Who is in Control? Defining Interactive Learning Environments

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Abstract

This paper will seek to address the pedagogical principles inherent in the design of learning environments with such educational media as telematics and live interactive television. By drawing on actual examples of interactive learning in these environments, the nature of dialogue and communication in the learning process will be described. The paper will argue for a conception of leaning that is dynamically responsive to the needs of learners. An emphasis on shared understanding rather than teacher-dominated discourse will characterise the framework described.

The paper will draw on the outcomes of our research and observations of learners at a distance in the electronic classroom and their process of learning to control the environment. Mastery for these students entails not merely analysing and reformulating information, but also manipulating the means of communication (e.g. shared graphics, audio) and using the learning materials. In traditional classrooms, students must achieve a sense of mastery over the content, and negotiate this with the teacher. In both learning environments, different types of interaction occur, but they share common features. Active participation by the learner in the learning process can be achieved in both contexts, but in the electronic classroom and computer environments, this participation requires teachers to redefine their roles in a more conscious, planned and systematic manner. The paper will describe some of the instructional design considerations that have emerged from our research on these technology-mediated learning environments.

Keywords

interaction, learner-control, telearning, communication, telematics

1. Introduction

In this study, two technology-supported learning environments, audiographics and live interactive television, are analysed in order to investigate the locus of control in the interactions between the instructor and learners. Learner control has been the subject of intensive research from many perspectives, for example, psychological, motivational and pedagogical (Lee and Lee, 1991; Keller and Kopp, 1987; Tennyson, Park and Christensen, 1985), since it is assumed that learners will be more highly motivated if they are allowed to self-regulate their own learning.

Much of mass instructional technology, for example broadcast television, is aimed to direct and focus students on the same elements and tasks. Teacher fronted classrooms and lectures at university perform similar functions, and share similar didactic presentation styles. In contrast, interactive learning systems such as computer-based learning and multimedia give learners many options and control over aspects of the learning process, for example, display control, pace and

sequence control. These interactive features are highly valued as they enable the learning to be individualised according to each learner, and are widely believed to enhance instructional outcomes.

2. Control as a Continuum

The construct *control* means having power over events, strategies or circumstances, including the dimension of interpersonal control. In the educational context, learner control means that students will be able to regulate their own learning, thus exercising choice and discretion over the sequence, pace and amount of information they can process (Chung and Reigeluth, 1992). It also means having the scope to choose appropriate strategies to manipulate the cognitive processing demands within a lesson.

The amount of learner control varies among tasks and types of environments and may be conceived as a continuum ranging from total learner control (e.g. in multimedia) to total instructor control (e.g. in a lecture).

The learning environments under scrutiny were expected to fall towards the instructor controlled end of the continuum, as previous research on classroom interaction indicates that 'lessons' are asymmetric speech events, where there are unequal communicative rights and claims to knowledge (Edwards and Westgate, 1994). The present research aims to expand the available data on student control of learning by looking at telelearning environments, and investigates how this control is managed and what patterns of interaction result.

3. Supporting the Learning Process

The growing trend in Australian universities towards more flexible and open forms of education and training has seen an increasing level of adoption of telelearning environments. These environments are characterised by instructional settings where teachers and students communicate at a distance through the use of telecommunications technologies. Common examples of telelearning environments include audiographics, interactive television, videoconferencing and more recently computer-mediated communications such as e-mail.

Supporting the learning process with appropriate technologies is a fundamental issue which educators must face, as the logistics and resources available indicate that flexible delivery options must serve learners in remote and isolated locations. In Western Australia, *telematics* systems are used in the delivery of education at primary secondary and tertiary levels (Oliver and Reeves, 1994). As used in the present article the term refers to:

- audiographics delivery, where computer communications provide the classroom with an interactive blackboard (the computer screen) which can be shared by teacher and students;
- live interactive television (LIT), in which one-way video, two-way audio are combined to enable the viewed to see and interact with the presenter.

These technologies can support interaction between teacher and students through:

- real time communication;
- two-way audio links; and
- document interactivity via facsimile.

The research was carried out in order to clarify the nature of interactions in both audiographics and live interactive television environments and to analyse the nature and locus of control. Previous studies of learner control have not been conducted on these particular environments and our objective was to use the observations as a basis for instructional design. The outcome of the research is intended as a guide to teachers to help learners make appropriate and effective control over learning processes in telelearning, i.e., teaching contexts in which audiographics and educational television are employed.

The first stage of the research centred on the degree of autonomy and control demonstrated by students in:

- controlling and using the technology for interaction and learning;
- demonstrating configurations of learning independent of the teacher; and
- demonstrating behaviours which result in a change of teacher strategy.

