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Evaluating the effectiveness of immersive learning in nurse education

Go over it, see it, get it!

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Otago Polytechnic School of Nursing
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Dr Liz Ditzel (Project Leader)

Executive summary

Purpose: This collaborative research project evaluated two technology-enhanced learning strategies for clinical practice. It assessed how nursing students responded to the introduction of clinical simulations in teaching and how effective these were in the context of a newly-developed immersive learning approach.

Background: Clinical experience is the hallmark of nursing education because it provides students opportunities to transfer their theoretical classroom knowledge to the clinical reality of nursing patients/clients. However, securing quality learning opportunities in clinical practice is not always guaranteed due to external factors such as placement and patient/client complexities influencing students learning opportunities. Simulation has developed as a response to such challenges to replicate the reality of clinical settings, providing students the opportunity to practice nursing care and make clinical judgments in a safe environment. High fidelity manikins provide authentic simulation learning experiences, especially in medical emergency situations.

The School of Nursing's immersive teaching and learning approach integrates traditional classroom tutorials with LabTutor, an online learning platform containing electronic case studies supported by medical notes and patient video material, with clinical nursing simulation using high fidelity manikins. This hands-on method was designed to link the student's knowledge and understanding of physiology with clinical assessment and nursing management in order to develop clinical decision-making skills. It was anticipated that students' learning experience would be enhanced by the higher level of realism that is possible using the high fidelity manikins, and using authentic clinical data and case notes.

Method: Approval to conduct this research project was gained from Otago Polytechnic Research Ethics Committee after consultation with Kaitohutohu. It was conducted in two phases.

> **Phase 1**: Qualitative data was gathered during the year using focus groups and an external facilitator. A structured interview format was used containing questions related to the level of satisfaction and confidence in dealing with the scenario, the learning experience, and preference for learning elements.
>
> **Phase 2**: Quantitative data was gathered at the end of academic year using an online survey instrument and self-reported data. Exam performance data was analysed when all students had completed the course.

Results: Participants were Year Two nursing students (N=111) divided into four groups (A, B, C, D). In phase one, 71 students (64%) participated in cycles of focus group interviews during the 2014 academic year. In phase two, 82 students (73%) completed the survey.

Summary of findings: Qualitative data collected from focus group interviews indicated:

1. The immersive learning process was effective. Seeing the videos embedded in LabTutor was particularly helpful. Students were able to link pathophysiology relating to the person's condition and the simulated nursing scenario involving the person presented in the LabTutor video.
2. Learning opportunities (negative learning) occurred when the manikin did not operate properly (e.g., the manikin kept on blinking but had no pulse) and prompted students to use critical thinking and problem solving skills.
3. Negative learning also occurred when there was a lack of integration within learning components. Where the sequence of immersive learning tasks, such as the link from online to practical implementation was unclear to students, they reported impeded progress and lowered confidence in understanding.
4. Realism was not well established. In the first half of the year, most participants referred to the manikin as *"the dummy*" suggesting that the transference or the person's identity (shown in the case study) was not occurring. However, later in the year when the manikin broke down, this term was seldom used.
5. Students reported improved levels of confidence in learning by simulation but didn't like being watched.

Quantitative data from the online survey verified these themes. A significant difference was found in exam marks (these were higher) for students who had had the immersive learning experience and been on a medical placement before the exam. This result was not surprising, as we would expect the different experiences to reinforce and augment student learning and result in a higher level of achievement.

Implementation: ADI recently upgraded LabTutor to 'KuraCloud', a cloud-based Learning Management System (LMS). KuraCloud offers the same electronic patient case studies and videos but is easier for students to use and academic staff can independently edit and update content. KuraCloud learning packages have been designed to meet the learning objectives of the BN607000 Pathophysiology course. The main teaching and learning resource is now the electronic case study supported by a lecturer-led tutorial rather than student's gathering their own data, i.e., the hands-on tutorial experiments such as spirometry

measurement and ECG recording have been dropped. Simulations are also being used across Years One, Two, & Three of the nursing degree programme.

