

CLINICAL PRACTICE

Maximising sensory learning through immersive education

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Received: May 1, 2014

Accepted: July 17, 2014

Online Published: August 8, 2014

DOI: 10.5430/jnep.v4n10p74

URL: <http://dx.doi.org/10.5430/jnep.v4n10p74>

Abstract

The use of simulated learning in nurse education is not new and much has been written regarding various approaches to using low, medium and high-fidelity approaches. Reality or fidelity is important in terms of creating quality learning using simulation; however, within the literature there is a strong focus on the use of computerised mannequins, rather than on the environment in which the simulation occurs. It is accepted that scenarios on which simulation is based should represent the reality of the clinical world, where students are enabled to learn through active participation in situation which they will likely encounter in the real world. Nurses retrieve information from patients using all of their senses; indeed nursing text books advocate the use of a multi-sensory approach to assessment. Using the senses is often highlighted as part of active learning reinforcing the need for seeing, noticing and observing as a central principle; however other senses may be just as important in terms of active learning. Educators need to determine which aspects of clinical simulation are most important for learning. For example, are motor, cognitive and sensory aspects of equal importance? This paper describes the emerging technology enabling educators to introduce a range of sensory learning stimuli, for example, the use of smell as a clinical indicator and sophisticated suits which provide the wearer with tactile feedback. We go on to consider the potential value of such mechanisms to learning through simulation.

Key words

Sensory learning, Immersive learning, Simulation, Technological advances

Introduction

There is no doubt that clinical simulation is here to stay. The technology available to educators is growing exponentially but sometimes the evidence to support the use of such technology is not always keeping pace. This paper outlines some of the recent advances in relation to immersive learning and how educators might maximise sensory learning during clinical simulation. The senses appear to be important to clinical learning, but to date there has been an over emphasis on observation and listening in the form of communication skills. Here the need for learners to recognise auditory bodily cues, smell as a clinical indicator and haptic feedback are explored in terms of learning.

What is immersive learning?

Immersive learning can take place along a continuum ranging from an interactive physical environment, in which multiple users can be situated at the same time through to engaging in a virtual world as an avatar, and includes the use of serious computer games, specifically designed for learning. Immersive learning places the learner at the centre of the educational process and should promote ‘whole encounters’^[1]. One example of a physical environment is an enclosed 360 degree interactive environment, referred to as a Dome, where a range of environments can be projected using conventional game development techniques to produce 3D digital content. A similar approach is described by Kneebone et al as distributed simulation^[1]. In terms of simulated learning the fidelity or similarity to the real world, is important and educators are required to develop authentic replicas of a range of clinical encounters. Fidelity refers to aspects of both the environment and psychological fidelity; in other words the physical characteristics of the environment and the emotional connection or feelings evoked by the learning stimulus are equally important. From a learning and teaching perspective, physical immersive environments such as the Dome differs from other conventional virtual approaches. Traditional virtual or simulated learning environments are often implemented through technology based on direct interaction with a single user, collaborative contact between users being simulated via an avatar or virtual self within a networked virtual space. Immersive Dome physical spaces enable collaborative multiple learners to work together in order to collectively share knowledge as they work through interactive scenarios. This enables educators to incorporate decision making processes through dynamic changes within the environment and associated feedback mechanisms.

One of the advantages of using immersive learning environments is the capability to apply other technologies which further enhances an affinity between the user and real-life experience, for example haptic and olfactory feedback. The implementation of such technology opens up the possibility for educators to include sensory elements to the learning environment which may further enhance learning, however, educators are required to determine which aspects of clinical simulation are most important for learning^[2].

Facilitating deeper approaches to learning

The concepts of deep and surface approaches to learning are classically described by Marton and Saljo who are attributed with outlining two fundamental approaches to learning^[3]. Surface approaches are concerned with memorising unconnected facts for subsequent reproduction. Deep approaches focus on sense making, and are thought to be more conceptual in nature whereby meaning is transformed. Snelgrove demonstrated that students tending to use a largely surface approach tend to learn in a superficial manner with an emphasis on rote learning. Students favoring a deeper approach appeared to have an inherent interest in the subject and needed to understand what was being learned through reading and research^[4]. Higher education aims to foster a deep approach to learning however, within nursing surface approaches or rote learning are also considered to be important. For example, as Jinks points out, the learning of psychomotor skills entails being able to recall or to do things quickly, automatically and without thinking^[9]. Within the realm of clinical practice, such speedy and efficient performance of clinical skills is paramount. Clinical simulation is thought to promote deeper learning through participation in realistic clinical encounters and structured de-briefing where meaning of the learning is explored.

