The need for choice and control: Preparing the digital generation to be teachers

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In this paper we describe an online classroom-based simulation, *ClassSim*. The software was developed to enable pre-service teachers to interact with a virtual classroom environment as they assume the role of the teacher. The project built on the research of Herrington, Oliver and Reeves (2003) by investigating how the design elements of authentic learning environments they identified could be operationalised in simulation software to engage pre-service teachers in understanding the complex decisions needed to plan and implement reading and writing experiences for young children.

With the support of a large grant from the Australian Research Council entitled: *Investigating a classroom simulation designed to support pre-service teacher decision making in planning and implementing literacy teaching* (DP0344011) we have engaged in iterative designs and accompanying trials of the software with more than 500 pre-service teachers studying within the Faculty of Education at the University of Wollongong, Australia. During these trials we noticed some trends in the ways in which pre-service teachers approached the software and report on the implications of these trends for instructional designers.

Key words: online learning, simulation design, teaching

Introduction

The term ‘Learning Design’ is used in this paper to describe the use of a wide range of pedagogies in online learning. Our goal was to design a learning environment that allowed for: multiple means of representation, providing learners various ways of acquiring information and knowledge; multiple means of expression to provide learners alternatives for demonstrating what they know; and multiple means of engagement to tap into learners' interests, challenge them appropriately, and motivate them to learn. Such an approach provides learners with alternative methods to demonstrate what they know. It also acknowledges that there is more that one way to learn and respects individual learning style differences of the new generation of ‘digital learners’ who now populate universities.

These ‘digital learners’ are reported to prefer rich, more constructivist learning experiences, with educational technology frequently cited as one way to create such experiences. Roblyer (2000) acknowledges technology as a way to motivate students as it captures their attention through the use of multi-modal presentations that illustrate real-world relevance. Indeed, it can be argued that when students see that complex theory has real-life application, it is no longer “uni work”, becoming instead knowledge and understandings that have clear value to their professional identifies.

The simulation we developed is an example of a popular use of technology to engage users in learning about, and critically reflecting upon, workplace practices and experiences. There are many examples of the use of simulations in a wide variety of professions such as medicine and health care, aviation, finance and traffic control. Often these simulations make use of a variety of cognitive tools that provide advice and feedback and these are integrated into the simulation to provide just-in-time support.

When we began to develop ClassSim we decided to focus on creating a digital resource that would support a group of users (our pre-service teachers) for a targeted purpose. We wanted the learning environment to be one that was useful and relevant to both their immediate situation and subsequent professional lives. We wanted the resource to respond to the research into pre-service teacher education that argues that often universities do not prepare beginning teachers effectively for their entry into the teaching profession with courses often presenting fragmented and decontextualised learning experiences (for example, Ramsey, 2000; Entwhistle, Entwhistle and Tait, 1993). Such research claims that typical

learning experiences in pre-service teacher education make it difficult for beginning teachers to retrieve knowledge from their university experiences when they are required to apply it in classroom situations. They assert that this happens because there have often been minimal previous links between the theory and the practice (Kervin & Turbill, 2003). While these findings encompasses a broad range of teacher education institutions, the development of the ClassSim software was targeted to respond to the observed needs amongst our students at our university.

The goal for us was to consider how we could develop a simulated learning environment to support our pre-service teachers in connecting the theory of their studies to the reality of classrooms. We were acutely aware that Ramsey (2000) in his review of teacher education in NSW recommended that pre-service teachers receive quality classroom-based experience supervised by an accredited teacher mentor, and his further comments that just providing more extensive classroom-based experience was not guarantee of quality experiences. Darling-Hammond (1999) has also highlighted this issue and conceded that school-based practical experiences often consist of a series of isolated lessons prepared and are implemented according to the requirements of the supervising teacher. The practicum has been described as an unsupported and disillusioning experience for many pre-service teachers (Ramsey, 2000). For us, the creation of an environment that would provide additional classroom based experience within a context that we knew and could deconstruct with the students to support their developing understandings, was an appropriate pathway in the development of the software.