Introduction

The aim of this research project was to evaluate the impact of an immersive teaching approach on second year nursing undergraduate student performance, satisfaction and engagement in learning. This involved integrating new learning and teaching methodologies with traditional classroom learning opportunities.

Simulation in nurse education in New Zealand

Providing nursing students with opportunities to apply their classroom theory to clinical practice is a major component of undergraduate nursing education (Spence, Valiant, Roud, & Aspinall, 2012). However, the quality of learning opportunities on clinical placement is variable. Factors such as the student/preceptor relationship, busy work environments and patient's clinical presentations potentially influence student learning opportunities (Spence et al., 2012). Additionally, patient safety is foremost in the clinical setting and must be maintained whether a student, novice or experienced nurse provides the care (Chan, 2002). These challenges and the ethics of 'practicing' on real people have prompted educators to investigate different ways to prepare nurses in the 21st century (Hayden, Smiley, Alexander, Kardong-Edgren, & Jeffries, 2014). Nursing schools have responded to such challenges by establishing simulated learning environments to teach nursing skills, assessment and management (Lasater, 2007; Leighton, & Johnson-Russell, 2013; Bailey, 2013).

Nurse educators have utilised simulation in various forms for many years beginning with anatomical models and task trainers through to role-playing and gaming (Nehring & Lashley, 2004; Schiavenato, 2009). The rapid advancement in simulation technologies over the last two decades has facilitated a move from using simulation mostly for the acquisition of technical skills, to teaching students the responsibilities and the role of the nurse in simulated learning environments (Jefferies, 2012). Examples of the types of simulation used today include, task trainers'; virtual simulation, peer to peer learning, role-play and full-scale simulation (Decker, Sportsman, Puetz, & Billings, 2008, p. 75). In this research project, a simulated-based learning experience is defined as:

> "[A]n array of structured activities that represent actual or potential situations in education and practice and allow participants to develop or enhance knowledge, skills, and attitudes or analyze and respond to realistic situations in a simulated environment or through an unfolding case study" (Meakim et al., p. S9).

Like many nursing schools in New Zealand, the use of task trainers for clinical skill development and role-plays to teach professional skills such as communication is a well-

established teaching method. In our school, second year students had their first simulated-based learning experiences in 2010 using simulations depicting a patient suffering from hypervolemia due to post-operative blood loss, and a patient experiencing chest pain. Since then the simulation program has expanded. Current nursing students participate in fifteen simulated-based learning experiences during their three-year degree program. Simulation scenarios relate to the four nursing disciplines of medical, surgical, mental and primary health.

For each simulated-based learning experience the student completes an hour of preparation involving online resources related to the scenario. This is followed by a twenty minute learning experience where a group of four students participate in a clinical scenario in the simulation suite (a dedicated room for simulated-based learning experiences). Each student is allocated a role to play, a student nurse, registered nurse (RN), relative or peer observer in the Simulation Suite. The simulated-based learning experience concludes with a thirty-minute debriefing session, facilitated by the lecturer. Debriefing provides an opportunity for students to reflect on their actions and link this to theory to learn how to manage future similar situations (Morse, 2012).

In 2012, video case studies of real patient stories were added into the Year Two pathophysiology course (BN607000). The aim was to expose students to real patients, their families and the health professionals providing their care through video to assist them to link their pathophysiology knowledge to real clinical cases. Students were able to review the patient's X-rays, scans and laboratory findings. In addition to viewing the videoed case studies, students also performed experiments to record, document and review their own physiological data which linked to the case. A local company ADInstruments (ADI) provided the videoed case studies and lab experiments through a digital platform named LabTutor. Course feedback indicated students were highly satisfied with their learning experiences using the cases and experiments.

Following the success of this first initiative, videoed case studies and experiments are now an integral part of the second year simulation program and theory for practice course, where nursing assessment and management skills are taught. Tracking a particular patient as a case study develops a narrative of clinical care for the student and a sense of identification with them and with the realities of clinical realities beyond the classroom. Staff developing this course wished to adopt a more immersive approach to using the teaching technologies of online learning, experiments and cases to assist students to link theoretical concepts with clinical practice. The term 'immersive'; meaning a sense that the student was immersed in the integrated learning experience, similar to learning to a clinical context (Mattis, 2010).

