



## Evaluating a Second Life PBL demonstrator project: what can we learn?

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Example of PBL Scenario in Second Life: Road traffic accident  
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Example of PBL Scenario in Second Life: Cedars Care home  
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## Evaluating a Second Life PBL demonstrator project: what can we learn?

Abstract. This article reports the findings of a demonstrator project to evaluate how effectively Immersive Virtual Worlds (IVWs) could support Problem-based Learning. The project designed, created and evaluated eight scenarios within Second Life (SL) for undergraduate courses in health care management and paramedic training. Evaluation was primarily qualitative, using illuminative evaluation which provided multiple perspectives through interviews, focus groups and questionnaires with designers, facilitators, learning technologists and students. Results showed that SL provided a rich, engaging environment which enhanced authenticity of the scenarios, though there were issues of access and usability. The article concludes by drawing together the lessons learned which will inform educators who seek to design and develop learning scenarios in this medium.

### Introduction

In recent years there has been growing interest in the use of immersive virtual worlds (IVWs) for education, since they open up new opportunities for teaching and learning which go well beyond virtual learning environments (Warburton, 2009). Not only do IVWs provide relatively unconstrained possibilities for simulation but they also include a rich social dimension. When combined, these two factors represent a new form of learning space, which Salmon and Hawkrigde (2008: 402) consider to be a 'paradigm shift in education' which affords 'infinite imaginative educational possibilities' (Salmon, 2008:526) and one where there is still 'a paucity of research' (Good *et al.*, 2008: 163), particularly in the area of pedagogical value of IVW's (Savin-Baden, 2008) where instructional design principles are 'only beginning to emerge' (Mayrath *et al.*, 2011).

At the same time there has been a debate about the nature of knowledge, and knowing, beyond Gibbons *et al.*'s (1994) concepts of Mode 1 (propositional knowledge) and Mode 2 (knowledge produced in, and validated by the world of work) to the acknowledgement of uncertainty (Barnett, 2004) and knowledge that is 'disregarded' by the academy, often knowledge related to emotional intelligence. The richness of the learning space provided in IVWs provides a context in which to explore these notions of knowledge and to research pedagogical approaches that are appropriate to situations with a social context and enabling students 'to function

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3 skilfully in a practical world' (Haggis, 2004:347). For example, problem-based  
4 learning acknowledges both the social context of learning and enables students to  
5 grapple with the uncertainties of messy problems (Uden & Beaumont, 2006). It is  
6 therefore a pedagogical approach that appears suitable to make the most of the  
7 features afforded by an IVW.  
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14 This article provides an evaluation of the PREVIEW demonstrator project (Problem-  
15 based Learning in Virtual Interactive Educational Worlds) which sought to combine  
16 pedagogy with technology, and which investigated the creation and testing of PBL  
17 scenarios in Second Life (SL). This project, funded by the JISC emerged out of  
18 concerns that IVWs were being adopted and adapted for higher education with  
19 relatively few pedagogically driven motives. Any future impact on the field of  
20 technology enhanced learning will require pedagogically driven solutions that are  
21 derived from user (learner and teacher) needs and requirements. The PREVIEW  
22 project sought to achieve its objectives by working with end users to create, trial and  
23 evaluate pedagogically informed learning scenarios that were be simultaneously  
24 accessed by groups of learners with the principle aim of working together to achieve  
25 the desired learning outcomes. It explored the use of novel features such as Chatbots,  
26 together with different ways of presenting scenarios in two learning contexts: A  
27 Foundation degree in Paramedic Science and BA Social and Health Care  
28 Management. An important aspect of the evaluation is that it considers multiple  
29 perspectives and diversity of scenarios.  
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44 In the following sections we consider the background and informing literature for this  
45 work, the design of the evaluation and a discussion of the results which highlight  
46 important factors when considering the use of an IVW.  
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## 50 **Background**

