INCORPORATING REAL EXPERIENCE INTO THE DEVELOPMENT OF A CLASSROOM–BASED SIMULATION

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Abstract

This paper reports on the design of an on-line simulation that enhanced pre-service teacher practicum experience in the important area of literacy teaching. Research with more than 200 users of the simulation showed that it developed pre-service teacher understanding of complex classroom situations associated with the teaching of literacy by giving them the opportunity to slow down or accelerate classroom events, revisit and reflect on critical decision points and replay events in the light of new understandings. This gave pre-service teachers time to think critically about complex teaching situations which relied on the teacher's ability to tune into children's experiences, engage with them in dialogue and negotiation as well as utilise a range of indirect instructions such as questioning, modelling and prompting. Pre-service teachers reported that their experience with the simulation enabled them to more fully appreciate the impact of subtle changes that experienced teachers made during lessons.

Key words
On-line simulation, design research, literacy, pre-service teachers

Introduction

Education systems face a crucial period as many of the current cohort of experienced teachers retire and their places are taken by the next generation of teachers (MCEETYA, 2003). This places increased demands on teacher education institutions to graduate more teachers but at the same time stakeholders rightly demand that graduating teachers are knowledgeable, highly skilled and dedicated professionals (Ramsey, 2000).

Critical to the success of a teacher education program is the practicum. But, as Ramsey (2000) reported, current school-based practical experiences often consist of a series of isolated, decontextualised lessons; or at worst it can be an unsupported and disillusioning experience. Ramsey

recommended that pre-service teachers engage in an expanded practicum supervised by fully accredited teacher mentors. However, the cost of the practicum is a significant factor in a teacher education program. In addition, a shortage of practicum places and suitable trained teacher mentors, creates a situation where it is difficult to make major changes to the current system without making major impositions on both schools and teachers.

The pedagogical focus of the simulation is on the teaching of literacy skills in lower primary schools. These skills are considered one of the keys to success in schooling (Comber, Badger, Barnett, Nixon, Prince & Pitt, 2001) thus, an important focus area for pre-service teachers. Teachers of children in the early years of primary schooling need to provide appropriate sequences of learning experiences that develop reading and writing skills (Purcell-Gates, 1995). It is also important that beginning teachers understand the impact of classroom discourse on student learning (Gee, 2000). This can be a very challenging task for beginning teachers. The simulation makes use of research data on how exemplary teachers facilitate learning and behaviour management within primary classroom settings, in particular during the teaching of reading and writing (Freebody & Luke, 1990).

Pre-service teachers are often presented with a number of different theories as to how to best organise and facilitate their classroom literacy experiences. Such understandings can come from their pre-service education, their experiences on practicum and indeed their own experiences as learners. We see a simulated environment as a way to demonstrate a theoretical perspective in action within a virtual classroom. As such, a simulation has the potential to be significant in developing student understanding of literacy practices within a classroom.

The purpose of this study was to conduct research into the design and implementation of an on-line simulation that developed pre-service teachers' pedagogical knowledge and practices of literacy teaching to children in the early years of schooling.

The key research question that the study addressed was:

How can an on-line simulated classroom be designed to engage pre-service teachers in decision-making about the use of appropriate instructional and classroom management processes and practices during literacy lessons?

A simulation is an ideal vehicle to achieve the purpose of this study as it can engage pre-service teachers in an on-line environment that stimulates sustained thinking about the appropriate use of instructional and classroom management strategies during literacy lessons. The incorporation of specific elements typical to classrooms within the simulation allows for the user to experience and experiment with a range of strategies as they deal with typical decisions a teacher would encounter.
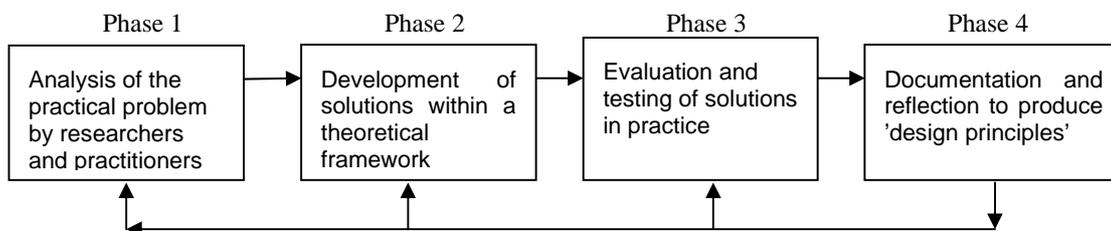
Background