Related literature

This research study was informed by narrative-based pedagogy, derived from an interpretive phenomenological approach to nursing research (Diekelmann, 2001). The concept of narrative pedagogy originates from the practice of telling stories (Walsh, 2011), and focuses on interpreting and deriving meaning from real world experiences to understand the different perspectives of the people involved (Diekelmann, 2001). Using a narrative approach to learning enables students to situate their theoretical knowledge into the human complexity of the real world of healthcare (Walsh, 2011).

Narrative reasoning is one of three processes experienced nurses use to make clinical judgments in the practice setting. This form of reasoning involves making sense of a situation through the interpretation of the patient's experience (Tanner, 2006) i.e., the meaning of the illness experience for the patient and family emerge when the nurse listens to the patient's story. The story provides a context that assists nurse to make clinical judgments required to assess and plan nursing care (Benner, Tanner, & Chesla, 2006; Tanner, 2006).

Simulated-based learning experiences are often criticised because they resemble an unrealistic and dehumanised learning environment (Foster & Hawkins, 2005; Chen, 2011). In the clinical reality, nursing care requires an emotional connection and empathy because it involves humans who are inherently complex (Gaba, 2004). Learning how to develop therapeutic relationships during a simulated learning experience is problematic when a simulator is unable to respond with non-verbal cues or emotional nuances (Foster & Hawkins, 2005). Similarly, a trained actor may be unable to display the full scope of emotion inherent in the clinical setting, despite their training for the role (Chen, 2011).

Another criticism is that simulated-based learning experiences are frequently 'crisis based' and may unintentionally focus on technical skills, at the expense of interpersonal relationships (McGovern, Lapum, Clune & Martin, 2012). Berragan (2011) warns new simulation technologies may move us away from emphasising relational, holistic nursing care, which is integral to nursing care.

The immersive learning process

To counter these criticisms, in this research we integrated online learning, experiments, cases, and simulated-based learning experiences to provide a rich, contextualized and active learning opportunity for nursing students. The approach represented the patient journey from initial presentation, through diagnosis and treatment to discharge and ongoing

care. In a simulated-based learning experience only, students may not get a feel for the whole patient history and have less of an opportunity to consider issues such as patient education, discharge planning and ongoing care.

The five steps of the immersive learning process used in this research are:

1. **Theory lecture and directed online learning (OLL):** students have theory content in the traditional lecture and then complete self-directed study online which involves meeting the person by way of a video case study presentation and looking at the pathophysiology of the person's condition.
2. **LabTutor session**: students conduct a physiological experiment and compare their own data to that of the person with the disease process (hands on learning).
3. **Group tutorial**: students continue looking at the case and discuss and link physiological data with the nursing management of the case they have observed in LabTutor.
4. **Simulation**: students provide nursing assessment and care for the person in the simulation laboratory (Integrates steps 1, 2 & 3).
5. **Debrief and reflection**: students debrief (discuss using a structured format) the simulation and complete a directed learning worksheet about the case.

These five steps are shown in Figure 1.

