Online classroom simulation: The next wave for pre-service teacher education?

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Pre-service teacher education has been the centre of much debate in recent times as research consistently shows that traditional programs are not adequately preparing beginning teachers for the reality of classrooms. This paper describes the rationale for the development of a simulation to support teacher education, we report of specific design features in our initial prototype version of the software and report on our research into its initial use by pre-service teachers. The prototype simulation allows the user to take on the role of the teacher of a simulated Kindergarten classroom (ages 5 to 6 years). During the simulation the user makes decisions about organising the lesson, classroom management, and responses to individual students. The user can monitor and track the progress of three targeted students throughout the course of the simulation. Embedded tools serve as a "decision assistant" and a "thinking space" are used in order to plan and justify new decisions, and to reflect upon the consequences of previous decisions.

Keywords: pre-service teacher education, simulation, online classroom

A rationale for developing a simulation in teacher education

Reviews of teacher education continually report on a number of key skills that are not well developed by traditional preparation programs. These include: student discipline, motivating students, dealing with individual differences, insufficient and/or inadequate resources, organisation of classwork, assessing student work, and relationships with parents (Koetsier & Wubbels, 1995). When interviewed, final year pre-service reachers claim that they leave university feeling inadequately prepared for professional practice and often uncertain about what will confront them when they arrive at schools (Cambourne, Kiggins and Ferry, 2003; Armour and Booth, 1999). Schools that employ recent graduates support such claims and further assert that most recent graduates are often unaware of how classroom cultures operate and find it difficult to transfer what they've studied at university into effective classroom practice (MACQT, 1998). The Ramsey (2000) review of teacher education in NSW confirmed these views and asserted that often pre-service teachers do not understand how good classroom practice impacts on student learning.

Hoban (2002) claimed that most teacher education courses represent a fragmented view of learning. He argued that this has enormous potential to hinder the development of pre-service teachers into flexible, progressive practitioners. It is understood that many recent graduates find it difficult to deal with life in the classroom, as they are often unable to retrieve the essential knowledge when they need it most (Kervin & Turbill, 2003; Stronge, 2002; Danielson, 1996; Entwhistle, Entwhistle & Tait, 1993).

Ramsey's (2000) review of teacher education in New South Wales strongly recommended that pre-service teachers receive quality classroom based experience supervised by an accredited teacher mentor, but r, just providing more extensive classroom based experience does not guarantee quality experience. Darling-Hammond (1999) and Ramsey (2000) both conceded that school based practical experience often consists of a series of isolated, decontextualised lessons prepared and implemented according to the requirements of the supervising teacher; or at worst it can be an unsupported and disillusioning experience.

Experienced researchers such as Groundwater-Smith et al (1996) and Cambourne et al (2003), have claimed that pre-service teacher learning is enhanced when pre-service teachers regularly participate in

the complex decision making processes that teachers typically make in classroom settings. In an ideal world pre-service teachers would have unlimited access to quality classroom episodes that progressively develop their classroom practice. However, the cost of the practicum experience, school needs, school availability and university course requirements place limits on access.

Lack of regular access to quality classroom experiences (Ramsey, 2000) frustrates both teacher educators and pre-service teachers. It is recognised that the initial years of a teacher education program are critical for pre-service teachers to develop fundamental understandings about their future work of teachers. Other ways of providing the sorts of experiences provided during personal experience with classroom based teaching episodes are needed. We believe that one approach is to make use of an online classroom based simulation. Thus the time has come to re-think school based practice teaching programs.

Advances in educational software have demonstrated that it is feasible to create a motivational simulation that supports pre-service teachers with tools that allow them to view the effects of their decisions from multiple perspectives, enabling them to get close to the teacher's and student's experience of a learning episode. Furthermore, simulations can be designed to incorporate feedback and advice, through devices such as an online mentor teacher, 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 enhance the real life experience. For example, simulations can provide authentic and relevant scenarios making use of pressure situations that tap users' emotions and forces them to act. Thus, providing a sense of unrestricted options which can be replayed (Aldrich, 2004).

