DESIGN INFLUENCES IN THE CREATION OF AN ONLINE MATHEMATICS UNIT FOR INDIGENOUS ADULTS

Linda Marshall, Maria Northcote & Max Lenoy
Kurongkurl Katitjin, School of Indigenous Australian Studies
Edith Cowan University, Australia
l.marshall@ecu.edu.au
m.northcote@ecu.edu.au
m.lenoy@ecu.edu.au

Abstract

This paper documents the specific influences on the design decisions associated with the creation of an online unit for Indigenous adult learners. As part of a bridging course, the unit of study, Thinking Mathematically, primarily aims to increase the students' mathematical skills and confidence levels in a supportive, constructive context. The manner in which the unit was designed was informed by a number of important factors relating to the specific student audience, the mathematical content of the unit, online learning principles and past feedback from our students. The presentation of the unit content, the provision of learning tools and the selection of communication technologies are aspects of the unit that are examined in this paper.

Keywords

Indigenous, pre-tertiary, online, mathematics, education, instructional design

Background

Thinking Mathematically is one unit within a one year university bridging course for Indigenous adult students in Kurongkurl Katitjin, the School of Indigenous Australian Studies, at Edith Cowan University in Perth. The course, Indigenous University Orientation Course (IUOC), is made up of a total of six units which students usually complete in a one to two year period. The Thinking Mathematically unit has recently been designed and delivered to students in a print-based external mode of delivery. During 2001, a team of online unit development staff worked with an academic staff member, the content expert, to create the online version of this unit. The unit aims to provide basic numeracy life skills for Indigenous adults. These are presented in the context of an Indigenous family and some of the everyday mathematics situations they may encounter.

Previous research conducted within the School has provided a strong influence in the planning and development processes adopted to develop the online version of this unit. The overall direction of the school's adoption of online unit development and delivery is clear from the School's policy documentation (Stratton, 2000). Observation and testing of students using the online unit material provided specific assistance in the selection of successful online strategies (Northcote, 2001). Also, from extensive interviews with students working in Regional Centres, there was a clear indication that they equated mathematics with budgets and money (Marshall, McLoughlin & Hayward, 2000). However, there were some students who could make a connection between the mathematics they had experienced in their education and any real-life situation. Students were also asked about their perceptions of online learning in general and mathematics in particular. The majority of the students indicated a preference for learning online, although there was some concern at inputting mathematical symbols via the keyboard. They believed that a certain amount of print-based activity would be needed. In general, the students said that they would prefer to study in an online mode. They also commented that tutorial support would be essential (Marshall et al., 2000).

Additionally, our recent evaluation of other online units within the IUOC course has directed our design efforts in relation to which ideas were successful and which ideas to modify or refrain from using. The content expert's knowledge of the unit content combined with her vast experience of teaching mathematics to adults also impacted heavily on the design of this unit. Lastly, the results of a survey of recent literature on the topic of online learning and current instructional design practices have guided our decisions about how this unit was designed and developed.

Theoretical Framework and Influences

The overarching theoretical principles of situated learning ultimately led the instructional design processes adopted to create this course. The curriculum design team were guided by the aim of creating authentic conditions into which supporting media and real life examples were set (Herrington & Oliver, 1997; Wilson, 1995; McLellan, 1994; Brown, Collins & Duguid, 1989). As a direct consequence of the research conducted in 1999 at the School, it was apparent that many students had negative attitudes about mathematics but were quite positive about learning in an online environment. These findings were applied in the way the interface for the unit was designed. By acknowledging our target audience's attitudinal base, we could respond to their immediate needs by creating an interface that was non-threatening but motivating at the same time (Evans & Edwards, 1999; Stoney & Wild, 1998). The role of emotion in the process of learning was absolutely critical to the predicted student success rates in this unit. As such, we aimed to create a supportive environment that recognised the interdependent roles of negative and positive emotions in the learning process (Pintrich, Marx & Boyle, 1993; Ames & Ames, 1991).

Although the design team were very much driven by the results of previous evaluation and research projects which were based on the students within the school, the overall importance of designing a unit which was tailored to the needs of Indigenous students was not overlooked. Considering the cultural contextuality of the learners, the development team attempted to create an environment that considered the theoretical understanding of Indigenous ways of learning. Harris' (1984) research within a remote Aboriginal community in the Northern Territory, highlighted five learning styles of these children. It is important to note that this theory is grounded in Indigenous children's learning styles not that of adults and that reflective research and discussion by others have questioned the theory of particular Aboriginal learning styles. Nevertheless, there is a strong suggestion that Indigenous learning styles differ enough to warrant attention by educators (Andrews & Hughes, 1988). Hughes and More (1997) provide an overview of each of the Aboriginal learning styles or ways of learning as such:

- Learning through observation and imitation rather than verbal instruction
- Learning through trial and feedback
- The group is more important than the individual
- Holistic (global) learning
- Visual-spatial skills
- Imagery
- Contextual learning
- Spontaneous learning.

To some degree each of these learning features have been explored as part of the unit and implemented into the instructional design of the learning environment.

Design Features

After a consideration of the theoretical framework and subsequent design features mentioned above, the manner in which these ideas were applied to the practical design of this unit will now be outlined. There were obviously some major factors that affected the instructional design of this unit and these provided us with definite course features that were integrated throughout the course. These are outlined in Table 1.