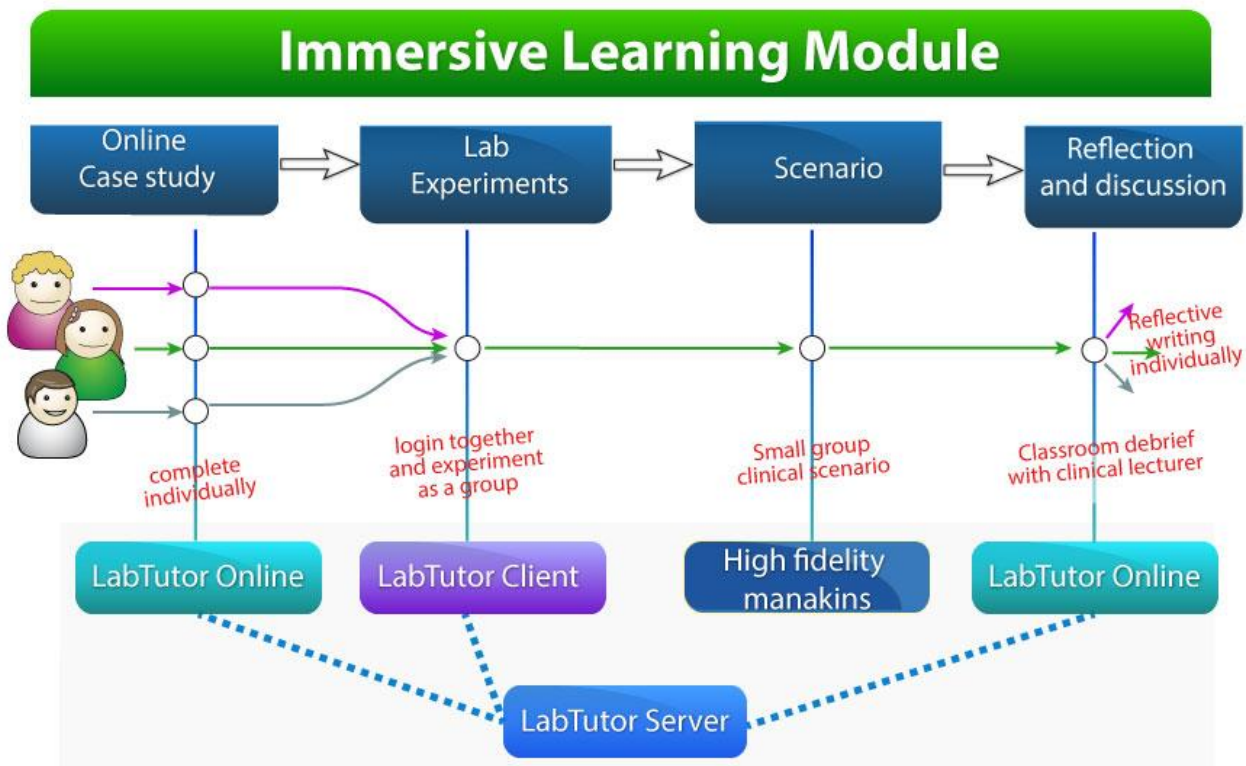

Figure 1: The immersive learning module

Two case studies were chosen for this project, a patient who has a cardiac arrest following a myocardial infarction (the MI case) and a patient admitted to hospital with an acute exacerbation of Chronic Obstructive Pulmonary Disease (the COPD case). The students were able to use the relevant information from the videos and clinical investigations to assess and intervene during the simulated learning experience which involved the previously seen case study patient they had observed. The patient case integrated the learning experience and was used to guide the debriefing session.

Research methodology

Ethics consultation and approval: After consultation with Kaitohutohu, and submission of a full ethics application, approval to conduct this research project was gained from the Otago Polytechnic Research Ethics committee (Approval 577)[1].

Research objectives: A two phase action research process was used to evaluate the four research objectives.

[1] See appendices for survey instruments and research documentation.

1. To integrate technology-enhanced simulation and LabTutor to apply pathophysiology, nursing assessment and theory for clinical case studies (Phase 1).
2. To evaluate the effectiveness of the approach for second year nursing students, as well as preferences for individual teaching strategies (Phase 1).
3. To evaluate the impact that the immersive learning experience has on student performance, satisfaction and engagement (Phase 2).
4. To evaluate the viability of implementing this approach as core learning strategy within the Bachelor of Nursing degree programme (Phase 2).

Research method: The research was conducted in two phases:

- **Phase 1**: Qualitative data was gathered using focus groups and an external facilitator. A structured interview format was used containing questions related to the level of satisfaction and confidence in dealing with the scenario, the learning experience, and preference for learning elements.
- **Phase 2**: Quantitative data was gathered using a survey instrument and self-reported data, MCQ and open-ended questions (online). A retrospective analysis of student exam marks in the Pathophysiology (BN607000) paper was completed at the end of the teaching year.