Simulations can allow the user to see the consequences of the complex decisions teachers make in managing learning environments. We believe that this medium can support the pre-service teacher as a learner to enter "…into an intellectual partnership with the computer" (Jonassen, 1996:4). In particular a simulation has the potential to engage the user in making decisions about student behaviour, classroom organisation and learning decisions 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 student's 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).

The pedagogical focus of the simulation described in this paper is on the teaching of literacy skills in lower primary schools. These skills are considered one of the keys to success in schooling (Cambourne, 2000; Comber et al, 2001) and from our experiences are often too abstract for pre-service teachers to understand without being meaningfully linked to actual classroom examples. 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) with explicit teaching in language and literacy (Martello, 2002:48). It is also important that beginning teachers understand the impact of classroom discourse on student learning (Gee, 2000). The literature supports our own anecdotal evidence as it acknowledges that the transference of this theory to classroom practice can be a very challenging task for beginning teachers. The simulation makes use of research data on how exemplar teachers facilitate learning and behaviour management within primary classroom settings, in particular during the teaching of reading, writing and spelling (Freebody & Luke, 1990).

Simulations as learning environments have a long history of use in education and training (Grabinger, 1996). Over the past decade simulations have become increasingly popular for creating realistic digital environments that closely replicate the world and the workplace. Research and development in virtual reality and simulation engines have led to the release of some popular simulation games, such as the Sim series that includes SimEarth, SimCity and the Sims. By manipulating these types of simulated environments users learn how to manage complex environments and the consequences of the decisions they take by being situated within these virtual environments. Some critics such as Tripp (1993:75) assert that computer based simulations based on a situated learning model are of limited educational value because "true expertise is learned by being exposed to experts". However, Jonassen (2000) argued that computer based simulations can be powerful vehicles for learning by applying the critical characteristics of the traditional apprenticeship and his research with business simulations supports his assertion. Will Wright, the creator of Sims, predicts that future simulations will be influenced by three factors:

community structures; player creativity (as in player created content such as scenarios) and metrics - measuring what players do and responding to that (Mangis, 2002).

Studies into the complex learning situations presented in video games and other simulations by researchers such as the Cognition and Technology Group at Vanderbilt (1990), Gee (2000), Jonassen, (1997), Reigeluth and Schwartz (1989) have identified various overlapping learning principles that share four common features. First, they involved socially shared intellectual work that is organised to achieve a task. Second, they contain elements of the traditional apprenticeship process (described by Lave, 1991) 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 needed to acquire 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. This emphasises inquiry, skill development, collaboration and reflection (Tan, Turgeon, & Jonassen, 2001).

Limited research has been conducted on simulations in teacher development. However, recent educational software advances have demonstrated that simulations are powerful tools for analysing, designing and operating complex systems. Now is an opportune time to design a simulation that mirrors some of the features of complex classroom environments in light of current criticisms of pre-service teacher education. Such a simulation has the capabilities to enable users to test hypotheses around teaching practice in a safe environment and provide a method for evaluating these decisions to develop understandings of the 'real world' of teaching. Also the simulation should be capable of communicating about some of the learning events that occur in classrooms. Harper et al (2000) claim that it is feasible to create communication tools that apply to classroom simulations by allowing users to view the effects of their decisions from multiple perspectives. The structure of the devised simulation incorporates feedback and advice; specifically through devices such as a thinking space plus the opportunity to repeat a lesson and explore alternative decisions. Usually this is not feasible, nor practical in traditional modes of classroom experience for pre-service teachers.

Significance of this research

This research addresses a gap in the research on educational simulations and specifically focuses on their potential to develop learners' understanding of complex situations. The key feature of an educational simulation is that it makes use of a model to represent a process, event or phenomena that has some learning significance. Most simulations are based on models that are *static* in the sense that they have been pre-programmed to respond to inputs from users. The learning environment developed for this research uses computer mediated communication tools to create an illusion of a simulation that is dynamic and evolving, reflecting the true nature of classrooms. Online communication and thinking tools will support real world decision making as learners participate in classroom scenarios in which events evolve and require a series of complex teacher interventions. As the pre-service teacher gains in both experience and confidence, we intend to increase the levels of complexity.

