significantly to lesson delivery.

The learning environments that were observed tended to have low levels of learner control and were typically teacher-centred and strongly teacher-directed. While these forms of interactions appeared to be suited to the nature of the curriculum being delivered, it was evident that few teachers used instructional models that would enable them to seek higher-order learning outcomes. The interactions provided the means to create a positive and engaging learning environment but were rarely used to seek particular learning outcomes or advantages.

There was much evidence of the story-telling mode of teaching where students listened and responded to the information supplied by the teacher. There was little evidence of negotiation where the students and teacher communicated on equal terms to pursue meaning or to construct personal ideas and models. For this to be achieved, it would be necessary for more interactions of an explanatory form to be included together with more meaningful communication where feedback plays an important part in the conversation. There would need to be more student-initiated dialogue and questioning directed to the teacher and among learners.

In a parallel study, we also investigated the nature of the interactions and communication in local telematics classrooms supported by live interactive television. This study involved a detailed investigation of teacher and student dialogue in five courses in Western Australia. Once again, analysis of the dialogue was used to explore the nature of the communications between teachers and students and to explore the impact of the technology use on learning outcomes (Oliver & McLoughlin,1996; Oliver & McLoughlin, in press).

The study found that instructors tended to use the interactive elements of the technology more to create a supportive and stimulating learning environment, than for instructional support. Observations of the forms of instructor-student dialogue revealed that those most frequently employed were of an informative and expository nature where both parties gave information to the other in relatively short exchanges. The visual link

provided a powerful support for information and content delivery which tended to be used consistently in conjunction with the audio link.

Analysis of teaching via live interactive television reveals that instructors underutilise the opportunities afforded by the medium to support cognitive interactions (McLoughlin and Oliver, 1997). Most instructors used the audio channel to give instructions and direction and to present and deliver the lesson content in the form of explanatory one-way talk. While this may be skilfully executed and supported by visual cues and appeals to student motivation, the essential dynamics of the teaching-learning interaction are missing. It is our belief that the communicative capabilities of the technology could have been used to support two-way dialogue, interaction and reflection, and engage the learners as co-participants in the learning process.

Supporting cognitive exchanges with live interactive television requires a degree of skill and experience on the part of the instructor. It is a teaching skill that must be developed and acquired. The instructor needs to be able to incorporate interactive elements into the instructional program in a planned and deliberate fashion. The outcomes from the study demonstrated possible shortcomings in the instructional practices commonly used with this medium with most instructors displaying didactic teaching practices which in turn limited the opening for students to participate, interact and engage in dialogue. Talkback television has the potential to support interactive learning at distance, but this requires recognition not only of the interactive capacities of the technology, but also of the communicative, social and dialogic aspects of learning.

**Extending learning in telematics learning environments**

More recent application of telematics to support learning at a distance provide examples of environments where technology can extend curriculum offerings and provide specialist support to rural students. In 1996 the Academic Talent program in Western Australia was offered for the first time via telematics. Four schools in the Perth metropolitan area were involved in delivery of mathematics, science, humanities and LOTE to a cluster of five rural schools. Most lessons were multipoint deliveries, ie teachers taught to two or more remote schools simultaneously.

The curriculum frameworks for the Academic Talent Program (ATP) were developed to encourage and support the development of students' cognitive, social and emotional well being regardless of location, gender or social class. Teachers utilise the curriculum guidelines to develop programs which extend, enrich and accelerate talented students in a special program tailored to their needs.

The provision of such a program via telematics presents interesting challenges insofar as it entails exploiting the technology to achieve a level of communication that will extend learners' thinking skills. Our current studies are being conducted in such learning environments and we are exploring ways in which telematics can be used to support the aims and objectives of the Academic Talent Program (McLoughlin, Oliver and Wood, 1997).