Participants: Research participants were Year Two nursing students (N=111) split into four teaching groups (A, B, C, D). Students were further divided into smaller subgroups, i.e., group A, into A1 & A2, etc. Each group had the same immersive learning experience, but at different times of the academic year. Focus group interviews were held soon after each immersive learning experience.

Staffing: LabTutor sessions were conducted by Dr Karole Hogarth, supported by an ADI staff member, the School of Nursing technician and others. Dr Karole Hogarth facilitated case study tutorials. Simulations and debriefing were conducted by Raewyn Lesa and other staff members. The research team met at regular intervals to review the key themes and identify matters requiring solutions.

Focus group findings

A total of 71 Year two students participated in focus group interviews during the 2014 academic year. Focus groups were conducted in six cycles; Cycle 1 (April; n=13), Cycle 2

(May; n=8), Cycle 3 (June; n=10), Cycle 4 (September; n=22), Cycle 5 (October, n= 12), Cycle 6 (November; n=16). Interviews were semi-structured and conducted by Dr John Farnsworth, an independent contractor for the project. Group sessions were approximately 50 minutes long, digitally recorded, then transcribed by an independent contractor. The project leader and interviewer through a pen and paper content analysis identified commonly expressed themes. Themes are presented as subheadings and discussed in what follows. Student comments are direct quotations and reported in italics.

Cycle 1: April (n=13)

Two groups of students participated in the first research cycle (group 1, n=5; group 2, n=8). There was a lower level of participation than expected (26 students had completed the learning module) due to a variety of factors including: Year two timetabling issues, the mid-afternoon timing of the interviews, and the proximity of the Easter break. In group 1, one student left early due to childcare commitments. The following five themes relating to their experiences of teaching and learning, using LabTutor, doing the clinical simulation, debriefing their clinical performance were identified from these interviews.

Teaching and learning - Go over it, see it, get it!

The first theme, captured by the comment – "*go over it, get it, see it!*" indicated that elements of the immersive learning model worked together to reinforce learning. For example, students learned about respiration using a spirometer to measure their own breathing rate, flow and volume. This experiment helped them to understand the pathophysiology underpinning the medical conditions presented in the case studies, i.e., Chronic Obstructive Pulmonary Disease (COPD) and myocardial infarction (MI). These hands-on activities also provided insights into how a person with COPD lives with the symptoms of such a debilitating condition, i.e., a restricted lung capacity, increased respiratory rate and lower inspiratory volume. Concerning the COPD case study, one student commented, "*actually breathing and pretending we had COPD is really good. I could feel the difference",* and for the MI case study another said, *"it was good having an ECG (Electro Cardio Graph). It's good to do it out of placement and then have the experience before doing it in class".*

Online learning activities where *"you had to match the diagram with the part of the heart belonged to that name, activities like that",* were reported as preferable to *"just reading and*

questions" and seeing the video vignettes of the person with the condition also enhanced students' learning.

- *"We learned about the disease during the lecture, and then we watched video on somebody who had the disease, and listened to them talking about their own experience with it and what that meant for them and how it affected their life and also their relatives."*

The interrelated aspects of the immersive process, i.e., the case material, video clips and lecturer's notes written on the whiteboard in the tutorial helped students to understand and link the pathophysiology to the clinical presentation and patient's experience of their medical condition.

- "W*e went over the content and the lecture, and we went over this again during the online work during the lab and during the tutorial as well, so it was good, was just reinforcing, and the lecture was mostly about the disease process and sort of the pathophysiology side of things*."
- *"COPD is a chronic disease – so someone is living with it constantly, whereas MI is sort of, like, an event so it happens and is more like an experience rather than a lifestyle. So it is different in that sense, just because when you met the case study guy who had the MI, he was sort of talking about past experience, and the COPD lady was talking about their everyday life".*

LabTutor experiment – help required please!

The second theme revealed the issue of inexperience in logging on and using the online LabTutor learning platform. One student said "*at the start of our first LabTutor session, a lot of people couldn't get online, it wasn't working or something".* Navigating the LabTutor menu and using the resources was also challenging for some who "*found it challenging to get my head round the layout of the LabTutor and I'd like to have more drag down options to use".* On the positive side, students found having knowledgeable tutors and staff helping them in the tutorial beneficial.

