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1-1-2005

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Operationalizing Nine Design Elements of Authentic Learning Environments in a Classroom-based On-line Simulation

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Abstract

Herrington, Oliver and Reeves (2003) assert that many researchers and teachers now accept that well designed multimedia environments provide an alternative to real-life settings without sacrificing the authentic context. Further, researchers report that recent educational software advances have demonstrated that it is feasible to create a motivational simulation that supports pre-service teachers by providing them with tools that allow them to view the effects of their decisions within a virtual classroom context (Aldrich, 2004) However, limited research has been reported on the use of authentic simulations in pre-service teacher education.

This paper describes the on-line simulation that we developed to support our first year pre-service teacher education program. We explain how we operationalized the nine design elements of authentic learning environments as reported by Herrington, Oliver and Reeves (2003) as a framework for the design of this software. In addition we describe the teaching and learning experiences incorporated within this virtual classroom and the responses to these experiences form the perspective of the initial users of the simulation.

Introduction

Studies by researchers consistently report that traditional pre-service teacher preparation programs do not adequately prepare beginning teachers for the reality of modern classrooms (Blackwell, Futrell & Imig, 2003; Cusworth & Whiting, 1994). Various small-scale innovations have been trailed and some show promise; however, one key factor that emerges from the research is the quality of classroom experience during practicum (Ramsay, 2000). It is this factor that is closely controlled in small-scale innovations because supervising teachers and classroom experiences are more carefully selected. As a result such trials are often deemed successful. However, the challenge remains for teacher educators to reproduce such a quality classroom based experience on a larger scale.

Many traditional teacher preparation programs are fragmented (Hoban, 2002) and this hinders the development of pre-service teachers into flexible, progressive practitioners. It is not surprising that many recent graduates find it difficult to deal with life in the classroom, as they are often unable to retrieve essential knowledge when they need it most (Danielson, 1996; Entwhistle, Entwhistle & Tait, 1993; Kervin & Turbill, 2003; Stronge, 2002).

The Ramsay (2000) review of teacher education in New South Wales claimed that school-based practicum experience can often be a series of isolated, decontextualised lessons prepared and implemented according to the requirements of the supervising teacher; and at worst can be an unsupported and disillusioning experience. Given that the practicum experience is a key factor in teacher development Ramsay strongly recommended that pre-service teachers receive quality classroom-based experience supervised by an

accredited teacher mentor. However, not all teachers are capable or willing to mentor future teachers. Therefore, other approaches are need to supplement and support the school-based experience.

Rationale for the use of simulations

Simulations have the potential to represent 'social reality' as the user is able to 'take a bona fide role, address the issues, threats, or problems arising in the simulation, and experience the effects of one's decisions' (Gredler, 2004, p. 573). Furthermore, simulations can support the user's learning as they incorporate feedback and advice, through devices such as an on-line mentor, and the opportunity to pause or repeat a lesson and explore alternative decisions. In a real classroom once a lesson is taught the exact context cannot be re-created, but a simulation can do this. Whilst a simulation is only a representation of real-life, there are features that can enhance the real-life experience. For example, simulations can provide authentic and relevant scenarios making use of pressure situations that tap users' emotions and requires them to act (Aldrich, 2004).

Users of simulations see the consequences of the complex decisions teachers make in managing learning environments. Also this medium allows pre-service teacher to enter 'into an intellectual partnership with the computer' (Jonassen, 1996, p. 4). In particular, a simulation can engage users in decisions about student behaviour, classroom organization, student learning and the impact of these decisions upon individual and collective student learning outcomes. Furthermore, users are able to get close to the teacher's and the students' experience within the learning environment and this allows users to understand how teachers and students feel their way, cognitively and emotionally through a learning task (Brookfield, 1995). Simulations also 'bridge the gap between the classroom and the real world by providing experience with complex, evolving problems' (Gredler, 2004, p. 573).

The Research Approach

This paper reports on both the simulation developed with the support of funding from a large research grant from the Australian Research Council and insights into the design of the simulation revealed from our first trial of this software with pre-service teachers at the University of Wollongong. The research drew upon a case study design with data collected through researcher observations, semi-structured interviews and analysis of student entries in the embedded tool, the 'thinking space'. Data were analysed by coding into categories based on the emerging themes. Conclusions were checked and discussed amongst the project members and key stakeholders within the University.

A Discussion of the Simulation Design

The challenge for designers of simulations is to create these environments in ways that make them authentic learning environments. This challenge stimulated us to look for guidance from the literature and one the most promising articles was a review by Herrington, Oliver and Reeves (2003). Their review of the literature identified nine design elements of situated learning environments: the provision of authentic contexts that reflect the way that knowledge is used in real life; authentic activities; expert performances and modelling of process; multiple roles and perspectives; support for the collaborative construction of knowledge; reflection; tools that enable tacit knowledge to be clearly articulated; scaffoldings and coaching at critical times; and the authentic assessment of learning within the tasks. The challenge for us was to operationalize as many of these as we could in the design of on-line simulation prototype.