Clearly there are challenges to the implementation of a successful Academic Talent Program using telematics as a medium for delivery. The effective development of programs for gifted and talented students requires a coherent and well grounded perspective on higher level thinking skills and technology use. In all instances, the communicative and interactive capabilities of the technology when combine d with appropriate pedagogies have the potential to provide the forms of support needed. In order to fully realise this potential, telematics learning environments need to be created that foster collaboration, dialogue and

communication among students who are learning in geographically separated classrooms. Our observations of these classrooms has enabled us to develop guidelines to assist teachers and instructional designers to maximise learning through technology.

**Appropriate technology use**

Clearly, pedagogical outcomes relating to higher level thinking require particular patterns of interaction which foster active learning. Teachers need to use a range of strategies to engage students in remote classrooms and be aware of the impact of their practices on student behaviours. Technology can be used to support learning rather than merely mediate communication, or act as a conveyor of the teacher's instructions. Computers of themselves, do not transform the learning experience.

For telematics classrooms, the "extended classroom model" (Burge and Roberts, 1993) would seem to offer advantages for gifted and talented students, as it is based on a number of educational practices which utilise the technology in support of student learning, autonomy and higher level thinking skills. It involves changes to didactic teacher-centred patterns of interaction that have been found to characterise telematics classrooms. It is characterised by fundamental *changes in perspective* from a view of learning confined to the classroom and controlled by the teacher, to one of a learning environment which is supportive, extended and distributed, consisting of a community of learners. It also embraces a changed view of technology from that of a device to deliver content, to a resource which can display creative ideas, provide support for inquiry, and extend thinking by bringing together students from different locations. The extended classroom model also necessitates a change to the notion of telematics as supporting teaching "content" to multiple sites simultaneously to allocating responsibility to small groups for self monitoring and sharing of ideas, and analysing information, ideas and experiences.

Adoption of the extended classroom model encourages teachers to create opportunities for higher order thinking skills by giving students more responsibility for their learning and by fostering communication between remote sites using the communications networks. Teachers can oversee social interaction in groups to ensure that there is equal participation between the remote schools. Alternatively, creative forms of leadership where students take control can be encouraged, rather than teacher initiated discourse.

**Students as active participants**

For teachers engaged in telematics delivery, it is essential to reflect on the basic processes that occur in the classroom and to assess the degree to which the pedagogy and tasks contribute to the development of independent self-regulated learning. Very often the demands of the syllabus can lead to a focus on transmission of content and a neglect of dialogue and interaction..

For teachers, some of the major issues that need to be considered are those such as their role in the learning process, the role of the student and appropriate teaching strategies. Telematics environments have the potential to foster self-directed and autonomous learning through appropriate use of the technology and the orchestration of appropriate interactions with learners.

Our current inquiries are now focussing on investigating the extent to which instructional design which embraces socio-cultural theories of learning can lead to higher order thinking in telematics classrooms. The study explores student actions and dialogue in classrooms where teachers are encouraged to develop learning environments with high levels of communication, collaborative discourse and student-centred activity.

**Summary**

This paper has reported on recent studies which have explored the communication and interaction patterns in telematics learning environments. Findings suggest that few teachers are able to fully exploit and use the potential offered by the various technologies and that alternative ideas for instructional design are needed. We maintain that the socio-cultural theories of learning can guide the development of more effective learning environments for telematics. We are currently testing these claims in a large scale project exploring the use of audiographics in the delivery of the Academic Talent Program to students in Western Australian schools.

Although there are many challenges to the implementation of a successful academic talent program using telematics as a medium for delivery, we believe that the effective development of programs for gifted and talented students can be achieved if due consideration and attention are given to:

- the use of a coherent and well grounded perspective on the higher level thinking skills that unpins teaching practices;
- use of technology which creates a learning environment and provides a supportive, extended and distributed community of learners; and
- a role for students as self-directed and autonomous learners engaged in higher order cognitive processes such as problem generation, reasoning and critical thinking.

Our study is investigating how these elements can be incorporated into telematics learning environments and the forms of learning outcomes that are brought about. Initial impressions indicate that the socio-cultural perspective can contribute to pedagogical practice and development of higher order thinking processes in telematics environments, and that the research will help us construct a framework that will support, foster and extend teaching practices to enhance learning.

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