A suggested conceptual framework for designing technology-enhanced distance learning environments for adult learners

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ABSTRACT

Although information technology is increasingly becoming the catalyst for economic and cultural change, many adult learners in South Africa are continuously being excluded from its benefits. Recent research shows that the technology for implementing new visions of open distance learning is available. But unless educators conduct research into constructive and sustainable solutions to accessing and utilising these new technologies, many communities will remain disenfranchised. This article is an attempt to develop a conceptual framework for designing contextualised, technology-enhanced learning environments for distance learners. Such a framework could form the basis for conducting research in this area.

INTRODUCTION

Information technology is increasingly becoming the catalyst for economic and cultural change. Unfortunately, "this rise of informationalism … is intertwined with rising inequality and social exclusion throughout the world" (Castells 1998:70). Sadly, a growing number of sub-Saharan African communities, including adult learners, are continuously being excluded from the benefits of this information technology revolution.

Distance education is undoubtedly the most affordable means for adult learners to specialise and retrain for new tasks and challenges in order to remain competitive in the global economic environment. According to Collins and Berge (1994) and McConnell (1994), the technology that can be used to implement new visions of open distance learning with the networked computer is emerging. Opportunities now exist for supporting interinstitutional links and collaborative learning experiences. However, in most the underdeveloped communities, access to networked information technology is limited. At the University of South Africa, for example, one of the largest distance education institutions in Africa, efforts to use technology are continuously sidelined because approximately 90% of the student body do not have access to computers and/or television.

Two tools are required to make information technology beneficial to members of society: gaining access and acquiring the capacity to make meaningful use of it. But unless educators initiate and conduct research into constructive and contextualised solutions to accessing and utilising these new technologies, taking into account the sociocultural variables, the specific learning needs and the limitations of the host institutions, communities in this part of the world will remain disenfranchised.

This discussion is an attempt to develop a conceptual framework as a guideline for designing contextualised, technology-enhanced learning environments for distance learners. Hopefully, such a framework could then form the basis for conducting research in this area. It is an attempt to locate and nuance a flexible and adaptable course-designing process in a South African environment.

THE FRAMEWORK CONSTRUCTS

Six underlying theoretical constructs underpin the exploration and analysis in this discussion:

- the constructivist learning theory

- Salomon's reference to the learning environment (LE) as the locus for change (including technological adaptation)
- Miller's socio-technical systems approach to designing distance learning materials
- Castells' space of flows theory
- Wort's distance provision framework
- Dahllöf's interactive process-centred approach to the evaluation of teaching

A synthesis of these six constructs provides an investigative framework and a possible methodological approach for a later study, as no documented and tested framework or methodology for designing and evaluating technology-enhanced courses for distance learning environments is available yet.

Next follows a brief outline of each construct and a suggested framework.

The constructivist learning theory

Although contructivism is not a learning theory, it is has come to be regarded as such by a number of educators, particularly mathematics and science educators (Holloway 1999:85; Perkins 1999:7; Kahn & Volmink 2000:5). Constructivist learning theory is a general framework for instruction based upon the study of cognition and has its roots in psychology and philosophy. Although the early pioneers such as Vygotsky, Piaget and Dewey did not refer to themselves as constructivists, their work has contributed to what is now considered to be constructivist thought. Much of the theory is linked to Piaget's work on cognitive development research (Kahn & Volmink 2000:5), Dewey's rejection of passive learning in favour of meaningful engagement in the learning task (Hawkins in Fensham et al 1994:6) and Vygotsky's emphasis social cultural context of learning (Barber 1995:92).

What we now call constructivism is based on the assumption that learners construct their own understanding of the world. Briner's statement on learning captures this line of thought when he states that "Learning is an active process in which learners construct new ideas or concepts based upon their current/past knowledge. The learner selects and transforms information, constructs hypotheses, and makes decisions, relying on a cognitive structure" (Briner 1999:1). The emphasis is on learning rather than teaching, and on facilitative environments rather than instructional goals. According to Young and Marks-Maran (1988), learning is an active cognitive process in which individuals strive for understanding and competence on the basis of their personal experience. Lave (1988) speaks of "situated cognition", which means that learning is best achieved when learning tasks are encountered, practised and applied in real-world contexts. It is also useful to have the assistance of experts and supportive others through apprenticeship and collaboration. How constructivism can be realistically incorporated into a course-designing process using networked technology in a South African distance education programme needs to be established.

The learning environment (LE) as the locus for change

Salomon (1991) describes a learning environment (LE) as a system consisting of interrelated components that jointly affect learning in interaction with (but separate from) relevant individual and cultural differences. He suggests that when technology is introduced to the LE, the changes in the individual will depend on the changes distributed over the whole learning environment.