The simulation is designed to improve pre-service teacher understanding of how students acquire and develop literacy skills in lower primary school classes. It combines the four main categories of teacher learning described by the research: technical (skill emphasis); inquiry based (process emphasis); collaboration; and reflection. It is designed to allow users to fully participate or to be an observer from the boundary engaging in what Lave and Wegner (1991) call "legitimate peripheral participation". This process allows the neophyte to progressively piece together the culture of the group and to understand what it means to be a classroom teacher. Over time the user will move from the role of observer to a fully functioning agent in the simulation. Thus the simulation represents a context that reflects the way that the knowledge of a teacher is used in real life and such an approach is based on situated cognition (Brown, Collins and Duguid, 1989).

Herrington and Oliver (2000) agree that many researchers and teachers accept that well designed multimedia environments provide viable alternatives to the real life setting provided they do not sacrifice authentic context. Their review of the literature identified nine design elements of situated learning environments and these were: the provision of authentic contexts that reflect the way that knowledge is used in real life; authentic activities; access to expert performance or advice; multiple roles and

perspectives; support for the collaborative construction of knowledge; reflection so that abstractions and generalisations can be formed; tools that enable tacit knowledge to be clearly articulated; scaffoldings and coaching by the teacher at critical times; and authentic assessment of learning within the tasks.

This study builds on the research of Herrington and Oliver (2000), and Herrington. Oliver and Reeves (2003), by investigating how we the design elements they identified in an online simulation could be operationalised. It extends on their work by making use of the research on simulations and video games, and also applies the concept of "legitimate peripheral participation".

The design of the simulation

The user is presented with a Kindergarten class (5 to 6 year olds) consisting of twenty six students. The initial screen (figure 1) presents the situation the user is to engage with in their role as the virtual teacher.

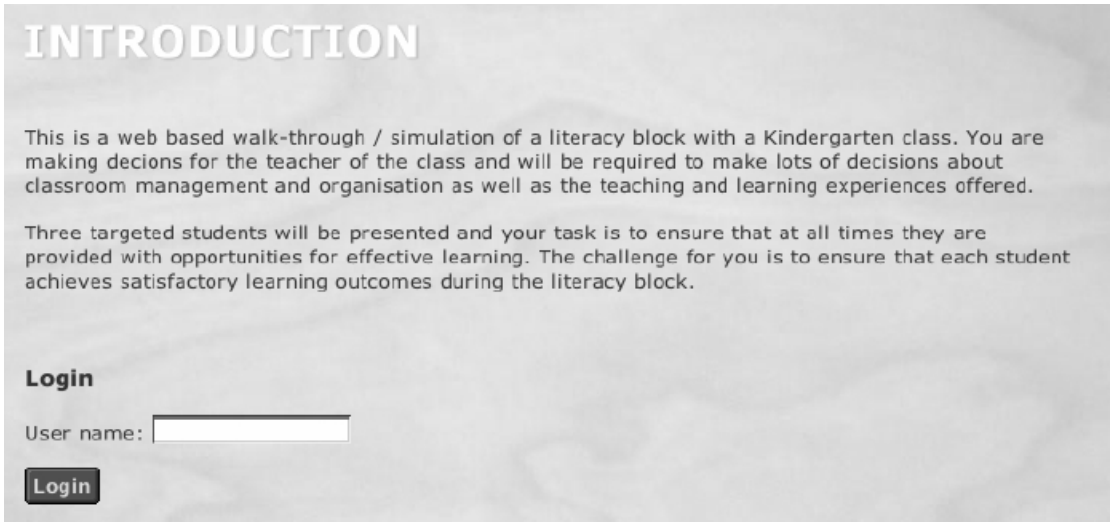

Figure 1: Introductory screen (screen design by Sprout Media www.sproutmedia.com.au)

The cycles

The user is then 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 will be 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 retell 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 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 user engages 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 simular student outcomes. This reinforces the notion that there can be several suitable approaches to specific student learning needs.