Eraut^[6] and Schon^[7] suggest that professional practitioners, have a specific and unique way of learning. Eraut refers to this as learning on the job, whereby professionals deliberate on specific events linked to the context of their practice; termed case specific learning. However, he acknowledges that in order for learning to take place, cases should be perceived as unique rather than routine with time being allocated to deliberate their significance^[7]. Schon suggests that the knowledge on which professionals draw is broad, deep and multi-faceted; moreover, the problems which professionals face are not straightforward, rather they are complex and messy; the creation of simulated active learning environments enable student nurses to learn professional artistry^[8].

Using simulated or immersive learning enables students to learn in a specifically designed learning environment which Schon describes as a practicum^[7]. Within such a practicum students can learn to undertake clinical tasks, in a context that replicates a real clinical world where students learn by doing. Roberts and Greene^[8] suggest that in order to enable students to learn within a practicum both students and educators are required to suspend disbelief, viewing the scene both as an audience member, and becoming an actor as part of the scene. Furthermore, they suggest that although simulation differs from traditional didactic teaching methods, it may prove a useful mechanism to aid progression and development in terms of skill acquisition^[8]. Errington^[9] suggests that through the careful construction and deconstruction of immersive scenarios, situated learning theory and valued contextual knowledge is brought to the fore, which he argues is one strategy for getting students, as aspiring professionals, closer to the realities of their chosen discipline.

Developing scenarios for learning that maximise the sensory experience

Previous work in the arena of disaster management has explored immersive learning as a preparatory training tool. Klomp, Spitalnick and Reissman^[10] found that immersive learning prior to deployment enabled the trainees to deal with the disturbing sights, sounds, and smells experienced during major disasters. In addition, the prior immersive learning was associated with increased job effectiveness and performance together with sustained resiliency once in the field^[10]. The main aim of the training exercise was to enhance the competence and confidence of members of emergency disaster teams prior to deployment by providing a safe and supportive opportunity to practice and adjust to unfamiliar and potentially challenging sensory stimuli. This reinforces the importance of creating learning environments that replicate the real world as a whole and therefore should include sights, sounds and smells^[11]. Similarly, Paige and Daley^[12] refer to experiential learning perspectives and in particular situated cognition as a pedagogical framework; whereby learning takes place through social activity incorporating the mind, the body, the activity and the tools in a complex and interactive environment. In other words, cues from the environment such as sights, sounds and smells are all important in terms of learning^[13]. Paige and Daley^[13] call for simulation which facilitates the students' embodiment of the nurse role. Traditionally, medicine has tended to objectify the body whilst largely ignoring the embodied experience of patients^[14], for example people become 'the hernia in bed three'. Immersive learning has the potential for learners to take on both the role of the nurse or the patient where they can begin to assign meaning to both roles through experiential learning^[8].

Smell as a clinical indicator, and the role of smell in learning to be a nurse

In an ideal world, modular learning outcomes would be aligned to clinical placements^[15]. Such an alignment may not always be possible for schools of nursing to provide when practice placements are at a premium; and so simulated learning might be one mechanism that promotes the use of the senses to help students to learn. Dewing^[16] particularly singles out the need for focussed observation and active listening skills. It seems that the use of the sense of smell is often overlooked; and yet anecdotally it is something that neophyte nurses worry about. Meskell and O'Connor^[17] explored Irish nursing students' perceptions of anatomical dissections as an educational tool and found that 58.1% of the 74 students surveyed reported the smell in the dissection room as disturbing; with the sight and feel of the specimens to touch as similarly distressing. Indeed the degree of fear of the dissecting room experience was statistically significantly related to the smell of the dissecting room^[17].

Smell is often a clinical indicator. An inquest into the death of Gillian Astbury found that there was a failure of nurses to administer insulin when Ms Astbury developed ketoacidosis, reported in *The Guardian*^[18]. It is well known that one of the most notable symptoms of ketoacidosis is the smell of ketones on the breath^[19] often described as being like pear drops, fruity, alcohol-like or acetone. Memories associated with smell are often very vivid, and can have the effect of taking an

individual back in time ^[20]. It is possible that the immersive simulated learning experience would be enhanced if the learning environment could replicate the smell associated with ketoacidosis; however, it is clear that evidence to support this notion is required.

Similarly, there are psychological aspects for individuals and nurses of living with or treating malodorous or fungating wounds ^[21]. Goode explains that whilst nurses might consider the patient's wishes about the selection of particular wound dressing; much less is known about the psychological impact of living with a malodorous wound. Furthermore, nurses might tend to assume that patients have somehow become accustomed or sensitised to the smell and therefore may not broach the subject with the patient ^[21]. Goode asserts that few studies have investigated how nurses have dealt with malodorous wounds, and calls for more research which focuses on the psychological aspects of care ^[21]. Further research is required to investigate the psychological impact of malodorous wounds on patients and nurses; by replicating the smell within an immersive learning scenario. It would then be possible to demonstrate whether students could then recognise such odours as early indicators and undertake additional assessment, or instigate treatment; or whether from a patient perspective, learning to recognise the smell leads to earlier calls for help.