The purpose of the developed simulation was to allow the user to take on the role of the teacher of a virtual Kindergarten classroom. During the simulation the user is required to make decisions about organising the lesson, classroom management, and responses to individual students. The user is able to monitor and track the progress of three targeted students throughout the course of the simulation. An embedded tool, referred to as the 'thinking space', has been used throughout the running time of the simulation to encourage the user to plan and justify new decisions, reflect upon the consequences of previous decisions and above all, have the opportunity to 'think like a teacher'.

There are a number of key features we incorporated within the design of a simulation to support pre-service teachers in this on-line learning environment. Figure 1 presents the introductory page of this on-line simulation prototype.

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Photo - JPEG decompressor
are needed to see this picture.

Figure 1: Introductory Screen

The purpose of the software is clearly indicated on this page. The design of the pages within the simulation allows the user access to the embedded 'thinking space', information about the students and the teacher along with support material (the class goals on this page) throughout the running time. The inclusion of decision points, targeted students, opportunities for reflection and the inclusion of support material and their role within the on-line simulation will be further discussed.
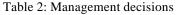
Decision Points

The simulation is designed into cycles that reflect the problem-solving nature of classroom life. At nominated points the user is required to make a series of decisions about the management of the classroom, of students and of random events that typically occur during a Kindergarten classroom experience. At other times they will be required to make decisions about the sequence of teaching, for example: do they begin a lesson with a reading experience, or a writing experience, or a language activity? Each of these decisions has the potential to impact on subsequent decisions in each of these described areas.

As the user makes decisions about the management of the classroom and how they will organise their teaching and learning experiences, the simulation allows access to a branching cycle, representative of a slice of time within the whole teaching period. Each cycle that the users engage with, presents them with decisions related to that specific cycle. Care has been taken to ensure that a number of alternate cycles can lead to similar student outcomes. This reinforces the notion that there can be several suitable approaches to specific student learning needs.

The cycles within the simulation represent management decisions and teaching and learning decisions typical to a Kindergarten classroom. Table 2 presents an overview of the management decisions within this prototype version of the simulation.

1. The Organisation of the classroom
2. The Start of the day
3. The late arrival of a student
4. Random decisions

Table 2: Management decisions

The teaching and learning decisions incorporated within the simulation continue the focus on the concept of the days of the week within the literacy-based experiences in a Kindergarten classroom —we believe this is a typical learning experience in a kindergarten classroom. Table 3 presents an overview of the teaching and learning experiences available to the user as they organise their literacy time within this virtual Kindergarten classroom.

Reading Experiences	Writing Experiences	Language Activities
Retell of a familiar story	Constructing a text around that day's name and weather	Sequencing activity
Modelled reading using the names of the days of the week on individual cards	Innovation on a poem	Handwriting task
Modelled reading using a calendar	Recount of previous week	Poetry activity
Modelled reading using a poem	Creation of a daily schedule	Search for the days of the week in community texts

Table 3: Teaching and Learning Experiences

Targeted Students

Three targeted students have been incorporated in the simulation, based on our own classroom teaching experiences and research. They are described below.

Bibi is a refugee child from Afghanistan. She has been in Australia for two months, one month of which was spent in a detention centre. She has limited English and listens intently to the teacher. Bibi has a friend, Mary who has also been built into the simulation story. The user is faced with a number of decisions relating to this relationship as well as providing meaningful literacy experiences for Bibi.

Harley is medicated for Attention Deficit Hyperactivity Disorder (ADHD). He finds the classroom situation difficult and he is frequently not engaged during classroom lessons. The teacher is aware that Gavin is bullying Harley and as such the situation needs to be carefully monitored.

Information about the targeted students is available to the user throughout the running time of the simulation. Figure 2 shows how the information about Gavin is presented in the form of teacher notes to the user. The notes are based on the type of notes that teachers typically keep. It is designed to add depth and authenticity to the simulation.

QuickTime™ and a
Photo - JPEG decompressor
are needed to see this picture.

Figure 2: Teacher Notes

Opportunities for Reflection

An embedded tool, which we refer to as the 'thinking space', is available to the user throughout the simulation. This has been developed with the aim of encouraging the user to articulate and justify the decisions they have made. This tool provides opportunities for the user to reflect upon the impact of previous decisions on the targeted students. It is our intended aim in these spaces to engage the user in Jonassen's understanding of critical thinking, that is, 'generalizable, higher-order thinking, such as logic, analyzing, planning, and inferring' (Jonassen, 1996, p. 24).

The thinking space presents three key questions to prompt thoughtful decision making.
   1. Why is this important for these students?
   2. How will I know this is an effective decision?
   3. What do I want to do?
A help screen that offers additional ideas for the user to consider supports these key questions. The user types their reflections and thoughts into the embedded tool which saves their notes. The user is able to retrieve and review their previous decisions and thoughts throughout the running time of the simulation.

Support Materials

Support materials were integrated into the simulation prototype to support and inform pre-service teacher learning and decision making. These include links to websites, textbook references and information summary sheets compiled and annotated by the research team. Textbook links are related to first year core textbooks in the primary teacher education program in the Faculty of Education, University of Wollongong. Hoffmann and Ritchie (1997) identify the importance of enabling students to interact with sources at the time that they need them.