Salomon's (1996:366) phenomenological approach guides the development of the conceptual framework proposed in this article. He uses an investigative approach which combines analytic and systemic processes to study the generic components of the LE as perceived and experienced by its inhabitants (teachers and learners). The analytic process involves an elucidation of the components in terms of their contents, while the systemic process involves mapping out patterns of configurations of relations between these components. Salomon's (Vosniadou, De Corte, Glaser & Mandl 1996:366) generic components of the LE include

- a teacher and his/her teaching qualities

- relations and interactions of the learner

- rules and regulations governing the LE

- consensually held view of participants as learners

- the mental effort they are willing to expend in learning

In a study involving the University of Arizona Science faculty (staff), high school students and teachers in Tucson, Arizona, Salomon took pre and post measures of the learning environment components for a group of high school students involved in a science course. The experimental group of students used advanced technologies while the control group did not.

The results were then submitted to a multidimensional scaling (MDS) analytic tool separately for both the experimental and control group. The resulting patterns clearly showed differences in the structures of the traditional and technology-enhanced LEs (Vosniadou, De Corte, Glaser & Mandl 1996:370).

While Salomon's approach focuses on the changes in the observed individual learning as technology is introduced, it has minimal reference to the interaction of the learner with the course material content, and the relations of the teaching organisation with its immediate external and internal environments. The other constructs provide means of accommodating these aspects.

Miller's socio-technical systems framework

Miller (1998) considers the course development process to be dynamic with a number of critical interactions with external factors, such as the political environment, managerial and organisational issues, and the personal and professional settings of the participants. Miller suggests using the systemic approach for developing and evaluating a course in an organic rather than a mechanistic fashion in order to deal with the dynamic human interactions. Her proposed sociotechnical systems framework consists of five subsystems:

- technical (educational activities and curriculum)
- psycho-socio (interactions, expectations, values of the participants)
- organisational structure (materials and tutoring)
- institutional (structural working of institution)
- the environmental (workplace and personal environment).

Miller's approach provides a way of understanding the processes of interaction between students' involvement with the course material in the particular context of their work. It does not deal very structurally with critical interactions within the distance education environment, however. Wort's (1998) work deals with this aspect.

Wort's distance provision framework

Wort's (1998:196) framework emphasises examining the critical interactions within the education process:

- learner-teacher
- learner-content
- teacher-content
- learner-learner interactions.

Wort suggests using these dimensions as bases for analysing the learning process where the intended learning outcomes form the central focus. The analysis of these interactions uses Boot and Hodgson's (1987) comparison continuum scale involving two basic orientations to open and distance learning: a dissemination approach which is concerned with effective information provision and a developmental approach which focuses on the intellectual and personal growth of the learners.

Wort's model is crucial because it focuses on the learning interactions within a distance learning environment. The position of "distance" in the learning process affects teaching roles, instructional methods and learner expectations, depending on the projected learning experience. To understand the effects of introducing technology clearly, the characteristics of these interactions need to be defined.

Castells' space of flows theory and Dahllöf's interactive process-centred approach to the evaluation of teaching fill in the remaining gaps required to construct this framework By introducing a spatial dimension to the technology process, Castells' approach suggests the need for a deeper level of inquiry in explaining how learning is different when technology is employed. Dahllöf's model brings all the constructs together.

Castells' space of flows theory

Castells (1996:411) developed his space of flows theory stems from perceiving space "as the material support of time-sharing social practices". Castells contends that the new information technology revolution is creating new spatial forms and processes. He describes the space of flows as a new spatial process which allows for simultaneity of social practices without territorial or physical contiguity. The contents of Castells' space of flows raises new questions about the influence of technology on educational practices, such as how this new spatial configuration affects the nature of the learning process.

Dahllöf's (1991) interactive process-centred approach to evaluating teaching

The strength of Dahllof's (1991) approach is its degree of comprehensiveness (attempting to accommodate many of the components of an LE). Their structural approach allows for evaluation at course and at program level, and is suitable and is suitable for academic, professional and vocational courses. They use the terms "evaluation for internal efficiency" and "evaluation for external efficiency" to differentiate between the two modes of analysis. The internal mode deals with issues associated with a specific course whereas the external mode can accommodate issues at programme, institutional and societal levels.