Simulations as learning environments have a long history of use in education and training. Jonassen (1997, 2000) argued that computer-based simulations can be powerful vehicles for learning by applying the critical characteristics of the traditional apprenticeship. As such they apply a situated approach to learning by focusing on the learning knowledge and skills in contexts that reflect the way that the knowledge is used in real life (Brown, Collins & Duguid, 1989). Jonassen's work is supported by studies into the complex learning situations presented in computer games and other simulations. Researchers such as Gee (2000), Aldrich (2004), and Prensky (2004) identified various overlapping learning principles that share four common features. First, they involve socially-shared intellectual work that is organised to achieve a task. Second, they contain elements of the traditional apprenticeship process that encourage student observation and comment, make explicit much of the know-how acquired, and permit the participation of the relatively unskilled players. Third, they are

organised around strategies necessary for acquiring a particular body of knowledge. Fourth, the process of playing a simulation or video game is focused on the individual, but makes use of a learning group to support decisions and provide reflection.

Limited research has been conducted into the use of on-line simulations in teacher education as it has only been in recent years that ICT has evolved to the point where researchers can begin to take full advantage of its potential. Recent examples are the work of Eckersley, Richards and Schofield (2004) who report on the development of an on-line simulation designed to introduce pre-service teachers to the broad work culture of primary and secondary schools. Gibson (2004) and others developed a simulation that was based upon interactions among numerical models of teacher actions, student personality and student behaviour.

Approach

The study uses a development approach to the research (Reeves, 2000; Reeves, Herrington & Oliver, 2005) (also known as 'design research' 'design experiment' or 'formative research') and involved four phases that are characteristic of this approach as depicted in the diagram that follows.

Phase 1	Phase 2	Phase 3	Phase 4
Analysis of the practical problem by researchers and practitioners	Development of solutions within a theoretical framework	Evaluation and testing of solutions in practice	Documentation and reflection to produce 'design principles'

This paper focuses on phases 1 and 2 of this project and briefly reports on the preliminary outcomes of phases 3 as phase 4 is still underway.

Phase 1: Analysis of the practical problem

The following research questions were posed to gain an understanding of the practical problems that the simulation was to address.

> *1. What does the current research say about the planning and organization of literacy lessons in lower primary school classrooms?*
> *2. How can pre-service teachers experience this knowledge in ways that encourage them to reflect on their current experience and access additional knowledge?*

Researchers Kervin, Cambourne and Turbill who had access to decades of classroom-based observation data addressed question 1. In addition an extensive literature review on this topic was written.

To address question 2 the researchers developed teacher scripts of classroom learning events designed to depict the research from question 1. These scripts were trialed with a reference group of literacy experts and expert teachers who suggested modifications. Storyboards of these events were then created in PowerPoint and again reviewed by the reference group. These events were later used as an initial framework for the simulation design.

Phase 2: Development of solutions within a theoretical framework

The challenge for simulation designers 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 identified nine design elements of situated learning environments and the challenge for us was to operationalize as many of these as we could in an on-line simulation. Table 1 below summarised how we operationalized many of the nine design elements in the simulation. Later in the paper specific screen captures will be presented to more fully illustrate these points.