The cycles incorporated within this simulation 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 listed below:

Management decisions

1 The organisation of the classroom
2 The start of the day
3 The late arrival of a student
4 Random decisions

Teaching and Learning decisions

5 Sequencing episode
6 Modelled Reading episode
7 Modelled Writing episode
8 Retell of a familiar story episode

Targeted students

Three targeted students have been developed in reference to our own classroom teaching experiences and also from the data we have collected from observing students. A general description of the three targeted students focused on throughout the simulation follows.

"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 she likes to be with in the classroom.

"Harley" is medicated for ADHD. He finds the classroom situation difficult and he 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 shows how the information about Gavin is presented in the form of teacher notes to the user. The notes are based on the sorts of notes that teachers typically keep. It is designed to add authenticity to the simulation.

Figure 2: Teacher Notes (screen design by Sprout Media www.sproutmedia.com.au)

"Gavin" has significant behavioural problems and as such a Classroom Teaching Assistant has been employed for twenty hours per week to support "Gavin" in the classroom. The teacher has negotiated a behaviour contract with "Gavin" and his parents (although his parents aren't supportive of this). The user has access to this contract throughout the simulation. "Gavin" often finds classroom tasks difficult.

A key feature of the simulation is the ability to track the learning of three targeted students. Throughout each cycle there are opportunities for the user to pause the simulation and view the impact of the users teaching and classroom management decisions for each of the targeted students. These are viewed when users select the student update button (individual buttons for each of the three targeted students have been developed). The updates have been organised according to the New South Wales (NSW) model of pedagogy (DET, 2003) and as such provide feedback on 'intellectual quality', 'quality learning environment' and 'significance'. At these points a sliding scale is available for the user to plot the expected performance of the targeted students as identified in the NSW model of pedagogy. Written feedback is presented according to this criteria so users can compare their predictions to that of a panel of experts. Once the user has made their predictions they are able to select a button entitled "see what the experts think". At this time, they will be presented with the plotting of an "expert" for that student at that time. In addition, artefacts may be available to further illustrate student performance. Figure 3 shows an

example of the teacher's thinking about the sequencing episode and predictions about how "Gavin" will respond to this. The user is able to employ sliding scales to plot their expectations of student outcomes at this point to each criterion. They can then compare their expectations with those of experts (will be superimposed over the output displayed).