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52 Learners from any discipline are ultimately being prepared for the workplace and  
53 therefore need to develop transferable problem-solving skills, and be able both to  
54 adapt within their own discipline and to transfer knowledge and skills across contexts.  
55 Thus learning through case-based scenarios is an excellent method for acquiring  
56 sound knowledge and developing decision-making and problem-solving skills (Bergin  
57 and Fors 2003; de Jong 1991). An increasing number of curricula are based on a  
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4 variant of a case-based approach to learning, problem-based learning (Conradi *et al*,  
5 2009) and there is a shift towards incorporating online and immersive spaces (Savin-  
6 Baden, 2007).  
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10 Problem-based learning (PBL) was popularised in the 1980s by Barrows and Tamblyn  
11 (1980), partly in response to the predominantly content-driven transmission educative  
12 model of the time. While there are many variants of PBL, often differentiated by the  
13 epistemological views and aims of the tutors, it is generally characterised by  
14 collaborative small-team organisation where learning is driven by an ill-defined, real-  
15 world scenario and students work together to solve or manage a problem (Savin-  
16 Baden, 2000). However, facilitating this collaborative approach is considerably more  
17 challenging in distance learning contexts, due to difficulties associated with effective  
18 discussion between geographically distributed learners (Chew and Beaumont, 2006).  
19 Online PBL, using a VLE may help, but for students it is sometimes difficult to create  
20 online learning opportunities which are both sufficiently immersive (i.e. inducing a  
21 feeling of being directly involved in the case) and collaborative, outside the tutorial  
22 room. (Conradi *et al*, 2009).  
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35 The potential of virtual realities for education has been recognised for many years,  
36 possibly influenced by the success of the flight simulators (Furness, 1986) and more  
37 recently collaborative massively multi-player online role-playing games (MMPORGs)  
38 (Whitton and Hollins, 2008). Furthermore, Winn (1993) suggested that there is a  
39 strong similarity in the psychological processes that become active in immersive  
40 virtual realities and those that operate when people construct knowledge through  
41 interaction with objects. Virtual environments offer students safe practice, procedural  
42 experience, exposure to unseen conditions or diseases, and above all, the immersive  
43 decision-making opportunities (Vozenilek *et al*, 2004).  
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53 The advent of a number of freely available virtual worlds has opening up new  
54 opportunities for learning. These include Active Worlds, Second Life (SL), Sims and  
55 There (Hendrickson, 2007), which all take very different approaches to creating an  
56 alternative reality, varying in their depiction of the alternative world (photo-realistic  
57 or impressionistic), the authenticity of the world (realistic or fantastical) and the depth  
58 of the interaction (prescriptive or relatively unconstrained). Second Life is perhaps  
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3 the most popular platform currently in use, and there is increasing interest in utilising  
4 it within education with many universities constructing their own campus island in  
5 SL. Furthermore, the number of health and medical education projects using SL is  
6 also proliferating. Boulos *et al.* (2007) provides a survey and discusses the potential  
7 of IVWs, discussing relevant issues and challenges, such as effect of avatar  
8 appearance, student participation and influence on reflective practices, though none of  
9 the examples refer to PBL.  
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18 Certain features of IVWs appear to offer considerable opportunities for promoting  
19 learning, particularly the support for synchronous interactions and collaboration  
20 together with the flexibility for instructors to construct customised learning  
21 environments (Livingstone *et al.* 2008). Minocha and Roberts (2008: 188) also  
22 highlight that the illusion of immersion in a 3D virtual world is important for  
23 providing a sense of social presence, which in turn promotes socialisation and leads to  
24 a ‘more human experience than 2D environments’. Indeed, there is a rich  
25 environment for developing identity, which Hollins and Robbins (2009) consider to  
26 be one of the five educational affordances of IVWs (along with space, activity, tools  
27 and community).  
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37 However Livingstone *et al.* (2008) point out that IVWs have not generally been  
38 designed for teaching and learning, and lack many features widely used within current  
39 Virtual Learning Environments, such as support for asynchronous communication,  
40 learner privacy and assessment. They propose a way of achieving the best of both  
41 worlds through Sloodle – an integration of Second Life and the Moodle VLE.  
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Clearly technological features of an IVW are important, but the most critical  
requirement for successful adoption of an IVW is the pedagogy that underpins its use.  
Consequently recent projects have explored the use of IVWs in specific learning  
contexts within Higher Education, for example MOOSE (Salmon *et al.*, 2009)  
explored in-world socialisation and facilitation for Archaeology and Digital  
Photography and Open Habitat (White and Le Cornu, 2009) investigated how an IVW  
can support creative collaborations and discussions for Art and Design, and  
Philosophy students.