Such rationale when coupled with Herrington, Oliver and Reeves (2003) assertion that many researchers and teachers now accept that well designed multimedia environments provide an alternative to real-life settings without sacrificing the authentic context, provided the context for the development of this software. Advances in educational software 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). A simulation allows its users to participate in the creation of a virtual-classroom world; make decisions like a teacher would have to, and then view and reflect on the effects of a multiplicity of classroom management decisions and teaching decisions. We believe that the development and use of a classroom-based simulation is one way to support the range of learning strategies incorporated within teacher education programs.

The development of ClassSim in connection with conditions for authentic learning environments

In our development of the ClassSim software our challenge was to create the virtual environment in a way that made it an ‘authentic learning environment’. This challenge stimulated us to look for guidance from the literature. Herrington, Oliver and Reeves’ (2003) 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. It was our aim to operationalise as many of these as we could in the development and refinement of an on-line simulation. We have previously reported in depth on these design elements (for example, Ferry & Kervin, 2007; Ferry, Kervin, Cambourne, Turbill, Hedberg & Jonassen, 2005), so this paper will provide a brief overview of these as way of contexualising the research we report.

Design element 1: Provision of authentic contexts that reflect the way that knowledge is used in real life

The Kindergarten classroom within the simulation was developed by the team members’ teaching experiences and classroom-based research. The complexity of classrooms was recognised and the simulated classroom aims to profile issues around classroom organisation and management, teaching and learning considerations and responses to individual students through the scenario it presents.

Design element 2: Authentic activities; access to expert performance or advice

The teaching and learning experiences incorporated within the simulation were collected from real classroom examples. The literacy focus within the simulation software is responsive to the reported difficulties that pre-service teachers experience with the application of often-abstract theory to the classroom. Opportunity for pre-service teachers to operationalise the theory is a central goal of the software.

In the introduction of new teaching and learning experiences the user is able to access 'teacher thoughts' pertaining specifically to what is happening in that episode. We believe this provides pre-service teachers with access to detailed commentary from someone on the field. Further, the ability to access commentary provided by an expert for individual targeted children at decisive points in the simulation provides additional access to expert advice. Figure 1 provides an example of such information. The user is able to see a rating of where on the continuum that particular child may be, along with a visual image representing what that child may look like at that time. We spent considerable time developing more than forty facial expressions for individual children within the virtual classroom. As teachers, we were very aware that often the first indication you get as to how engaged a student is, is from looking at their face. With that in mind, the development of a visual representation seemed appropriate to accompany the more descriptive written commentary.

Figure 1: An example of a student update

Design element 3: Expert performances and modelling of process

Teaching and learning experiences incorporated within the simulation were collected from ethnographic data illustrating real classroom examples. The opportunity for users to interact with these expert stories and examples of teaching process provides for a rich data base for commentary, analysis and reflection. In our trials of the software, many users have engaged in specific analysis of the virtual teacher. This, when coupled with other classroom examples and theoretical understandings, provides a solid platform of understanding for our pre-service teachers as they consider the work of a teacher.

The ability for the decisions made by the user to impact upon not only the teaching and learning experiences offered, but also the interaction of the teacher with students in the virtual class, provides example of the different pathways teachers take to support student learning. This is a difficult concept for many pre-service teachers to understand. Having them work within an environment, where we intimately know the different pathways, provided us with a common context within which to explicate and explore this concept.

Design element 4: Multiple roles and perspectives

When initially planning for the first prototype version of the software we explored the idea of enabling the users to select and assume a role within the classroom (for example, as the teacher or an individual student). However as our targeted audience was pre-service teachers, and we considered further the rationale for the development of the online simulation, we considered it more meaningful to develop the software so they assumed the role of the teacher.

The decisions the user makes guides their course throughout the simulation. Some decisions may seem to be fairly inconsequential, but may later impact upon what happens in the classroom. The role of a classroom teacher is more than just teaching. The simulation also includes a number of random events requiring the user to make management decisions. These decisions have been designed to illustrate the often unpredictable nature of classrooms and to further exemplify the impact that these can have upon the

teacher, the students and the quality of experiences and subsequent student work product. The occurrence and frequency of these random events is unknown.

Design element 5: Support for the collaborative construction of knowledge

Just-in-time support is offered through summary sheets that feature links to core subject textbooks, mandatory departmental policies (NSW), classroom artefacts and relevant web references. These links take the user to organised information sheets about specific areas that relate to what is happening within the simulation at that time. As the software was developed for our pre-service teachers, these pages feature links to sources relevant to their immediate professional situation. The connection to resources that respond to their immediate professional needs has shown that these resources are frequently used and cited by the users.