Table 1 Operationalizing the Nine Design Elements

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 an 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; access to expert performance or advice	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 is difficult for students working at this level to understand (need to focus more on input rather than providing an output).
Expert performances and modelling of process	The simulated Kindergarten teacher provides a model of teaching practice. The user's decisions impact upon the teaching and learning experiences offered and the interaction of the teacher with students in the class.	
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

Design Element	Initial Prototype	What we learnt
		is pre-service teachers, it is considered more meaningful to allow them access to 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 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 classroom and plan, articulate and justify future decisions as they occur.	The first prototype offered the thinking space at decisive points throughout the running time of the simulation. The next version will have this embedded tool available throughout 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. The next version will incorporate a "notebook" where the user will be able to cut and paste from summary sheets into a notebook facility which 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.	We did not expand this feature past the beginning of the simulation as the once users took on their own role, we felt that this would have been a distraction.
Authentic assessment of learning within the tasks	Not operationalized in this version	

The design of this simulation is based upon segmenting sets of authentic classroom teaching episodes into interconnected short-term events called cycles. Sets of cycles can link in a variety of ways to form a diversity of possible teaching episodes. The way that each teaching episode unfolds is based upon the decisions that users make about the management of the classroom, of students and of random events that occur during each cycle. The simulation allows the user to take on the role of the teacher of a virtual Kindergarten classroom. The user is presented with a Kindergarten class (5 to 6 year olds) consisting of 26 students.

The initial screen of the simulation (Figure 1) presents both the situation and the purpose of the user's interaction in his or her role as the virtual teacher. It allows pre-service teachers to explore a variety of appropriate instructional and classroom management processes and practices during literacy lessons.
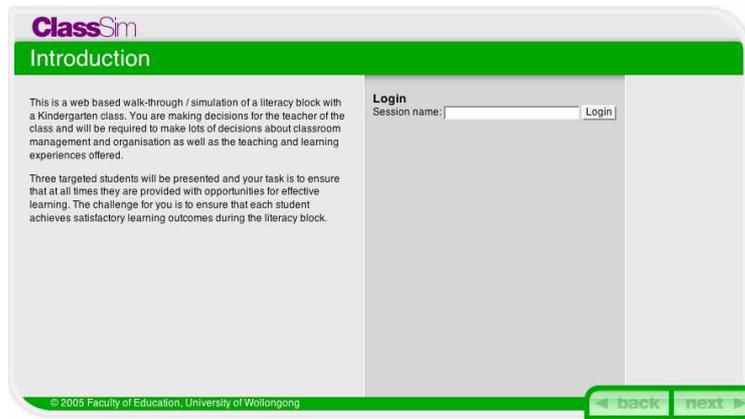

Figure 1: Initial screen

The simulation cycles reflect the problem-solving nature of classroom life. 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 lesson. At other times they are required to make decisions about the sequence of teaching, for example: do they begin a lesson with a sequencing episode, or a modelled reading episode, or a modelled writing episode, or a retelling of a familiar story episode? Each of these decisions has the potential to impact on subsequent decisions in each of these described areas.

As the users make decisions about the management of the classroom and how they 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 focus on the concept of the days of the week within literacy-based learning and teaching experiences—we believe this is a typical learning experience in a kindergarten classroom. The cycles within the simulation have been organised as shown in Figure 2.

Three targeted students have been represented in the simulation, based on our own classroom teaching experiences and other research data gathered from classroom observations. 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.

Harley is medicated for Attention Deficit Hyperactivity Disorder (ADHD). He finds the classroom situation difficult and is frequently not engaged during classroom lessons. If he is not medicated he tends to distract and annoy other children. The teacher is aware that Harley is being bullied by Gavin and as such the situation is being monitored.
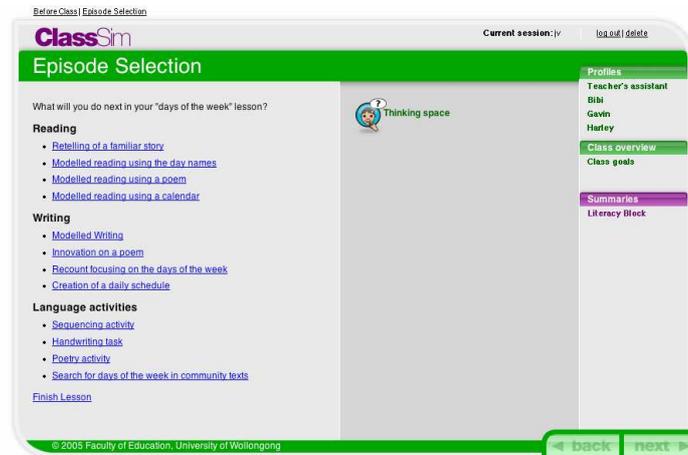
Figure 2: The cycles within the simulation