Open Habitat concluded that IVWs work best with less authoritarian pedagogies

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3 based around exploration, where there is no 'correct answer'. Problem-based Learning  
4 would therefore appear to be well positioned to take advantage of IVWs. In a study  
5 by Good *et al.*, (2008) the combination of PBL and SL was seen as beneficial by  
6 reinforcing the facilitator's role, providing an authentic environment and being  
7 motivational. However, while an analysis of a PBL 'classroom' in *ActiveWorlds* by  
8 Omale *et al.* (2009) showed that the IVW promoted social presence and problem  
9 identification and analysis, it was less effective for the problem solution phase of  
10 PBL, and students could easily be distracted.  
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19 It is notable that in many published cases references are made to the *potential* of  
20 IVWs, particularly the flexibility to use a variety of pedagogical approaches. The  
21 nature of these findings shows that they are still at an embryonic stage of  
22 development, and further systematic research is required to evaluate the opportunities  
23 in a wide range of learning contexts.  
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30 The novel approach taken in this project was that it did not seek to create knowledge  
31 management systems for learning or merely create formal classrooms in 3D spaces.  
32 Instead the focus was on combining the advantages of a strong and well tested  
33 pedagogical approach (problem-based learning) that could be adapted to fit diverse  
34 disciplinary needs within 3D virtual worlds. Providing scenarios within an immersive  
35 virtual world was perceived as a method of overcoming one limitation of 'traditional'  
36 paper-based scenarios, namely that they often restrict students' decision making and  
37 are linear in nature, whereas interactive online scenarios allow students to consider  
38 options as the scenarios unfold, and allow students to explore the consequences of  
39 their action (Poulton et al, 2009).  
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50 Practicing skills within a 3D virtual world also offers advantages over learning  
51 through real-life practice, in particular the exposure of learners to a wide range of  
52 scenarios (more than they are likely to meet in a standard face-to-face programme) at  
53 a time and pace convenient to the learner, together with consistent feedback. It offers  
54 learners the chance to make mistakes without real-world repercussions. Furthermore,  
55 with the increasing use of distance learning programmes, learning that takes place in  
56 virtual environments creates online opportunities which are immersive and  
57 collaborative outside the tutorial room, in ways that current VLE systems do not.  
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5 The next section outlines the aims and method for evaluating one particular  
6 pedagogical approach (PBL) in Second Life as a contribution to this developing  
7 discourse.  
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### 10 11 **The PREVIEW Project**

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13 The aims of the PREVIEW project were to develop, deliver and test eight PBL  
14 scenarios within SL for paramedic and healthcare management education; ensure  
15 user-guided development and share technology and good practice. Over a period of 9  
16 months two categories of PBL scenarios were initially designed: *Information-driven*  
17 *scenarios, (IDS)* and *Avatar-driven scenarios (ADS)*. Information-driven scenarios  
18 presented information through virtual world content, such as video footage, images,  
19 and audio with links to external content, such as relevant web pages. Avatar-driven  
20 scenarios use non-player characters (NPCs) as ‘chat bots’, where the student interacts  
21 with the NPC to gather necessary information. These scenarios were developed,  
22 tested and adapted over the 9 month period.  
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33 For paramedic scenarios a realistic environment was created including an orientation  
34 area; motor cycle accident street scene; a house; an underground station; a benefits  
35 office; a nightclub and a hospital. Teleports facilitated navigation between scenarios.  
36 Scenarios were constructed a minimum of 20 metres apart to avoid crosstalk. On  
37 arrival, students assess the virtual patient (NPC) and environment and discuss the  
38 treatment/action. Information is gathered through a heads up display (HUD) which  
39 presents the media content associated with the virtual patient; text-chat to question the  
40 virtual patient, which responds to certain keywords; touching (left-click the mouse)  
41 parts of the patient which displays possible actions and paramedic equipment  
42 including monitoring tools.  
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53 The four health care management scenarios took place in a virtual care home. An  
54 example scenario (see Figure 1) is a difficult situation about an outbreak of disease  
55 within the facility. The role of the students is to gather and discuss information and to  
56 formulate an action plan. Information is elicited from NPCs, the virtual environment  
57 and information presented in-world as text or video. In these scenarios, NPC dialogue  
58 used a sophisticated approach where natural language input was processed (using an  
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artificial intelligence-based pattern matching method) through a separate server outside of SL linked to the NPC.

(Figure 1)

*Example of PBL Scenario in Second Life: Road traffic accident.*

(Figure 2)

*Example of PBL Scenario in Second Life: Cedars Care home.*

## Evaluation Method

The evaluation encompassed formative elements to inform the project team and summative elements to establish the worth of what has been achieved. The objectives of the evaluation were

1. To explore the impact of problem-based learning scenarios in 3D virtual worlds on learning.
2. To assess the usability of the learning environments and the user acceptance.
3. To evaluate the effectiveness of feedback mechanisms and guidance materials
4. Offer an analytic account of the experience of the project from the perspective of all the key stakeholders.
5. Be responsive and flexible enough to capture unintended outcomes, and unanticipated effects.
6. Provide an overall summary of the project, highlighting strengths, weaknesses and areas of development.
7. Inform current and future developments, paying particular attention to their structures, procedures, working practices, relationships and practices.

The evaluation was planned at the start of the project, informed by JISC guidelines (Glenaffric Ltd, 2007) and illuminative evaluation, which is argued to take account of wider contexts than more traditional evaluation and, is primarily concerned with description and interpretation rather than measurement and prediction. (Parlett & Hamilton, 1972). In practice this meant a focus was on

*1. Technical perspective:*

- a) Integration of tools and applications in the learning environment.
- b) Functionality of the tools for use in PBL.