Design element 6: 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. This cognitive tool was developed to provide avenue for more formalised reflection. We found that pausing and reflecting was not a natural process for many of our pre-service teachers. Including a tool that was continually accessible, with prompting questions to think about, was one way to encourage articulation of thoughts, rationale for decisions and notes for future reference amongst our pre-service teachers. This tool is illustrated in Figure 2.

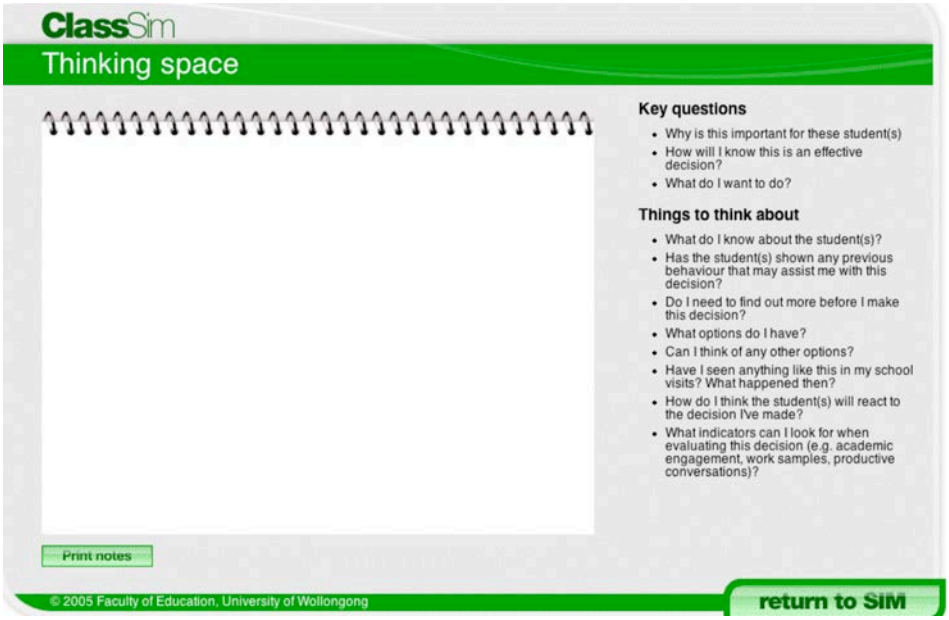

Figure 2: The 'thinking space' tool

Design element 7: Tools that enable tacit knowledge to be clearly articulated

The 'thinking space' provides opportunity for the user to articulate their understandings at decisive points. Earlier trials of the prototype saw many users taking physical notes from the summary sheets. At this time we observed the 'thinking space' did not allow the users to fully build upon their tacit knowledge. Subsequent versions of the software slightly changed the nature of the 'thinking space' into a more 'notebook' form, where the user was able to cut and paste from summary sheets into a notebook facility which they can later print for their records, in addition to their own notes recording thoughts, rationale for decisions and questions to follow up.

Design element 8: Scaffoldings and coaching by the teacher at critical times

Information about what the teacher is thinking is available to the user throughout the running time of the simulation. These screens were designed and included in each version of the software to allow the user to enter into the 'mind' of a teacher to begin to see why they make the decisions they make. This coupled with the support materials and opportunity to formally reflect on what is happening within the 'thinking space', supports pre-service teachers at critical decision points.

Figure 3: An example of a screen that allows the user to be aware of the teachers' thoughts

Design element 9: Authentic assessment of learning within the tasks

The software has been included as a key learning experience within core subjects focused on curriculum and pedagogy across the four years of the Bachelor of Teaching / Education degree structure at our university. The formal inclusion of the software within subject schedules enables pre-service teachers to engage with the software in a lab situation where they have been able to be supported by academics as they work to decode what their role within the virtual classroom entails and the ramifications of the decisions they make. This then provides a forum for considerable discussion and debate as users work through the scenario.