Figure 3 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 authenticity to the simulation.
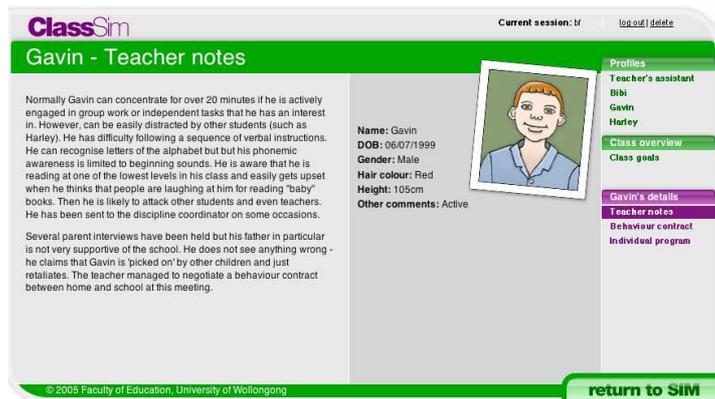

Figure 3: Teacher notes on Gavin

Phase 3: Evaluation and testing of solutions

Three trials have been conducted with this software with first year primary education students from the University of Wollongong. The first trial was conducted in 2004 with a cohort of twenty-four pre-service teachers enrolled in their first year of the Bachelor of Teaching program. These participants were all studying through the alternate Knowledge Building Community (KBC) program. During this session pre-service teachers focus on literacy education and all participants were based in classrooms weekly. These pre-service teachers used the simulation in a laboratory over two 90 minute periods. They were arranged in adjoining pairs, so that they could converse and articulate their understanding and problem solving strategies when using the simulation. This trial identified a number of refinements that could be made to the software along with some indication of how these users interacted with the software (for further information see Ferry, Kervin, Turbill, Cambourne, Jonassen and Hedberg, 2004).

The second trial was conducted in 2005 with another cohort of 24 first-year students enrolled in the KBC program. The focus during this time was on the users' use of new design features (such as navigation, time taken by the users, analysis of history trail left by the users and analysis of thinking space entries). After this, 185 pre-service teachers enrolled in a core first year subject entitled "Curriculum and Pedagogy 1" engaged with the software. Each trial drew upon a case study design with data collected through researcher observations, semi-structured interviews and analysis of user entries in the embedded tool, the 'thinking space'. Potential case study participants volunteered to be involved in the research with a purposive sample selected from these volunteers by the researchers. A research associate was employed to assist researchers to record observations on a protocol during each 90 minute period. At the end of each session the researchers using stimulated recall and semi-structured interview techniques interviewed five pre-service teachers. The selection of these interviewees was based on the observation data ensuring that we select participants who represented pre-service teachers who were highly engaged with, partly engaged with or not engaged with the simulation.

The data gathered were analysed using processes of data reduction, data display and conclusion drawing and verification (Denzin & Lincoln, 2000). This process was continuous and on-going and informed our future observations as well as the selection of the next set of 5 pre-service teachers to be interviewed. In total 10 pre-service teachers were interviewed (i.e. 5 for each 90 minute period). Interview responses were transcribed and given to interviewees for verification.

Outcomes

Our experience with each of the trials showed that the simulation design has the potential to engage pre-service teachers in deep thinking about the virtual classroom environment. When asked if the simulation was a useful and worthwhile experience, one participant stated:

> "I think it was the closest thing to actually being in a classroom that I have experienced at university. It gave me something that was really tangible".

The outcomes are briefly reported from the perspective of a pre-service teacher in this section as the focus of this paper is on the design of the simulation. Examples from our data are summarised below and more extensive details on user trials will be reported in future publications. Our overall analysis of data from these trials suggests that interaction with a classroom-based simulation is a feasible way to support and extend upon existing classroom-based experience. Analysis of user interaction with the simulation highlights three key implications for the use of simulations in pre-service teacher education.