Before detailing the observations made, the centrality of learner control in the learning process will be established.

4. Learner Control and Motivation

Research in a number of disciplines has indicated that contexts which support autonomy as opposed to controlling behaviour lead to positive outcomes. When learners, whether adults or children perceive that they have control over their own learning they achieve more positive outcomes, greater interest, more trust, higher self-esteem and greater persistence (Deci and Ryan, 1987). Interpersonal, social and educational settings can either support autonomy or exert a controlling function depending on events like feedback, imposed deadlines, and choice offered.

Previous research has indicated the increased benefits to students of self-determination (Papert, 1980) and control (Keller and Kopp, 1987). Other examples from research on multimedia (Carrier and Williams, 1988) found positive outcomes relating student control to improved learning. Motivational theory research (Keller, 1979) has demonstrated that when students are given some control over aspects of their learning, they are more likely to have positive feelings towards the task combined with intrinsic motivation. Previous research on learner control in hypermedia (Becker and Dwyer, 1994) provides evidence that self determination and overall intrinsic motivation of students may increase with appropriate design. Laurillard (1984) also conducted a study relating to perceived control and found that learning enjoyment increased when students were given control.

These studies attest to the importance of student control in the learning process, at both a theoretical and practical level. Consideration also needs to be given to pedagogical and theoretical principles which provide a rationale for student control over the process of learning.

5. Models of Teaching and Learning

How does learner control relate to the process of learning? Two broad descriptions, or models, of the learning process are suggested by Laurillard (1991), broadly described as the *communication* and *didactic* models respectively.

Each of these defines a different meaning for student control. According to the didactic model learning is viewed as the transmission of facts to the student. Subject matter is knowledge of givens, facts and the content of the syllabus. Teachers impart to their students a corpus of facts,

descriptions of the world and events. The pedagogic practice which ensues gives the teacher total control over content, how it is taught and when and how it is presented. Learners have a minor and quite passive role in the learning process. Teaching refers to the activities carried out by the teacher while imparting the content; learning is assumed to occur as a result of these activities. What, or how the learner must perform in order to learn are not central considerations.

A contrasting theoretical landscape is the communication model which sees knowledge as the outcome of negotiation and discourse. Accordingly, students must construct their own understanding and perspective on the subject by participating in dialogue with a teacher. The role of the learner is

> ... self regulative, in that he (sic) actively controls the sequence of knowledge. The teacher is a guiding significant other to induce the child to reflect on the emerging logic and to use it as a generating base for acquiring future knowledge. (Esland, 1971, p. 95).

Within the communication model, the validation of good teaching is not the acquisition of facts, but the active and constructive activity of the learners in the developing autonomy, responsibility and control of what and how they learn. This view is consonant with cognitive conceptions of learning which give centrality to the role of the student in negotiating meaning (Pask, 1976). Four essential processes are identified as fundamental to learning: discussion, adaptation, interaction and reflection. These the learner must engage in to reach understanding and knowledge (Laurillard, 1993).

In a later article, Laurillard (1994, p. 19) reflects that 'the world the learner interacts with is necessarily a teacher constructed part of the world'. This is often by necessity the reality. Even when adopting a student-centred approach it remains the teacher's task to construct appropriate learning experiences for the student. Achieving the right balance between learner control and teacher direction is the real issue for instructional designers.

In adopting the communication model for the present research, the question is its applicability to situations where the teacher is absent, and where dialogue, the essential ingredient, is mediated by technology. Is it possible to maintain the communication model as a paradigm of good teaching for the electronic classroom? And if so, how must teachers redefine their own roles and those they assign for their students?

Our view was that this model was an appropriate starting point for telelearning environments, where all activity is predicated on the dialogue and interaction between teacher and students. Although we anticipated that the telelearning environments would tend towards the didactic model displaying a narrow range of interactions as previous research had indicated (Oliver and Reeves, 1994; McLoughlin, 1994), we had a clearly defined view that the learning process should approximate an educational conversation where all participants have a degree of control over their involvement in the learning process.

6. Interactivity, Dialogue and Learning

The popularity of telelearning as a medium for distance and open learning programs stems from its capacity to provide interactivity between teachers and students. Interactivity is recognised as an important element that can contribute significantly to the effectiveness of instructional episodes. Questions still remain, however, as to the optimal forms and nature of effective interactions in telelearning environments.

The terms *interaction* and *interactive* are now ubiquitous, and their association with multimedia environments has led to the unrealistic expectation that all interactive technologies guarantee

instructional interactions between the learner and the environment or software. In the context of the present research, it was considered essential to adopt a functional definition of interactivity. This means that interaction was viewed, not as an attribute of the technology, but as an outcome of communication dynamics resulting from planned instruction.