As previously described the advantage for engaging users in the virtual scenario in this university context, is that we know what it is that the pre-service teacher has experienced. Typically in school-based experiences, we rely on the pre-service teacher to describe and annotate what it is that they experienced within the classroom setting. In this virtual classroom, we are aware of the possibilities in each scenario and are better equipped to question, challenge and prompt the users as they assume the role of the teacher. Further, we are able to download a 'trail' for each pre-service teacher to track their progression through the software and places they have paused for longer. This then informs our teaching as we are able to cater for the needs the pre-service teachers demonstrate.

Research methodology

Since 2004, more than 500 pre-service teachers studying within the Faculty of Education at the University of Wollongong have engaged with iterations of the software. An overview of research trials conducted is reported in Table 1. With each trial of the ClassSim software we used the same methodology. First, we used a survey to collect demographic data from all users, focus group interviews were held at the end of all sessions that focused on how users interacted with the embedded tools in the software, analysis of thinking space entries was conducted, and observations by a research assistant during scheduled times of interaction with the software occurred. Data collected and analysed from each trial provided the researchers with considerations to take into subsequent versions of the software as the design principles for 'authentic learning environments' were further explored.

Findings from pre-service teacher interaction with ClassSim

For the purposes of this paper we will examine the themes that have emerged from using the software with the pre-service teachers in their first and third years of study.

Interaction patterns

The focus that we take for each of these levels is different. For example, in first year, we have used the software as a way of preparing pre-service for their first real school based visit. Our experiences with students at this level has shown that the very nature of classrooms often makes them an overwhelming environment for pre-service teachers at the beginning of their studies. Having the opportunity to 'play' and 'explore' the virtual environment appears to have given them scope to understand the complexity of

the environment, while also providing us time to begin to deconstruct key elements with them. One participant expressed surprise as ClassSim "… showed how many decisions you actually need to make … I didn't know about the amount of in-depth thinking a teacher has to make about decisions and responses".

Table 1: Overview of pre-service teacher use of ClassSim

Year	Pre-service teacher cohort	No. of students involved	Pattern of engagement
2004	First year students enrolled in alternate teacher education program	24	2 x 90 minute lab sessions + URL access
2004	Fourth year Bachelor of Education students	20	4 x 60 minute lab sessions + URL access
2005	First year students enrolled in alternate teacher education program	24	2 x 90 minute lab sessions + URL access
2005	First year Bachelor of Teaching students	187	2 x 55 minute lab sessions + URL access
2005	Third year Bachelor of Teaching students	40	1 x 55 minute lab session + URL access
2005	Fourth year Bachelor of Education students	24	4 x 60 minute lab sessions + URL access
2006	First year Bachelor of Teaching students	180	2 x 55 minute lab sessions + URL access
2006	Third year Bachelor of Teaching students	180	1 x 55 minute lab session + URL access
2007	First year Bachelor of Teaching students	185	2 x 55 minute lab sessions + URL access

We have found this initial experience gives students a lens through which they can view their actual classroom based experience. Alternatively, our third year students have used the software as a way to articulate what they know about the nature of classrooms and the role of a teacher, and a mechanism to identify areas for future professional learning. They have demonstrated ability to make significant connections between what they have experienced across their school-based experience (including the simulation), the role of a teacher, and where their 'gaps' in knowledge and understanding are. One participant described, "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 …". In both these instances, pre-service teachers were provided with continued access to the software through a URL and our data shows that many of them continued to revisit the simulation after these structured subject experiences.

Engagement with the virtual learning environment

Our research has shown that ClassSim was an effective learning environment for pre-service teachers. The identification of a target audience for the software helped to target key design features as we were acutely aware of the localised issues that faced graduating teachers, as well as the mandated curriculum and policy documents they were expected to use. We were also aware that we needed to apply this knowledge to provide an experience that was meaningful, appropriate and authentic to their needs. Our data has consistently revealed that the participants find the decision points within the simulation a safe place to 'practice' being a teacher as they select options with the ability to go back and change these according to the outcomes. One participant acknowledged, "you can make mistakes with this and it doesn't matter".

The opportunity for pre-service teachers to work through virtual classroom experiences that peers have also experienced provided opportunity for the collaborative construction of knowledge. The ability to schedule the use of ClassSim within the degree structure has enabled us to promote the resource and support users as they engage with the scenarios it presents.