1. Identifying Potential Classroom Problems

Interaction with the simulation appeared to assist users to develop an awareness of the challenges they face as a beginning classroom teacher. One participant stated:

> "you get into school the first time, you have no idea about kids with problems, because when you were in kindergarten there were those kids but you didn't pay attention to them…so you have no idea of what problems you're going to encounter."

In particular, decisions around classroom management within the virtual classroom engaged many of these users in dialogue with each other and compose written reflections in their thinking space entries. The following excerpt from audio-recordings made while the participants were using the software, captures some discussion focused on the reaction of a targeted student to a decision made by the user.

Hayley: Oh my god, Bibi is crying. What did I do?
Bree: Don't worry she cries all the time. She has cried for me a few times now. Just ignore her and she will stop.
Hayley: Ignore her?
Bree: Yeah, she hates attention. Read her profile and her updates.

This excerpt also identifies the use of the support materials when encountering such issues within the software.

Many of the participants appeared to use the simulation to gain insight into some of the problems and challenges that typically face classroom teachers. One participant referred to the ability to become immersed in the life of a classroom:

> in the everyday decisions you have to make and interruptions…and losing your train of thought", as a strength of working within the simulated environment (Rachel, 23.3.04)

All of those interviewed made similar remarks and preliminary data from the 2005 study with 180 users supports the notion that use of the simulation develops pre-service teacher awareness of the challenges they will face as beginning teachers.

2. New Perspectives and Reflecting on Preconceived Ideas

One participant claimed that her use of the simulation assisted her to "put things into perspective". This was a theme that consistently emerged throughout the analysis of the data. The users of the simulation software identified the enormous scope of the role of the teacher and associated demands with key stakeholders. The remark made by one participant - "Is a teacher's job ever done???" – identifies an awareness of the complex role of a classroom teacher. A number of the participants were able to identify areas for further study that emerged from their use of the simulation. For example, one participant expressed motivation to investigate the areas of ESL teaching and bullying. This participant stated:

> "With the Simulation it's kind of made me think that I am going to be faced with these things, these challenges and I think the Simulation prepared me more because now before I go on my prac I'm actually going to read … documents and I'm also going to refer back to the website that's available in the Sim about bullying".

The 'thinking space' encouraged many of the users to think more deeply about the decisions that are made on a daily basis as a teacher. In addition, the 'thinking space' provided opportunity for the users to acknowledge and reflect upon their preconceived ideas about teaching.

One hundred and fifty seven out of 180 users from the 2005 cohort reported that the simulation motivated them to think in more detail about the decisions that teachers make on a daily basis.

3. Development of Opinions and New Ways of Thinking

The simulation appeared to encourage the users to form opinions related to different facets of teaching, and to reflect on those beliefs. One participant said that in real life situations she can dismiss the decision making process and does not "even bother thinking about it", however, the simulation is continually asking, "What do I [the user] think?" The thinking spaces encouraged the users to justify, reflect on and evaluate their decisions, and this participant seems to believe that they achieve this aim in her case. She said that "seeing the thinking space there and thinking, ok I have to have an opinion on this" encouraged her to form and justify her beliefs.

Many of the participants identified that the virtual environment within the simulation provided space for the users to make decisions and take risks without affecting real children. One participant commented that she "…liked how you can go through and check your answers. You can go through and if you don't like the consequences of your decisions you can go back and change it".

In all of our trials users stated that they valued the opportunity to record and justify their thinking through the 'thinking space'.

Concluding Comments

Our data showed that the simulation has the potential to develop pre-service teacher understanding of complex classroom situations associated with the teaching of literacy by giving them the opportunity to slow down or accelerate classroom events, revisit and reflect on critical decision points and replay events in the light of new understandings. This gave pre-service teachers time to think critically about complex teaching situations which relied on the teacher's ability to tune into children's experiences, engage with them in dialogue and negotiation as well as utilise a range of indirect instructions such as questioning, modelling and prompting. Users consistently reported that their experience with the simulation helped them to make their practicum experience more focused by giving them knowledge and experience to more fully appreciate the impact of subtle changes that experienced teachers made during lessons.

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