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2. *Organizational perspective:*

a) Knowledge and skills of academics for development and assessment of teaching and learning.

b) Acceptance and user satisfaction of the tools.

3. *Pedagogical perspective:*

a) Content and structure of the scenarios.

b) Coherence of technology in use with pedagogical principles.

**Data collection**

A primarily qualitative method was used, with semi-structured interviews and focus groups being the principle data-gathering approach. Questionnaires were also used to collect student perceptions. Data were collected and analysed from three main sources: internal and external project documentation; interviews with key respondents (project leader, three subject matter experts who designed and facilitated scenarios three learning technologists and the technical developer) and finally evaluation activities involving students.

Student evaluation data was collected from activities known as 'Testing days'. The paramedic scenarios were evaluated on three occasions during June and November 2008. In June participants were first year paramedic students (n=10) familiar with PBL but not Second Life; testing was carried out in a computer lab. The first testing days in November involved four of the original ten participants and one new student. A further test in November used a different opportunity sample of ten mixed first and second year paramedic students. The structure of tests consisted of SL orientation (1hr), demonstration scenario (1hr) followed by group rotation around different scenarios (approximately 1hr per scenario). This was followed by a paper questionnaire and focus group (1hr). Scenarios were facilitated with groups of 2-4 students. The SME facilitated student interaction and provided suggestions at appropriate points.

The health care management scenarios were tested on two occasions with 12 volunteers drawn from health-related professions, (not students on the target course) and almost all had no experience of PBL. None had prior experience of SL. These activities generated considerable volumes of data comprising in-world chat logs,

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3 video screen capture; video footage of the students interacting with scenarios, post  
4 testing focus group responses (video-recorded) and questionnaires.  
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9 The methodology adopted provided multiple perspectives on a complex learning  
10 environment. The small sample size and contextual differences in students, scenarios  
11 and mode of learning means that any generalisation of findings is inappropriate.  
12 However, this does not mean that the results are invalid; within the context of this  
13 project, high validity has been ensured thorough multiple perspectives/ data sources  
14 (triangulation) and most importantly, member validation procedures. While context is  
15 important in any course or learning environment, this evaluation aims to discover  
16 design and development issues which need consideration by others adopting a similar  
17 approach.  
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### 25 *Data analysis and processing procedures*

#### 26 *Analysis*

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28 Data collected from interviews and focus groups were analysed interpretively to  
29 examine the subtext of data and identify themes and patterns of response in relation to  
30 the areas of enquiry. Findings were transformed into developmental models and  
31 practice materials. Questionnaire data consisted of both quantitative and qualitative  
32 responses and ensured that all student participants' voices were heard. The  
33 quantitative data was analysed with simple descriptive statistics, qualitative data  
34 supplemented that collected from the focus groups.  
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#### 43 **Results**

44 This section critiques pedagogical aspects of the project and starts by analysing in  
45 detail the preparation of students and usability of Second Life and the scenarios.  
46 Subsequently, the paper considers pedagogical issues of scenario design, facilitation  
47 and collaborative behaviour. Table 1 lists frequencies of students' comments in open  
48 questions in the questionnaire regarding advantages/disadvantages of SL.  
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56 (Table 1)

#### 57 **Emergent themes**

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3 A number of themes were identified from the qualitative data which illustrate the  
4 challenges of using this medium for learning. The themes include Student  
5 Preparation, Pedagogical Design and Collaboration and Interaction. Whilst there were  
6 data that transcended these themes, data here have been categorized to illustrate the  
7 troublesomeness and difficulties experienced by staff and students.  
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### 10 11 12 ***Student Preparation: Access, usability and orientation***

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15 Technology can be an enabler of learning, or a barrier, depending on usability and  
16 alignment to task. Second Life provides a rich and novel environment, requiring  
17 control of the avatar, camera, objects and interaction with Non-Player Characters  
18 (NPCs) and collaboration with colleagues. The bandwidth and PC performance  
19 requirements also impose greater demands than conventional e-learning (VLE)  
20 environments. Three main concerns were identified within this category:  
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#### 26 27 *Access*

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29 Several students reported problems downloading Second Life on their computers in  
30 halls of residence. A subject matter expert also reported that only five out of 30 of his  
31 students perceived that they had computers that met the hardware specification.  
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33 Furthermore, the quality of the experience depends on network bandwidth and during  
34 one test the use of wireless laptops was curtailed since the performance was  
35 unacceptable. It is also important to note that there are accessibility problems with  
36 Second Life; inability to use a mouse or visual impairment effectively excludes the  
37 student from participating. At all testing sessions some of the students experienced  
38 Second Life crashes, which excluded the student from the scenario for a few minutes.  
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40 Whilst this was judged a minor annoyance by those testing the scenarios,  
41 collaborative users of the system within a course may consider this much more  
42 important.  
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52 Clearly access was a significant issue, given that one of the perceived benefits of the  
53 project was for distance learning. However, PREVIEW can be regarded as an early  
54 adopter of the technology, and the issues can be expected to diminish with time.  
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### Usability

