International Journal of Medical Informatics (2005) **74**, 527—533

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International Journal of Medical Informatics

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# eLearning techniques supporting problem based learning in clinical simulation

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Received 1 November 2004; received in revised form 16 February 2005; accepted 23 March 2005

**KEYWORDS**
Problem based learning;
eLearning;
Clinical simulation

**Summary** This paper details the results of the first phase of a project using eLearning to support students' learning within a simulated environment. The locus was a purpose built clinical simulation laboratory (CSL) where the School's philosophy of problem based learning (PBL) was challenged through lecturers using traditional teaching methods. The solution: a student-centred, problem based approach to the acquisition of clinical skills that used high quality learning objects embedded within web pages, substituting for lecturers providing instruction and demonstration. This encouraged student nurses to explore, analyse and make decisions within the safety of a clinical simulation. Learning was facilitated through network communications and reflection on video performances of self and others. Evaluations were positive, students demonstrating increased satisfaction with PBL, improved performance in exams, and increased self-efficacy in the performance of nursing activities. These results indicate that eLearning techniques can help students acquire clinical skills in the safety of a simulated environment within the context of a problem based learning curriculum.


## 1. Introduction

PBL has recently been the chosen educational philosophy of Glasgow Caledonian University (GCU) School of Nursing, Midwifery and Community Health. With this approach, learning is derived from the exploration of issues arising from patient centred scenarios and is claimed to develop skills in critical thinking, decision making, team-working and problem solving [1]. As a teaching method PBL is resource intensive, and because it is contentious whether long-term benefits for professionals actually materialise, there is demand for rigorous evaluation [2]. Being a new approach for many in GCU, staff development focused on how students acquire theoretical knowledge, with some success [3]. However, for clinical skills acquisition, the student-centred approach was compromised through lecturers providing information and demonstrating activities in a traditional, teacher-centred manner, where students were passive recipients with limited practice under direct supervision. There were quality concerns as lecturers had varied clinical

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doi:10.1016/j.ijmedinf.2005.03.009

expertise that was of unknown currency and validity. This issue, clinical credibility, is a long-recognised challenge for nurse lecturers [4—6]. That aside, the contradictory philosophies of education, liberal for theory and traditional for skills acquisition, could only have been confusing for students. It was proposed, therefore, that teachers be encouraged to step back from their traditional role, and allow students to develop team-working, analytical and decision making skills in simulated practice, by providing quality assured learning resources for students, facilitated through eLearning technologies.

The case for using eLearning techniques to support PBL derives from their shared philosophical underpinning of constructivism. The conceptual exploration, analysis and decision making central to PBL [7] parallels the exploration, analysis and decision making required in browsing hypertext based learning objects [8]. Both produce incidental learning, and students have the advantage of being in control of the process and content of their learning. Disadvantages such as studying to inappropriate depth, becoming distracted or spending excessive time searching for resources are common to both, requiring greater self-discipline by students [9]. The role of the educationalist is complementary: teaching in PBL is more accurately a process of facilitation, while eLearning can also be facilitative through discussion forums, and using learning objects such as animation or video that promote enquiry. Within the context of the clinical skills laboratory, where outcomes are measured in terms of clinical competence, the challenge for educationalists is to achieve the fine balance between giving instruction and promoting enquiry, in order that efficient and effective skills acquisition occurs in the short-term, and benefits of PBL materialise in the long-term. The purpose of this study is therefore to evaluate this change, however, the difficulties in evaluating such innovations in nursing education are well documented: one review of 26 evaluative studies of using computers in learning spanning 30 years found significant design flaws, including small sample size and lack of controls [10]. Evaluating virtual environments from an educational perspective is a developing concept [11]. However, using the rationale that learning technology is one factor in a complex situation, it can be argued that a multidimensional and flexible approach needs to be taken to its evaluation. Such an approach would attempt to show how technology contributes to the overall learning experience and has been widely accepted [11—16]. In this project, therefore, quantitative outcomes in terms of student satisfaction; exam results; and self-efficacy in relation to clinical skills were combined with interview data to provide a holistic impression of the change in educational approach, rather than attempting to make discrete, causal links in a reductionist way.

This type of project requires skills in management, investigation and specification, design, production, validation and evaluation, with careful documentation and consideration given to future maintenance [17]. A team was formed to reflect the demands of the project and was supported with a substantial grant from GCU.

## 2. Materials and methods

### 2.1. Creating the ICU learning environment

A Draeger™ mannequin was attached to, among other equipment, a ventilator and monitor that could simulate and display clinical data. This became 'George Morgan', the central character of a PBL scenario that students would 'nurse' each week for 6 weeks. Typical bedside equipment completed the environment and ICU background sounds provided an extra layer of fidelity. A networked computer was provided at a workstation, and video recording equipment was installed that could be controlled remotely. Software was created in Authorware™ supplemented with tools for network communication. Formative evaluation, based on the work of Tessmer [18], was extensive. Content was checked for accuracy and currency by intensive care experts, while final year students determined usability and identified errors and misunderstandings. A 'minimum instruction' approach was taken to encourage students to investigate and explore, and learn from each other. This has been shown to be more effective than providing explicit directions [19], and is consistent with the philosophy of PBL. With feedback, the interface became simple and intuitive, with easy access to scenario resources, e-mail links to facilitators and on-line multimedia quizzes.

Students in groups of four selected an hour-long, unsupervised lab session each week as the PBL scenario unfolded. This complemented face-to-face tutorials and fixed resource sessions such as lectures. Once logged onto the web-based system, students involved themselves in practice situations, receiving subtle guidance and prompts from multimedia learning objects embedded within the scenario text, with no teacher present to instruct or demonstrate. Instead, current, practising nurses from intensive care units were videoed, demonstrating their clinical competence in a variety