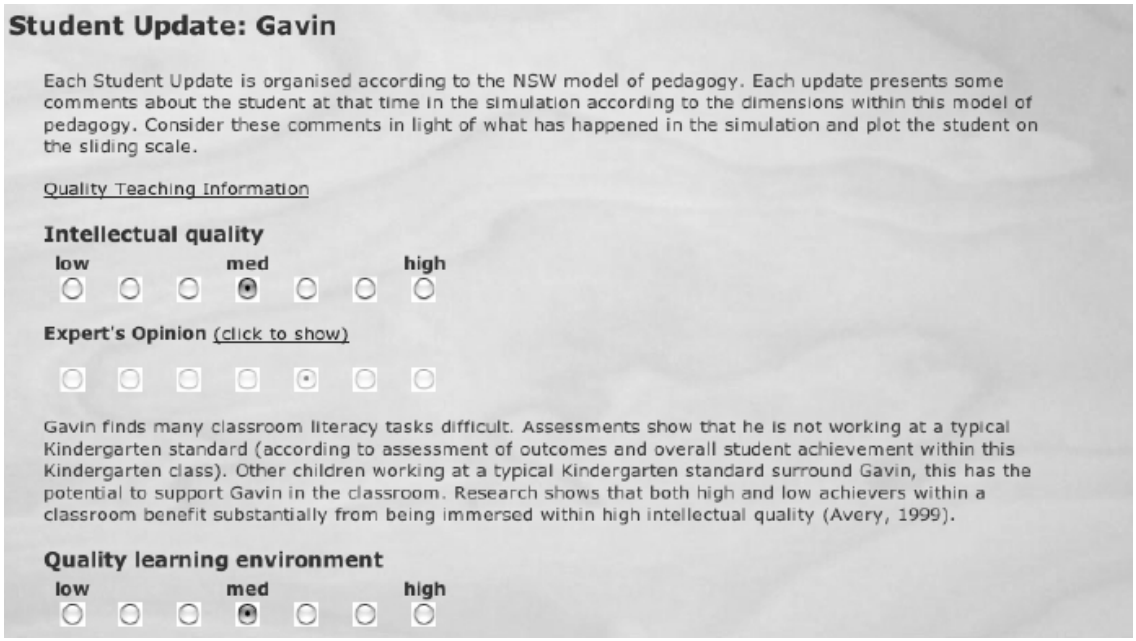

Figure 3: Sample of student update within sequencing cycle according to NSW pedagogy model

Embedded tools

A "thinking space" has been designed for users to interact with throughout the running time of the simulation. This is located at decisive points throughout the simulation, with the aim of encouraging the user to articulate and justify the decisions they have made. They also provide opportunities for the user to reflect upon the impact of previous decisions in view of the targeted students. It is our intended aim in these spaces to engage the user in Jonassen's understanding of critical thinking – that is, "…generalisable, higher order thinking, such as logic, analysing, planning, and inferring" (Jonassen, 1996:24).

As such, the thinking space presents three key questions developed to promote thoughtful decision making. These key questions are supported by the help screen shown on the right hand side which offers prompts and additional things to consider. The user types reflections and thoughts into the blank space and can save their notes. The user is able to retrieve and review their previous decisions and thoughts throughout the duration of the simulation. An example of a "thinking space" is captured in figure 4.

The initial trial of this prototype simulation with pre-service teachers

The initial trial was conducted with a group of 24 pre-service teachers enrolled in the first year of a primary (elementary) teacher education course. The participant ages ranged from 18 to 43 years and 19 were females. Nineteen were under 25 years of age.

During the introductory session the group was broken in to two sub-groups of twelve and each sub-group spent 90 minutes familiarising themselves with the simulation. In these sessions three observers took field notes. The users were videotaped and audio recorders were placed randomly on computer workstations to capture dialogue between the users. Each member of this trial cohort were provided access to the simulation via a CD copy after this introductory session. Another 90 minute session was held with these participants the following week where once again they engaged with the simulation with the researchers present. Twenty one of the users gave their permission for the researchers to download and analyse the comments that they entered into their personal thinking spaces throughout the simulation. As they continued to engage with the simulation the researchers were able to continue collecting the data the users

had entered. These data were analysed and a purposive sample of 4 users were then interviewed. The interviews were audio recorded, transcribed and analysed.