Usability is a function of both the Second Life interface, technical and scenario design. From a Human Computer Interaction perspective, the affordance provided by Second Life objects (how to interact with them) was not intuitive for many novices consequently labelling of widgets/objects within the scenarios was needed to enhance their visibility (and affordance). For example, such labelling enabled teleporting to be achieved easily without error. However, students commented: *'Sometimes it was hard to realise what you could and couldn't do'*.

The complexity of the interface also provided a high memory load for novices, and all student groups commented that sometimes there was *'too much going on'*.

Information could be provided through several means simultaneously, voice, local chat, HUD, dialogue boxes. However, despite the complexity and these issues, students suggested it was *'mostly straightforward'* and observation of the students returning for a second session showed that they retained Second Life skills after 5 months without further practice.

While students in focus groups reported enjoying the experience and considered that usability issues were not serious, some subject matter experts/ facilitators were more cautious, suggesting that poor usability impeded students from achieving learning outcomes:

*'This is my greatest concern. In order to get the student close to a point where clinical reasoning/learning is both valuable and the prominent area of concern, it seems to take a large amount of effort to overcome the heavy interface of Second Life'*.

*'..facilitation would be heavily influenced with technical (i.e. Second Life instruction..)'*.

### Student preparation and orientation

Student preparation sessions took twice the time allocated (originally half an hour) and while questionnaire responses from the paramedic students revealed that 80% (n=20) agreed/strongly agreed that the preparation was sufficient, 65% requested



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3 more time to practice. Students encountering the environment for the first time liked  
4 to experiment, for example in modifying avatar appearance. There was a large  
5 variation in students' ability to adapt to Second Life; some took many minutes to  
6 learn the simple task of attaching a HUD. Assisting novice students through Second  
7 Life was not easy, and facilitators commented that real-world communication was  
8 helpful at this stage. Students also requested a guide to accompany the training.  
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16 When arriving at a paramedic scenario, students stated that they did not find it  
17 intuitive how to progress, and needed facilitator guidance to communicate and use the  
18 tools. Activities such as examining the patient and using and attaching equipment to a  
19 patient must be carried out differently in Second Life, and this required learning.  
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21 Similar orientation difficulties occurred in the health care management scenarios and  
22 several students said they 'felt lost' 'confused' and 'helpless' at the start. Some of  
23 this related to the Second Life factors, controls, the unfamiliarity / multiple sources of  
24 information and confusion over avatar names, but other aspects were scenario-  
25 specific, (e.g. understanding of individual and NPC roles) and others related to group  
26 dynamics (leadership, collaboration).  
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### 33 34 *Pedagogical design*

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36 When evaluating SL as a tool for supporting PBL, it is necessary to consider how well  
37 it facilitates the PBL process. Typically, PBL involves tutor-facilitated groups of  
38 students who collaboratively co-construct knowledge through identification of  
39 learning issues, individual research, group sharing and application to the problem  
40 scenario. Scenarios are deliberately designed to be authentic, realistic and messy and  
41 students can explore various paths (Uden & Beaumont, 2006).  
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### 48 *Authenticity*