Simulation – a bit lost at sea!

Performing a simulated nursing scenario was not a new experience as all students had completed one in their first year. However, many reported being "*a bit lost at sea*"; that they did not know what to do, or were unprepared for this simulation experience. Comments included:

- *"We wanted more information about nursing interventions and roles – we were not given the next step…I didn't really know what to do in the simulation….we were not prepared at all".*
- "We *needed more information on the nursing intervention…we knew about the disease, this happens in the body, we weren't given what nurses are supposed to do with that – we weren't given the next step".*

Students worked in groups of three to four for each scenario. In the simulation suite there were usually three roles (registered nurse, student nurse, relative sitting at the bedside) and outside the suite, an observer viewing the simulation through the one-way mirror. Performing these different roles, particularly that of relative provided them with valuable insights.

- "*I found being a family member was a realistic and valuable experience".*

Making the simulation look and feel like a real clinical nursing experience was critical to the immersive learning design. The Gaumard high fidelity manikins were chosen because their software programs can be programmed to replicate the signs and symptoms of a medical event such as a cardiac arrest (as a consequence of an MI). For example, in the MI scenario, vital signs change to reflect the haemodynamic changes experienced with compromised heart function. It is possible to show changes of cardiac ischaemia on the patient monitor and cyanosis is evident when the skin tone on the manikin's face turns blue. The nurse can also take vital signs (blood pressure, pulse, respiratory rate) and perform other tests such as an oxygen saturation reading taken on the manikin's finger by way of an electronic sensor.

Realism however, was difficult to achieve. While some students were "*blown away when manikin went into cardiac arrest",* others found the COPD simulation more realistic that the MI.

- *"Just because it was, like, you're fine; you're talking to a patient, everything is going well. Then all of a sudden and they flat line, and it just doesn't – very rarely does it happen like that. There's lots of warning signs usually before somebody just crashes like that".*

A factor that did help the scenario appear more real was the voice communication via microphone when staff responded to student questions (or gave prompts) during the simulation.

- "*The lecturers were good too. Talking though the dummy was a realistic thing".*

Debrief – very helpful

The post-simulation debrief that involved discussing and reflecting upon the nursing interventions in the simulation as rated as "very helpful". The debrief assists learning because "*issues were talked about and explained"*. However, some found the process less satisfactory due to "*different teaching styles"* and felt unsupported when there was "*no discussion of why did you start to do what you did".* Overall, student comments indicated that they found the learning experience effective, interactive and engaging.

- *"It was good getting to see the patient and see how it all connected – which I like, to follow through all of it".*
- *"I was never dreading one thing. It was all very new and exciting, interactive engaging".*
- *"This will never escape my mind again!"*

Two areas for improvement were identified.

- *"Could be improved by including nursing intervention side of things, tweaking some of the software stuff in terms of the whole log in business".*
- "*I found the COPD simulation was easier to handle…I felt like I needed a little bit more extra for the MI with technology".*

Action research interventions

In response to issues identified in the first cycle, the following interventions and adjustments were made.

1. Technology and logon difficulties were discussed with ADI to find solutions.
2. Students were provided with clear instructions on how to log on and navigate LabTutor[2].
3. Teaching staff adjusted the Myocardial Infarction (MI) case content and changed some aspects of the scenario.
4. Students were given time to explore the Simulation Suite and were shown all equipment before the simulation started.

[2] See appendix

Cycle 2: May (n=8)

In May, two small groups (of 2 and 6 students) were combined (group 3, n=8).