The sounds of clinical practice

The dome provides an opportunity for a fully immersive learning experience; which includes the use of sound. The following is a data excerpt from the thesis of Melincavage ^[22] where students specifically mention the sounds of clinical practice and the associated anxiety that these sounds might invoke:

“...I listen to a patient's heart sounds and lung sounds and I hear something (abnormal), I'm still at that stage where I hear it and I recognize it but I want somebody to validate it because I want to know that was crackles (an abnormal lung sound) or that was rhonchi (another abnormal lung sound) and now I know what it sounds like for next time. It's nice to have that validation...I'm fairly certain that I'm correct but I'm not an expert yet and I don't do this 40 hours a week every week and somebody that's been there and done that gives me a sense of reassurance that I'm on the right track and I'm not completely out in left field... (p101)”.

Although much has been written about expertise, there is a gap in the literature concerning how nurses learn to use auditory cues, and filter out the ambient noise of the clinical environment in order to focus on what they need to hear. Anecdotally, for example, many students struggle to hear Korotkoff sounds associated with taking blood pressure recordings manually.

Within Mental health nursing simulating auditory hallucinations (such as those experienced by people with schizophrenia) have been demonstrated to increase empathy and understanding about the condition as participants were able to glean an 'insider's perspective' ^[23, 24]. Chaffin and Adams ^[24] used a pre-recorded training compact disc containing a range of voices which 67 psychiatric nursing students listened to through headphones whilst undertaking a range of simple tasks. The participants are reported as being emotionally changed by the experience and when they returned to clinical practice were “more focused and showed extreme kindness and patience when interacting with psychiatric patients” (page 10). However, the study reports only the pre and post test scores regarding the experience itself, and no data is presented to support the claims made in terms of impact on clinical practice.

Therefore, the sounds of clinical practice are associated with bodily cues and those of equipment and the environment itself; but it appears that to date there is minimal work in this field, particularly in terms of learning to recognise such sounds; and whether including such sounds in immersive learning scenarios enhances student learning.

Touch and tactile feedback in simulated learning

Contemporary technology includes the ability to simulate forces and hence administer sensations which are perceived as touch or force ^[25]. There are two aspects of touch or tactile feedback in immersive learning environments: “multimodal

interfaces can be programmed to provide realistic force feedback (e.g. simulating object compliance, weight and inertia) and / or tactile feedback (e.g. simulating surface contact geometry, smoothness, slippage and temperature) by employing physical receptors in the hand and arm” (page 53)^[26]. When force feedback simulation is combined with visual simulation students are able to have what Reiner^[27] (Cited by Weiber)^[26] terms as an embodied experience which resulting in the learning developing more accurate mental models and representations said to enhance learning. Hamza-Lup and Stanescu^[25] argue however that it is difficult to define relevant training tools that would benefit from haptic feedback. Furthermore, they go on to suggest that the concepts that best lend themselves to such simulation remains unclear and that further research regarding the evaluation of technology acceptance and impact on learning are areas requiring further research. For example, it is known that sensory symptoms such as tingling or burning are commonly described by people with Parkinson’s disease^[28] such tactile hallucinations are often reported alongside visual hallucinations^[28, 29]. It is possible that a learner could wear a haptic suit which would replicate such tingling sensations; if worn within an immersive environment simulating the associated visual hallucinations; this may enable the learner to experience some of the symptoms exhibited by those suffering with Parkinson’s disease. The impact of such immersive experience needs to be evaluated and tested; but such learning methods may result in enhanced empathy and understanding of the patient experience.

Conclusions

It is clear that immersive learning and clinical simulation are here to stay, and there appears to be huge potential for learning and teaching within nurse education. New technology is enabling educators to have more tools at their finger-tips which may maximise sensory learning experiences through the application of visual, olfactory, auditory and tactile mechanisms. However, it is also clear that a sound evidence base, achieved through robust evaluation of the teaching and student experience is required. Nurse educators are encouraged to reach out to colleagues from other disciplines to explore potentially pioneering ways in which immersive simulation could provide both interactive and dynamic teaching and learning opportunities in the future. Through collaboration it may be possible to increase the potential scope of the application of the technology serving multiple areas of teaching and health care, and therefore satisfying a wide range of academic and patient outcomes. However, it is clear that more research is required in order to demonstrate the impact of using such approaches within immersive learning environments.

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