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50 The development team expended considerable effort constructing a realistic virtual  
51 environment, including specialist tools for the paramedic scenarios. The scenarios  
52 were scripted to be professionally authentic by the subject-matter experts (SMEs) who  
53 considered that SL supported PBL by providing both an *immersive* and an  
54 *unstructured* environment. An SME stated that these features supported his  
55 pedagogical aims by adding realism, which assisted the role play that he envisaged  
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3 within the scenarios, and the unstructured nature of SL empowered participants and  
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5 *'lends itself very strongly to creating a rich and valuable decision making exercise'*.  
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9 Paramedic scenarios included simulation of medical equipment, enabling tests on the  
10 patient by clicking/ dragging operations. When students evaluated the experience in  
11 focus groups they stated that *'seeing everything'* in the simulation assisted decision  
12 making and 14% of advantages they identified related to realism and suitability for  
13 professional education. Students found customised in-world resources particularly  
14 useful (e.g. an electrocardiogram (ECG)). This prompted them to request more  
15 external resources e.g. guidelines to look up drug dosages.  
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23 Furthermore, a key theme that ran through the focus groups was feedback and these  
24 can be divided into two categories: *intrinsic* feedback and *performance* feedback.  
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26 Intrinsic feedback adds to authenticity, since the consequences of actions are evident  
27 in 'real time' in the scenario (for example in the patient's condition or reaction to  
28 treatment) and students requested that this aspect should be enhanced, typical  
29 comment being: *'you can't know if you are clinically correct'*. All focus groups  
30 highlighted an advantage of second life as being able to provide this kind of realistic  
31 feedback. Indeed, they pointed out the unrealistic behaviour (e.g. patient not guarding  
32 a wound in the road traffic accident and burn scenarios) as being confusing and  
33 questionnaire open questions regarding disadvantages yielded most responses on this  
34 aspect (table 1).  
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44 This student preference for realism and presence within the scenarios was also  
45 demonstrated as they expressed the view that information driven scenarios did not add  
46 any value over traditional VLE and web-based presentations, in fact the complexity of  
47 SL added a barrier to learning. However, in contrast students evaluating the health  
48 care management scenarios considered IDS to be appropriate for presenting  
49 information. Such findings are not contradictory, but emphasise the importance of  
50 contextual factors in any learning situation. The pedagogy employed in health care  
51 management scenarios largely focussed on collaborative discussion using presented  
52 information, rather than the more directly active approach within paramedic scenarios.  
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54 This is important since a number of authors describe presence as the sense of being  
55 'in' or 'part of' a 3D virtual world (for example, Slater and Wilbur, 1997). Thus the  
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3 sense of presence in Second Life means not only feeling ‘there’ with other staff and  
4 students and guided to learn, but also feeling as if they are actually present in that  
5 environment (Beer *et al.*, 2003). This absorption and engagement of the student in the  
6 learning experience is argued to focus and improve learning (Kang *et al.*, 2008;  
7 Richardson and Newby, 2006). Furthermore, Dede (1995) suggests that within  
8 learning environments, immersion can be created through the capacity to execute  
9 actions, through semantics and semiotics, and through physical and sensory provision  
10 that creates a feeling that the user is surrounded by the 3D virtual world. Approaches  
11 to teaching in Second Life seem to differ not only because of the medium being used  
12 but also because of the nature of immersion that occurs in that environment.  
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### 22 *Scenario purpose and facilitation models*

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24 In the paramedic scenarios, one SME confirmed that the scenarios assumed students  
25 had a level of knowledge that they could apply and the scenario focussed on  
26 developing clinical reasoning and decision making in simulated real-life situations.  
27 However, his original intention for the pedagogic model required that prerequisite  
28 knowledge (background) would be incorporated within the Second Life scenario and  
29 that the scenario could therefore be used to promote learning of theory in addition to  
30 application to practice. He envisaged an active facilitator approach; which would  
31 vary as students repeatedly visited a scenario and would ‘*direct them how to learn and*  
32 *where to find information ... and follow them until I make sure they are heading the*  
33 *correct way*’. This background information was not able to be incorporated within  
34 Second Life during the project.  
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45 The technology also had a strong influence on the pedagogical model, as explained by  
46 another SME:  
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49 *‘SL lends itself to individuals or pairs consolidation or decision making*  
50 *exercise .... like to see it as a standalone exercise without facilitation’*  
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54 *‘I don’t feel it lends itself very well to a group (3-4)...– quite high boredom*  
55 *factor for those not directly participating with NPC, ... they were checking*  
56 *email, adjusting appearance – so from facilitators point of view it is a good*  
57 *decision making exercise but not for what we understand as traditional PBL*  
58 *session’.*  
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5 Thus, the outcomes were not classical PBL learning issues that students identified, but  
6 application of existing knowledge, development of decision making, reasoning and  
7 reflection on their performance at the end of the PBL cycle. Yet as Ramsden (1984,  
8 1992) suggested students' perception of the learning context is an integral component  
9 of their learning. The learning context is created through learners 'experience of the  
10 constituents of the programmes on which they are studying, namely teaching  
11 methods, assessment mechanisms and the overall design of the curriculum. Therefore  
12 learners, Ramsden suggests, respond to the situation they perceive, which may differ  
13 from that which has been defined by educators. However, regardless of content or  
14 principles of problem-solving, it is the context in which the initial problem is  
15 presented that tends to affect the degree to which transfer of knowledge takes place.  
16 For example, a learner's ability to transfer knowledge gained from the first problem  
17 situation into the second problem presented will be affected by whether the learner  
18 expects the principles used in solving the two problems to be related.  
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32 However, the subject matter expert related this to real-life acquisition of knowledge,  
33 related closely to the early stages of the PBL cycle.  
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35 *'[I'd] expect students to discuss what the problem was, identify areas where*  
36 *need more knowledge as in real life – e.g. for C-difficile get specialist*  
37 *knowledge, but also actually undertake ... a series of actions to manage crisis'.*  
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42 Reactions of subject matter experts undertaking the facilitator role varied, possibly  
43 reflecting their personal view of facilitation: one SME tutor saw his role as 'a quiet  
44 role', guiding students by interjecting with pertinent points, encouraging or leading  
45 discussions. He perceived this to have worked well and reported that student debate  
46 had occurred several times. This contrasted with another SME who saw facilitation as  
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50 *'much more for us to direct them how to learn and where to find information ...*  
51 *to respond & reflect on information' .*  
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55 This SME also perceived the facilitator role as providing appropriate guidance and  
56 performance feedback. All SMEs identified an additional role in Second Life- that of  
57 facilitating the use of the technology as well as the scenario.  
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4 One of the difficulties of problem design that occurs in many curricula is that little  
5 attention is paid to the different types of problems available, how they might be used  
6 and the level of the curriculum where they are used. For example, in some medical  
7 programmes problems change in terms of complexity and capability as the learners  
8 progress through the first two years of the programme, yet the level of criticality the  
9 learners are expected to develop towards learning and knowledge often changes very  
10 little. The assumption in many programmes is that learners will be able to recognise  
11 and describe knowledge and issues before being able, in their final year, to defend and  
12 evaluate that knowledge.  
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### 19 20 ***Collaboration and interaction*** 21