Influencing factors	Design features
Students' perceptions of mathematics	Countered negative experiences of mathematics with positive ones. Supportive "look" and "feel" – use of cool colours, simple navigation.
Students' attitudes to online and print based learning	Students preferred online options but wanted some form of paper-based material.
Research into Aboriginal ways of learning	Holistic learning environment with family as focus; providing a non-judgemental learning context using money, budget, work skills etc.
Literature about online learning principles	Use of cognitive tools (glossary, calculator, workbook and calendar). Combination of linear and non-linear design. Acknowledgement of prior knowledge – option of "have a go" section at the beginning of each module.
Mathematical content and process	Provision of paper-based components for students to record their work.
Real-life context	Situated Learning environment.
Learning context (Student needs, interactivity, available resources and access)	Choice of website creation instead of stand-alone CD-ROM. Provision of customised graphics, video, voiceovers, interactions, animation etc.
Literature on the value of hyperlinking for conceptual and administrative purposes	Selected links within unit material.

Table 1: Influencing factors and design features

Implications for the Future

As a result of this unit development process, we have gleaned some valuable knowledge to use for future course design. It is anticipated that this particular unit will be delivered to external students in Semester 1, 2002. However, trialing the unit with students is expected to take place in Semester 2 of 2001. Our baseline research will also occur at this time in the form of an online survey form which students will encounter when they first enter the online unit. We have learned of the value of baseline research as an indicator of the general and specific needs of our students. For this reason, we will continue to collect feedback from students and course evaluators before, during and after the development of the units takes place. Evaluation of online and multimedia course material will continue by adapting Reeves' (1997) dimensions.

In an online environment a reflective means of self-evaluation and adapting the medium is more possible due to the nature of the technology. However it is essential that designers do not apply a standard template or method but continue to design media in response to the learners' needs and the context in which the content is delivered. This is true of all learners, both Indigenous and non-Indigenous.

References

Ames, R. & Ames, C. (1991). Motivation and effective teaching. In L.I.B. Jones (Ed.), *Educational values and cognitive instruction: Implications for reform* (pp. 247-271). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Andrews, K. & Hughes, P. (1988). *Towards a Theoretical Framework for the Development of an Aboriginal Pedagogy*. Melbourne: Curriculum Development Centre.

Brown, J.S., Collins, A. & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18* (1), 32-41.

Evans, C. & Edwards, M. (1999). Navigational interface design for multimedia courseware. *Journal of Computers in Mathematics and Science Teaching, 8* (2), 151-174.

Harris, S. (1984). *Culture and Learning: Tradition and Education in North-East Arnhem Land.* Canberra: Australian Institute of Australian Studies.

Herrington, J. & Oliver, R. (1997). Multimedia, magic and the way students respond to a situated learning environment. *Australian Journal of Educational Technology, 13* (2), 127-143.

Hughes, P. & More, A.J. (1997). *Aboriginal Ways of Learning and Learning Styles.* Paper presented at Australian Association for Research in Education, Brisbane, December. [Online]. Available: http://www.aare.edu.au/97pap/hughp518.htm [24 September, 2001].

Marshall, L., McLoughlin, C. & Hayward, K. (2000). *Indigenous Australian adults' perceptions and attitudes to mathematics and on-line learning of mathematics* Paper presented at the Australian Indigenous Education Conference, Fremantle, 3-7 April, 2000.

McLellan, H. (1994). Situated learning: Continuing the conversation. *Educational Technology, 34* (10), 7-8.

Northcote, M. (2001). *ABB1112 Journeys in Writing: Evaluation results from students at Geraldton regional centre*. Unpublished research paper. Available from Kurongkurl Katitjin, Edith Cowan University, Mt Lawley, Western Australia.

Pintrich, P., Marx, R. & Boyle, R. (1993). Beyond cold conceptual change: The role of motivational beliefs and classroom contextual factors in the process of conceptual change. *Review of Educational Research, 63*, 167-199.

Reeves, T.C. (1997). *Evaluating what really matters in computer-based education*, [Online]. Available: http://www.educationau.edu.au/archives/cp/reeves.htm [1 September 2000].

Stoney, S. & Wild, M. (1998). Motivation and interface design: Maximising learning opportunities. *Journal of Computer Assisted Learning, 14*, 40-50.

Stratton, G. (Ed.) (2000). *Review of the Aboriginal University Orientation Course at Kurongkurl Katitjin, Edith Cowan University*. Perth, Western Australia: Edith Cowan University.

Wilson, B.G. (1995). Situated instructional design: Blurring the distinctions between theory and practice, design and implementation, curriculum and instruction. In M. Simonson (Ed.), *Proceedings of selected research and development presentations*. Washington D.C.: Association for Educational Communications and Technology.

Copyright © 2001 Linda Marshall, Maria Northcote and Max Lenoy.

The authors assign to ASCILITE and educational non-profit institutions a non-exclusive licence to use this document for personal use and in courses of instruction provided that the article is used in full and this copyright statement is reproduced. The authors also grant a non-exclusive licence to ASCILITE to publish this document in full on the World Wide Web (prime sites and mirrors) and n printed form within the ASCILITE 2001 conference proceedings. Any other usage is prohibited without the express permission of the authors.