Operationalizing the nine design elements

The design elements reported by Herrington, Oliver and Reeves (2003) is a reference that is repeatedly cited when examining authentic learning environments. Investigation of these elements led the team to believe that this design framework was a plausible and useful structure within which to develop the simulation prototype. Further, our initial trial of this software revealed elements within the simulation that supported this framework and also areas that needed further consideration for the next version of the prototype. Table 1 summarises how we attempted to operationalize the nine design elements in the prototype version of the simulation. It is organized under the headings of design element (a general description of the individual design element), initial prototype (how we operationalized the element in the initial prototype), and what we learnt (recommendations from the initial trial of the prototype).

Design Element	Initial Prototype	What we learnt
Provision of authentic contexts that reflect the way that knowledge is used in real life	The Kindergarten classroom within the simulation has been developed from both the teaching experience and classroom-based research undertaken by team members. The literacy focus is responsive to the difficulties many pre-service teachers are reported to experience with the classroom application of often abstract theory. The simulation prototype provides opportunity for the students to operationalize the theory.	Collection of classroom artefacts (eg student work samples) adds to the authenticity of the software.

Authentic activities	Teaching and learning experiences incorporated within the simulation are collected from real classroom examples. The Quality Teaching Framework (DET, 2003) has been used to describe in detail what is happening in the classroom with specific attention on three targeted students.	Need to further trial the teaching and learning experiences with "real" Kindergarten children to further develop and refine the virtual experience. Need to review the inclusion of student updates according to the targeted audience of first year pre-service teachers. Our trial has indicated that the Quality Teaching Framework (DET, 2003) is difficult for students working at this level to understand (the need to focus more on input rather than providing an output became apparent).
Expert performances and modelling of process	The simulated Kindergarten teacher provides a model of teaching practice. The user's decisions impacts upon the teaching and learning experiences offered and the interaction of the teacher with students in the class.	The ability to critique the simulation teacher provides opportunity for the user to comment upon and discuss what constitutes "effective" teaching practice.
Multiple roles and perspectives	The user is able to take on the role of the 'teacher'. Three targeted students within the classroom can be monitored.	Ability to monitor and track more students who are reflective of the diverse nature of classrooms. The initial plan for this project provided for the user to take on a selected role within the classroom. However, as our targeted audience is pre-service teachers, it is considered more meaningful to allow them access to take on only the role of the teacher.
Support for the collaborative construction of knowledge	Just-in-time support is offered through summary sheets that feature links to core subject textbooks, mandatory policies (NSW), classroom artefacts and relevant web links.	Need to look to incorporate some type of forum or a way to capture the user's personal journey throughout the simulation. This would provide opportunity for discussion about the thinking space entries. The incorporation of this software within pre-service teacher training may change the role of a tutorial throughout use of the simulation.
Reflection so that abstractions and generalisations can be formed	The embedded thinking space provides opportunities for the user to reflect on what has happened in the simulated	The first prototype offered the thinking space at decisive points throughout the running time of the simulation. The

	classroom and plan, articulate and justify future decisions as they occur.	next version will have this embedded tool available throughout the whole time of the simulation, the user will be able to decide when they wish to access this tool.
Tools that enable tacit knowledge to be clearly articulated	The thinking space provides opportunity for the user to articulate their understandings at decisive points.	Our trial of the prototype saw many users taking physical notes from the summary sheets. The thinking space did not allow the users to fully build upon their tacit knowledge. For the next version we plan to incorporate a "notebook" where the user will be able to cut and paste from 'summary sheets' into a 'notebook' that they can later print for their records.
Scaffoldings and coaching by the teacher at critical times	Information about what the teacher is thinking is available to the user. These have been designed to allow the user to enter into the 'mind' of a teacher and see why they make the decisions they make.	The ability to view the thoughts of the simulation teacher provides opportunity for the user to enter into the metalanguage of teaching with specific attention to why such decisions are made within a classroom.
Authentic assessment of learning within the tasks	Discussions after using the simulation software provided some evidence of the connections the users made between the theory of their pre-service teacher education and what this may look like in the classroom.	This area has been identified as a specific focus area for the next version of this software. In particular, we need to focus on how pre-service teachers learn and what supports them in learning to be a teacher with particular emphasis on the connections they make.

Table 1: Operationalizing nine design elements of on-line learning environments
(Herrington, Oliver and Reeves, 2003).

Conclusion

Our first experience with the initial cohort showed that the simulation design has the potential to engage pre-service teachers in deep thinking about the virtual classroom environment. In particular, we noticed that many users were able to link their own school-based experiences to those presented within the simulation, and some were able to link the theory presented in their pre-service teacher education training to classroom practice.

We are interested in following up the current research by exploring mechanisms to further engage users in thinking processes by extending the way that we operationalize the nine design elements of authentic on-line learning environments. The prototype will be further developed in view of what we have learnt from our initial trial.

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