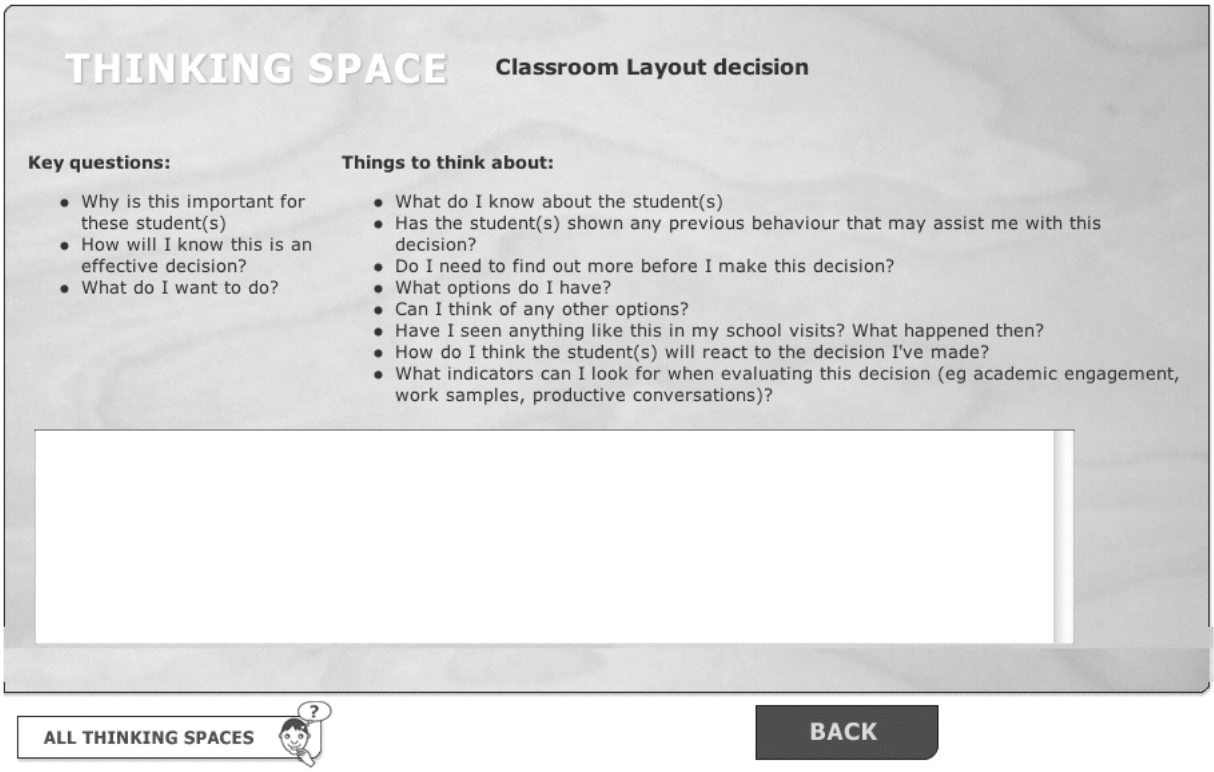

Figure 4: Thinking space (screen design by Sprout Media www.sproutmedia.com.au)

Findings

Our preliminary analysis of the collected data suggested that whilst the users engaged with the simulation to varying degrees, there appeared to be three key levels the users engaged with when exploring the Simulation. Each of these levels will be explored further.

The simulation environment

Comments from the users identified that the simulation environment provided them with a 'safe' way to explore the virtual classroom. Several of the users identified that it enabled them to make decisions and explore the consequences of these, without fear of affecting 'real' children. The support components within the simulation (explicit links to literature/theory, school and classroom artefacts) were identified as being useful resources to encourage additional research and build upon the user's understanding of what had happened and why in this virtual Kindergarten classroom.

Simulation processes

Many of the users made links between what happened in the simulation and what they had observed in their own school based experience. The previous experiences of these students enabled them to confidently critique the experiences within the simulation. Further, many of the users identified that engaging with the simulation increased their awareness of their own personal beliefs and how these impact upon their developing teaching style.

Links between theory and practice

The collected data shows that some users began to make sound links between the theory of their pre-service teacher education and the practice they were observing in the simulation and from their classroom based experiences. These links seemed to occur when the user engaged with the support materials

provided to justify and reflect upon the decisions made in the simulation, acknowledged the formulation of new ideas and began to identify areas for their own future professional learning.

Concluding remarks and future directions

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 to extend and enhance their links between the theory and classroom practice. In addition we have identified the need for other cohorts from different pre-service teacher education programs, and at different stages within these, to engage with the simulation. We acknowledge that the current study was limited to twenty four students enrolled within a specialised program. This in turn limited the range and quality of data that we were able to gather at this time.

However, the initial use showed that all users were deeply engaged with the Simulation for a sustained period of time. Our evidence shows that in during the two ninety minute sessions all users were on task and actively interacting with the simulation for almost all of the time. Thus, we can state that the prototype Simulation did engage the learners for a sustained period of time and evidence of deep thinking was apparent in their responses in the thinking spaces and in their interactions with researchers. We are optimistic about the potential of this design for a range of contexts that are similar to that presented in this research.

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