22 Second Life affords collaboration through a rich multi-media environment of voice,  
23 text and shared objects in a shared 3-D environment. However, it became evident that  
24 a protocol is required to ensure that effective learning takes place. Such a protocol in  
25 real life is generally well-learned by the time students reach university, but in Second  
26 Life this socialisation requires negotiation of acceptable behaviour and protocols.  
27 Students and facilitators highlighted the chaos that could occur if multiple participants  
28 communicate simultaneously in Second Life. Students expressed a preference for  
29 communication through voice rather than text chat and facilitators' perceptions were  
30 that levels of collaboration increased and students made more rapid progress using  
31 this mode. However, mixed use of voice and chat was problematic since information  
32 was presented in text tended to be ignored (in favour of voice contributions) by others  
33 in the group.  
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45 Group dynamics and intra-group communication was raised as an issue, echoing  
46 Minocha and Roberts' (2008) emphasis on the need to make avatars more expressive.  
47 Students explained that a lack of social cues in the Second Life environment impeded  
48 them from 'taking control' to ensure progress was made in a systematic rather than  
49 haphazard way. One student stated that he felt '*baffled... on the fringe*'.  
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56 The student response to Second Life, and these scenarios as an effective collaborative  
57 environment varied significantly; 75% (n=20) of first-time user paramedic students  
58 agreed/strongly agreed that 'it is easy to collaborate in the Second Life scenarios', and  
59 students volunteered positive views, for example:  
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5       *'communicating with others helped assess the situation... gave better*  
6       *understanding'*.  
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10 Indeed, comments regarding the benefits of collaboration were the second highest  
11 ranking advantage listed in student questionnaires.  
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15 However, paramedic students strongly identified an advantage of being able to use the  
16 scenarios individually to consolidate learning or as a means of revision; convenience  
17 of working on their own was the most-identified benefit from open comments in the  
18 questionnaire (44% open comments). As one student put it:  
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22       *'..but I would have liked to do it alone as well so I have time to think about what*  
23       *to do at my own speed'*.  
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28 The project chose to incorporate NPCs which would respond to text communication  
29 from participants' avatars. Restricted keyword driven dialogue in the paramedic  
30 scenarios was viewed as useful by students. More ambitious use of chatbots to  
31 respond to natural language dialogue in the health management scenarios was not  
32 sufficiently sophisticated to provide realistic responses to student queries.  
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### 38 **Discussion and lessons learned**

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40 The project used an innovative approach to address difficulties of distributed  
41 collaborative problem-based learning and take advantage of the new opportunities  
42 afforded by IVWs. Key issues for effective PBL are authenticity of the environment,  
43 collaboration and facilitation. The capacity for providing authentic scenarios  
44 incorporating a good degree of realism and the lack of constraints on actions students  
45 could take was identified as strength of Second Life.  
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52 Furthermore, Second Life is sufficiently flexible to enable scenarios to be developed  
53 which promote individual, pair and group collaborative learning or application of  
54 learning. Technology such as chatbots and Machinima can effectively enrich the  
55 experience. The pedagogical design of the ADS appears highly promising in  
56 providing opportunities for developing clinical reasoning and including intrinsic  
57 feedback. However, careful consideration needs to be taken of the communication  
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3 requirements and methods used in-world to ensure that they promote appropriate  
4 behaviour. Considerations should include student-student sharing of information and  
5 discussion, and the communication with Non-player Characters and objects. Whilst  
6 the authors expressed the view that the scenarios produced were appropriate and fit  
7 for purpose, it is revealing that none would currently consider adopting them in a live  
8 presentation of a course, although they have been adopted and adapted by a number of  
9 UK courses.