Teaching and learning – signs of immersion working

Comments indicated that the immersive process was working and students were beginning to see the links between learning activities and simulation:

- *"I thought it was very interesting…having the activities immersed in the middle of each thing was nice to be able to test yourself and then you could go back and check it. It's nice for us to go back and … I was actually taking it in and it was real nice".*
- *"I felt like I learned more by seeing it as well as reading about it".*
- *"When we did get into it though, we did have good instructions, step-by-step it was good… the LabTutor part worked well, and LabTutor had really, really, good instructions"*
- *"I'd read that in the textbooks maybe 15 times then when you see someone actually trying to speak with COPD you go, oh yeah".*
- *"To see someone who walked such a short distance and was gasping for air… You can read it in a book but unless you actually see it you can't comprehend it".*
- *"As much as people describe COPD to you, it's always good to see someone who actually has it. You can't imagine it".*
- *"The COPD was definitely better than the MI".*

Technology – mixed experiences

This group of students had just returned from a semester break and some experienced difficulties accessing the online learning resources. At the same time, building and construction activities in the floor immediately below the School disrupted the student's learning environment, affected the wireless technology and caused problems with the functionality of the manikin.

- *"[There was] A bit of a mix up in our first week… the programme hadn't been opened up to us yet…. there was no real guidance like it was here's your computer, log in, read whatever is on the screen…for me that doesn't work….A lot of us couldn't sign in".*

Students seemed a bit lost and appeared to need more direction from staff.

- "*We need to be told what to do*".

- *"We didn't do all the work, the directed learning work; we didn't get told we needed to do it before the LabTutor experiment. …No one knew we had to do any pre lab work so when we got to the lab we didn't know what we were doing. …we need to be told what to do and when".*
- *"I hadn't submitted my paperwork and I didn't realise that as I hadn't been told that what we had to do and it might even help if they [teaching staff] put in specific pages so we could read them further".*
- *"Just show us how to do it".*

Simulation – skills developing

Some of these students had recently been on a medical nursing rotation which gave them more confidence in performing the simulation because they were able to draw on actual nursing experience gained whilst on that clinical placement.

- *"I actually got to see a patient with COPD before the simulation and I actually ran into a situation that was exactly the same as the simulation… So on the day of the simulation I kind of know what to do because I had the experience".*
- *"Compared to a simulation room, in a clinical environment, you'd be more comfortable because you know where all the equipment is".*

However, students without recent experience were less confident.

- *"Going in to the simulation I had the theory knowledge but I had no knowledge about what to do to how to apply it".*
- *"I get into the room and I'm, like, 'I think I need a nurse now, Help!'"*
- *"If we'd been prepared it would have been awesome".*

It also appeared that not all students had the opportunity to familiarise themselves with the simulation suite as planned and some found the environment unrealistic.

- *"I think it's quite a sterile environment and it would be good if you were allowed in beforehand to see where all the equipment is".*
- *"If I'm in the ward I'm going to go to the drug room to get some more…you can't because it's not a real ward…and that just confuses us".*
- *"It's a manikin. I can't get over that. It's unnatural".*

Debrief – 'negative learning'

In this group, students discussed their "*negative learning*" experiences resulting from intermittent internet wireless 'drop out' beneath the Simulation Suite and electrical

interference that affected the manikin's performance. Negative learning occurred when the situation did not make sense to the students (or work out as it should have done). The following comments tell the story of the 'dead' manikin continuing to breathe after an unsuccessful resuscitation.

- *"In the debrief we had to learn what you would do if it was a real situation…like the strength of what you did, your weakness, and what you can improve on, so that's good and we learned from the experience of the manikin still breathing even though it was dead!"*
- *"It's a manikin, so you don't see it go unconscious. It doesn't have an expression on its closed eyes…. it was still breathing…it was confusing".*
- *"I reckon that if that monitor had been working, it would have been good. And if he hadn't been breathing, we would have known what was happening, it we had seen it and then we should have been able to do it."*

The paradox of the unconscious (or dead) but still blinking manikin provided the best teaching material for staff leading the debriefing discussions, as the manikin failure provided the perfect opportunity to reflect upon this experience and to use problem solving and critical thinking skills to investigate this unexpected situation.

Action research interventions

1. Technology problems in relation to the functioning of the manikin and monitor were resolved.
2. Staff posted clearer instructions about pre-class self-directed learning requirements.
3. Students were sent email reminders to complete self-directed learning before coming to class.
4. Staff involved in simulation met to discuss the consistency in procedures, i.e., orientation to the Simulation Suite and the importance of the debriefing experience, especially in relation to unexpected outcomes.