The main components of their structure are

- the actors, namely the
  - student groups (with their profiles)
  - teachers or competence teams (their experiences and limitations)
  - management (leadership styles and skills)
- frames factors which are parts of the LE subject to decisions at higher levels (eg, the programme/course structure or curriculum, time available for a given course or programme, human and material resources and rules governing the allocation and use of these resources)
- learning and teaching processes, specifically in terms of time spent, methods used and assessment strategies employed in teaching topics or courses
- the outcomes, which involve a combination of the actual outputs (expressed in terms of student achievement and degrees of satisfaction with the courses) with the intended goals of the programmes or courses

Dahlöff (1991:18) is aware of the distinctions that exist in post-secondary institutions in terms of orientation to academic (theoretical) and practical (professional and/or vocational) methods of training, but are emphatic that "understanding and practice are complementary, the one

facilitating the other". They stress that although specific courses and programmes should have specific goals and outcomes, higher education goal and outcome formulation should demand

- in-depth understanding of mechanisms within a specific field of study
- insight into the basis and limitations of research in the given field
- learners' ability to communicate the relevant concepts and insight effectively.

Dahllöf's (1991:117, 147) approach is further strengthened by the realisation that "evaluation is best served if the teaching/learning process is viewed consistently from the perspectives of the student group involved" and should not only be focused on the "testing of achievement in examinations, accreditation procedures or both". Rather, they are in favour of an overall emphasis on and interplay between student characteristics and enrolment trends, strengths and limitations of staff, impact of frame conditions, instructional methods and time used for teaching and learning, and the links between planned learner course and unit outcomes and actual student achievement.

SUGGESTED FRAMEWORK

The suggested framework for designing technology-enhanced distance learning environments for adult learners is a modified version of Dahllöf et al's model for components used in institutional evaluation, with inputs from Miller's structure of sub-systems, Salomon's methodological approach for demarcations of the component boundaries and Wort's framework for distance provision. These baselines are greatly influenced by a constructivistic approach and Castells' general views about technological adoption.

The proposed LE framework will consist of the following components

- individual learner group profiles (including views, values and expectations)
- teacher competencies, experiences, strengths and
- limitations management styles and skills
- frame factors (course/programme structure or curriculum, human and material resources, organisational and institutional rules/regulations)
- the learning and teaching process (including all the interactions, instructional methods, assessment strategies)
- overall outcomes with the outputs (performance results) and learning goals, and the attitudes
- external conditions, including societal, cultural, economic, workplace and market conditions, educational demands.

(See the accompanying diagram (figure 1) showing the main components and links)

POSSIBLE USES OF THE FRAMEWORK

This type of framework could then be used to examine how the dynamics of a distance learning environment change when technology is introduced. For example, a possible approach could involve

- identifying the configuration of the components in the LE by mapping the interactions between them
- examining how the configuration changes as a result of technological intervention.

Presumably, the process of locating and identifying variables in the learning environment and the adult learner, and analysing them in both traditional and technology-enhanced environments, will illuminate the configuration characterising a technology-enhanced LE. Ultimately, this process would help teachers/instructors in making design decisions concerning technology adoption. Although a likely methodology would mainly be a study of

interactions of the adult learner with the other components and the technology adopted, it would also involve an analysis of course material and structure, managerial and organisational issues, and interactions of the teaching organisation with its immediate external and internal environments (cultural, political and economic).

QUESTIONS THAT NEED TO BE DEALT WITH IN TECHNOLOGY ADOPTION

There is a need to pay attention to identifying tensions and constraints which affect the functionality of the LE , and to carefully analyse the impact of introducing technology. In the case of web-based technology, for instance, questions concerning the transformation of the interaction space of the LE would be critical. It would be important to find out how the new spatial configuration would affect the nature of the learning process, content and interactions within the LE, and what effect the unrestrained boundaries would have on the institutional and organisational structures.

In more general terms, important questions would seek to influence future technology adoption, such as

- What crucial issues should be dealt with in designing technology-enhanced LE's in distance education?
- What are the cost-benefit trade-offs associated with each design issue? (The costs and benefits relate to the effects on student learning and motivation, and to the costs in time of money and effort required to implement and maintain aspects of the LE.)

Educators should be asking vital questions that seek to monitor the teaching/learning processes and their outcomes and, if possible, to improve them, such as

- What are the ongoing distance education practices? How do we characterise them?
- What is the vision of an appropriate pedagogy? What is desirable? What is possible?
- In what ways can technology make a genuine difference?

CONCLUSION

We are at an exciting phase of technological and communication advancement and in fact, technological adoption can be used to transform and improve distance education practice. However, unless underpinned by informed research, the enthusiasm about technological adoption could prove to be more futile than fruitful. As Salomon (2000:7) aptly advises "let technology show us what can be done and let educational considerations determine what will be done".

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