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12 However, the principle stumbling block concerned usability and access to Second  
13 Life. In particular the relatively high technology demands (graphics/cpu/bandwidth)  
14 were considered a barrier for these cohorts of students. Furthermore, the novelty and  
15 high information content in the interface was considered by facilitators to be a  
16 significant hindrance prior to reaching the learning outcomes. When designing for  
17 learning in an IVW, authors also need to consider identity and socialisation  
18 (Warburton, 2009). All participants regarded the orientation and preparation sessions  
19 as essential to help overcome these issues.

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22 Given the limited use of the scenarios at this stage in the project, it was not possible to  
23 explore facilitation in detail. However, it was evident that each facilitator in this  
24 study had differing views which impact on their perception of how a scenario should  
25 be used, and the consequent suitability of that Second Life scenario. An interesting  
26 consequence of the richness and authenticity of the Second Life scenarios is the large  
27 amount of detail provided, much more than is usual in paper-based face-to face PBL  
28 sessions. It is not clear at this stage if or how such detailed virtual reality impacts on  
29 the way the scenario is used and facilitated. Savin-Baden & Wilkie, (2006) points out  
30 that facilitation of PBL is itself a source of concern for many teachers and that there  
31 are differences and tensions to be resolved between online and face to face  
32 facilitation. Second Life can provide a more authentic learner environment than  
33 classroom based PBL and therefore changes the dynamic of facilitation. This is an  
34 important area for further research.

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37 A key point that was learnt from our experience in the PREVIEW project is that the  
38 focal point of design should be around what it means to learn in Second Life and  
39 therefore consideration of the relationship between learning and design is imperative.,

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3 scenario writing can be time-consuming, a lot depends on the case-writers, and it is  
4 not always easy to verbalise the scenarios and how they should run. One mechanism  
5 used assist the design process was to film staff role-playing the scenarios. From this it  
6 was possible to create a script for the chatbot and work out how to design the  
7 environment in which the scenarios were to take place.  
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14 Perhaps what is most important is to leave sufficient time for developing and testing.  
15 Boardman (2009) argues that some of the questions that should be asked of staff can  
16 subsequently save designers and technologists considerable time. For example, does it  
17 matter that the dwelling is a texture or a hut? Are staff concerned about the  
18 appearance of objects and buildings, especially if this appearance is unlikely to affect  
19 the learning outcome? In the PREVIEW project it did matter both that the audio  
20 sound (ringing) came from a telephone, and it was something students would  
21 recognise, so they would realise they should touch the telephone in order to get  
22 instructions. Boardman suggests then that staff need to consider issues of design that  
23 relate to ensuring students engage, that the buildings, objects and activities are both  
24 relevant and believable, that they are easily navigable and help students to focus on  
25 what is to be learned. Thus questions she suggests you need to consider are:  
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- 28 1. What do you want built?
  - 29 2. What is the learning outcome?
  - 30 3. How detailed does it need to be?
  - 31 4. Do you have a picture?
  - 32 5. Do you have a mental model and can you draw it?
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46 This demonstrator began as a project to explore the extent to which it was possible to  
47 use problem-based learning in Second Life. The evaluation indicated that despite a  
48 number of difficulties it was in fact more of a possibility than the project team  
49 initially envisaged, which promises well for the future. However, what is clear is that  
50 discipline-based pedagogies, staff perceptions and sound planning and design should  
51 be seen as central components when designing a PBL scenario for an IVW.  
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Table 1: Categorised open responses from paramedic student questionnaires (n=20)  
 Brackets indicate frequency of responses.

Advantages	Disadvantages
1. Can work at own pace, convenience and on your own for practice/revision (44%) 2. It was good to bounce ideas off other people regarding treatment promotes team working (14%) 3. Scenarios are realistic, applicable to professional education (14%) 4. Cannot harm the patient, can experiment with treatments and learn from errors (12%) 5. Suits people who prefer interactive learning to reading/notes, more fun (10%) 6. Scenarios can be built to suit needs of students (4%) 7. Cost effectiveness (2%)	1. Lacking detailed realism: Inadequate feedback doesn't show adverse reactions, some treatments missing, can't know if you are clinically correct (54%) 2. Technical issues: High spec, crashes, Learning Second Life / applying equipment, (32%) 3. Not face to face or hands on – not a substitute for these (10%) 4. Group working issues( only one can interact with patient at a time, prefer to use on own (4%)