Active learner participation in the learning process means giving control to the learner of the pace, sequence and form of the instruction (Livengood, 1987), rather than some lower order activities such as clicking a mouse, or pressing a space bar.

In analysing the telelearning environments our concern to apply our analytic processes to the dialogue occurring in these classrooms. Talk was viewed as the focus and source of data. To record and deconstruct interaction in these settings we observed how language was used to organise various tasks and activities, looking at each setting at a distinct communicative event. We observed that a range of functions was served by the discourse which occurred, for example, stating expectations, encoding, explaining, giving or receiving feedback, questioning, evaluating and hypothesising (table 1).

7. Approach to Analysis of Data

For the research undertaken, a total of eight hours of telematics and twelve hours of educational television were viewed, and transcripts were made of all the exchanges between teachers and students, and among students themselves. The following research questions guided the interpretation of data:

1. How did students manifest their control of the medium?

2. When and how did teachers give control to the learners?

3. When and how did students assume control?

For each of these questions, both telematics and educational television lessons were analysed. The rationale was that while the lesson was approached as a communicative event where participants had unequal communicative rights, the questions would bring into focus any opportunities or potential for the lesson to be viewed as *an instructional conversation.* In this way, the pedagogic interventions could be planned so as to provide a closer approximation of the communication model.

7.1 How students demonstrate control of the technology?

In telematics and educational television environments, dialogue is maintained by means of a two-way audio link which remains open throughout the lesson. In addition, both learning environments are synchronous. While telematics provides a shared visual screen, a computer interface on which both parties can write, teachers and pupils cannot see each other. In live interactive educational television (LIT) however, the students can see the teacher throughout the lesson.

In both environments the students were observed to use and manipulate the technology for interaction independently of the teacher. For example:

- confirming that participants were ready to commence lesson (audiographics);

- using the shared graphics interface (audiographics);

- using the audio link to ask and answer questions (audiographics and LIT); and

- collaborating on tasks that were assigned on the computer (audiographics).

Thus, in both environments, students demonstrated the capacity to use the technology effectively to establish dialogue. However, in the telematics environment, the teacher appeared to circumvent any direct student control by continually directing, questioning and evaluating all student initiatives.

7.2 Did teachers give control to the learners?

Overall our observations showed that teacher led discussion and questioning dominated the lessons in both telematics and educational television. In the audiographics lesson, the teacher set group tasks or games, but still kept control by demanding student responses at regular intervals.

During the live educational television broadcasts, a different scenario occurred. When students phoned the presenter in response to a request, they were given adequate scope and time to express their views. On such occasions, the exchanges were more akin to an educational conversation, with discursive and interactive exchanges between student and presenter.

7.3 When and how did students assume control?

In both environments, there were instances when students assumed control, not only of the technology but of the lesson. In the audiographics lessons, for example, the teacher was reliant on student feedback to indicate when the class was ready to commence, and on whether the lesson was being transmitted on screen. For the most part this cooperative element worked well, and students and teacher shared the responsibility for the technology. Most of lessons observed allowed little scope for digression from a pre-ordained plan of teacher domination. In the audiographics sessions, students showed some resistance to this pattern of interaction by delaying their responses or by collaborating on tasks which were intended for individual attention. This tendency was evident across all the lessons observed.

7.4 What patterns of interaction occurred independently of the teacher?

Various configurations of learning occurred in both audiographics and educational television which were independent of the teacher. Firstly, in the audiographics lessons, where small groups at various sites were linked via computer and telephone, the students formed a cohesive group and tended to assist each other with the tasks, support each other and to interact more within the group than with the teacher. Several teachers attempted to generate intergroup activity with games and simulations, but intervened at regular intervals.

In the live talkback TV episodes, a variety of functions (e.g. explaining, negotiating, clarifying) were recorded when students dialled the toll-free telephone number in order to talk to the presenter. Other configurations of learning and interaction may have occurred at the telecentres where viewers congregated to watch the program, but these informal networks were outside the scope of the present investigation.

7.5 Overall observations

In the telematics environments under investigation, there was little systematic effort given to involving students in areas where they had a choice over the content, the learner activity or the pace of the lesson. There was some evidence, however, that the learners had the potential to control the technology and to manipulate the progress of the lesson, though they were given little scope to pursue their own interest, or to give expression to their views on what was happening. Students did not question the teacher at any stage, not they generate any questions among the group. The teacher maintained strong control over classroom management, activity setting and questioning. Indications of group solidarity were ignored, and teachers frequently directed questions to named

individuals, thus creating a face threatening situation. Learning with audiographics was therefore seen as conforming quite closely to the didactic model.