Our data has consistently shown that interaction with the software supports the preparation of our pre-service teachers for classroom reality. We have frequently heard participants acknowledge the complexity of the role of the teacher and the need to consider so many things within the simulated environment they had not previously considered. The ability to view what is happening in the virtual classroom with the support embedded within the software and the physical university environment provides for a powerful learning experience. One participant described, "I think I learn a lot more by observing things … When I'm focused on practical stuff I can actually see it, it sinks more into my head, and I can refer back to it".

Our data shows that students enter actual classroom environments after using the simulation with greater awareness of the many facets that make up the multifaceted classroom situation.

Many of the pre-service teachers have identified they were able to connect wit the virtual environment. We have attempted to model the perspectives that students bring to ClassSim and figure 4 represents in conceptual form of our understanding of how pre-service teacher's perspectives change over time. Line A represents a student who begins with a gaming perspective but over time moves to a more an authentic learning perspective – our surveys indicate that, initially, approximately 20% of students approach ClassSim from this perspective. That is, they enter the software as they would a game – one participant described they thought the software would "increase levels … and the amount of control you have [with] … students to look after … with more consequences for your actions". Line B represents a student who engages with the software as a professional exercise and retains that position, representing the majority of students. Obviously there are a variety of linear and non-linear pathways that could represent individual student perspectives on ClassSim within the triangle made by lines A and B. However, our data shows that the trend for the majority of students is represented in this diagram. Eventually the majority of the students view ClassSim as an authentic learning environment as they can see the relevance of the scenarios presented to their future lives as teachers.

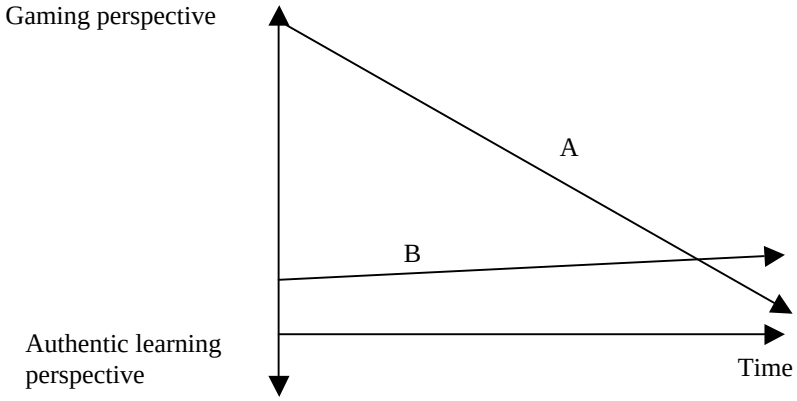

Figure 3: A model of what appears to happen over time as pre-service teachers use ClassSim

Awareness of connections between the virtual environment and future professional practice

We feel that we are justified in claiming that the success of this simulation software is due the fact that the pre-service users can see that ClassSim is relevant to their current and future working lives. Therefore is has a relevant purpose. In addition it is a knowledge rich learning environment that contains resources that can be used beyond the virtual environment of ClassSim. As a result the majority of the pre-service teachers who have used ClassSim have demonstrated motivation to engage with it for sustained and frequent periods of time and to make extensive use of the resources offered within the software program.

Concluding comments

Emergent technologies, such as simulations can provide pre-service teachers with a safe environment in which to explore possibilities and experiment with decision-making before entering a classroom. It provides them with choice and control in preparation for their future role as a teacher. Our research has consistently indicated that interaction with ClassSim has provided the users with insight into the role and work of a teacher. Many of the pre-service teachers who have used the software have demonstrated explicit connections in their discussions with us between their university studies, the simulation, and actual classroom practice.

To sum up, we feel that we succeeded in designing a learning system that allowed for: multiple means of representation, providing learners various ways of acquiring information and knowledge; multiple means of expression to provide learners alternatives for demonstrating what they know (eg decision points and thinking spaces); and multiple means of engagement to tap into learners' interests, challenge them appropriately, and motivate them to learn (variety of pathways and support material). Also we feel that our design acknowledged that there is more that one way to learn and, as such, it respected individual learning style differences.

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Please cite as: Ferry, B., Kervin,L., Carrington, L. & Prcevich, K. (2007). The need for choice and control: Preparing the digital generation to be teachers. In *ICT: Providing choices for learners and learning. Proceedings ascilite Singapore 2007*. http://www.ascilite.org.au/conferences/singapore07/procs/ferry.pdf