In the live interactive television episodes, those sequences of dialogue recorded and transcribed indicated that the notion of an educational conversation was indeed feasible, and, while the presenter could not see the student, eye contact with every individual viewing the lesson was possible by virtue of the technology. Many of the exchanges recorded had interactive, discursive reflective and adaptive components, as described in the Laurillard framework (1993). Nevertheless, teacher control was manifest in most stages of the lesson.

8. Implications for Instructional Design

In order to make instructional design recommendations for these technology supported environments, an appropriate theoretical perspective must first be adopted. Stated simply, the role of the learner in the instructional process must be recognised as of paramount importance (Shuell, 1988). This implies a realisation that ***what the learner does*** during the lesson plays a crucial role in the learning enterprise**.** Through dialogue the learner mediates the relationship between the teacher's behaviour and the learning outcomes.

There must also be teacher understanding of the interrelationship between communication, interaction and learning. For learners to be effective, they must be able to engage in construction of meaning and make appropriate instructional choices (Papert, 1980) so that the learning environment is defined, not by tutor, but by a self-motivated individual with participative rights. Laurillard's conversational framework is merely a starting point for the recognition that the students contribution to learning, *via dialogue*, is essential.

9. A Framework for Learner Control

How then can we design instruction that will tap into learners' internal processing, and direct their use of controlling strategies to enable them to master the content and the learning environment? The paradox of many instructional innovations is that they assume skills of autonomy and self-direction which learners may not possess. For example, the conversation framework of Laurillard may work effectively with students at university, but this requires articulate and skilled learners, as the adaptive and discursive component presuppose a high level of verbal fluency and confidence. To cater for individual learning styles, it is suggested that the allowing total control is not always productive, as students may need to develop metacognitive control. Furthermore, as Laurillard (1994) suggests, many learners do not know enough to be left in full control.

The following framework is based on that of Shuell (1988) and incorporates the findings of Kinzie (1990) who investigated the requirements of successful instruction. Based on our observations, telematics environments have the potential to become self-directed and autonomous learning environments while the teacher is interacting with the learners. A framework is presented which identifies the essential functions a learner must engage in to learn from instruction. This contrasts with the observed patterns of interaction in the present study, where teacher talk dominated and there was little evidence of student participation or engagement in cognitive, affective or metacognitive functions.

The framework is intended to enable teachers to help learners take appropriate steps to control their learning by creating opportunities for dialogue and reciprocal action. The aim is not to dominate but to direct the instruction so that increased learner input and control is fostered. In this way, the telelearning environments can bring about progressive, individual interactive participation where learners can develop control strategies to enhance their own learning. Table 1 below represents

those functions which the teacher initiates in order to bring about learning, but most importantly, shows that at every stage the learner must also be engaged in a reciprocal action.

Function	Teacher initiated	Student initiated	Learner control feature
expectation	specify instructional outcome	identify or state purpose of lesson state expectations	self-direction (metacognitive)
attention	verbal emphasis	underline, take notes	learning strategies, mnemonics
encoding	explains, cites examples, contextualises	generates examples, creates images	elaboration, verbal extension
questioning	asks questions, checks understanding	self questioning, hypotheses generation, asking 'what if' questions?	stimulation of curiosity, internal processing
feedback	provides positive and negative feedback correct responses	group monitoring, self testing	self regulation
evaluation	asks students to evaluate their own performance	express what is known, not known identify gaps in understanding	personal causation and involvement

Table 1. Learner control features in interaction and learning.

10. Future Directions

The outcome of our research on telematics environments indicated a strong trend towards a teacher controlled, didactic paradigm. There was little recognition by teachers in the audiographics sessions that students had the capacity to contribute to the learning process and so enhance the outcomes of the lessons. In teacher-fronted classrooms, the teacher's actions can indeed control pupils, but learners also can manipulate, orient and refocus the instructor through their interventions, feedback and behaviour. There appears a trend within the technology-supported learning environments that we have studied for instructors to seek to exert strong control on all aspects of the learning environment. These negative findings nevertheless have lead to positive prescriptions which may serve to enhance the learning environment.

There is clearly a need to initiate a move towards a learner controlled paradigm in the instructional design process as opposed to a didactic teacher-driven and controlled environment where the students have no control over the learning process. Further exploration is needed in technology supported environments other than multimedia to develop instructional design guidelines which aim to optimise strategies for learner control. By building on empirical observations of actual interactions and documenting the outcomes it is possible to expand opportunities for communicative interactions and to generate instructional design strategies which will foster autonomous self-directed learners.

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