Cycle 3: June (n=10)

Two groups participated (group 4, n=8 & group 5, n=2) in the third cycle.

Teaching and learning – some things difficult or unclear

Students found watching the embedded video the most helpful learning experience but still found some learning activities difficult or unclear.

- *"You had to go through the pre learning stuff which was like video and naming parts of the lungs and all that stuff and I guess, I find it a bit difficult knowing what I was actually doing".*

Technology – challenges

Using the online technology remained challenging. Many students had forgotten passwords, others reported not knowing what to do or being unfamiliar with navigating the learning platform.

- *"I struggled a bit until someone actually told me and then I was fine".*
- *"I didn't know your user name had to be in capitals…I had to get my password reset so I could actually get on".*
- *"Yeah, none of us did it because it was a public holiday – Queen's Birthday we were meant to do it on the Monday but we didn't end up doing it…"*

Some students found performing the laboratory experiments difficult.

- *"We had the pulseometer on, too, and doing relationships between the ECG and what we got. But we didn't really see how it had much to do with the MI unless it was trying to show us a normal ECG... I don't know".*

Simulation – 'good'

The simulation experience was commonly described as *"good".* Some students however, did not know what to do in the event of a cardiac arrest and felt thrown in at the deep end.

- *"Like today, with the MI one, like we didn't know we were going to have to perform CPR but we did have to, and I guess we hadn't really be educated on the clinical setting, on when someone goes into cardiac arrest".*
- *"It was just because we had to get the crash trolley and get the defibrillator and so CPR which we hadn't done before in a simulation".*

- *"It was stressful at the time being put through it, but now it's good to think that actually we do have that information".*
- *"The COPD one was okay though…yeah…because it was all in the pre-learning really compared to the MI one. I don't think we had enough pre learning on that one".*

Action research remedies

1. Staff checked and posted clearer student instructions on Moodle. ADI supplied a technician to help students perform the spirometry measurements and ECG experiments. Additional teaching staff assisted students at the beginning of each tutorial.
2. Information technology staff investigated the 'dead spot' related to wireless uptake in the Simulation Suite.
3. The project team discussed poor recruitment and participation in focus groups. It was decided that staff not involved with the project should visit classes, supply the information sheets and encourage students to attend.
4. Focus groups were rescheduled for lunch times (instead of early afternoon). Food (pizzas) and drink were provided as an incentive to attend.

Cycle 4: Early September (n=12)

The extra effort put into recruiting more study participants paid off when a larger group (n= 12) turned up for lunchtime pizzas!

Teaching and learning – repetitive content

Teaching material was found to be repetitive. Repetition related to pre-case online learning material also reviewed in tutorials. *"You had pre-case learning then you had entry into LabTutor, then you did LabTutor then the tutorial. But the tutorial was identical to the pre-case learning".*

- *"I think there were a few extra videos but the majority was identical to the pre-case learning".*
- *"We watched the same videos in the tutorial that we looked at a few days earlier in the pre-case "It would have been better if we could have gone over what we had already done in LabTutor to clarify that [case material], rather than clarify what we had already done, if that makes sense".*

- *"They had just shown us the videos of the consultant and the patient recovery. If we hadn't seen them it would have been good: there would have been continuity between them all, but we had already seen it and we kinda went back to square one".*

Taking an optimistic view, the content may have seemed repetitive because (unlike some in the earlier groups) these students had actually completed pre-case work before coming to the tutorial. Possibly, it also reflects the fact that by this time of the academic year, more theoretical content had been covered and students were more clinically experienced.

Case study tutorial

LabTutor provided an effective teaching and learning platform and aspects the students especially enjoyed were:

- *"Real live case studies with actual patients".*
- *"Interviews and stuff with them".*
- *"We could watch the videos and there were little quizzes where you could test yourself. Following the patient through the process was useful".*
- *"I felt it [learning] was better because we were following the same patient and [get to] see the actual outcomes and stuff".*

Also appreciated was face-to-face teaching and the presence of a tutor in the classroom as this provided an opportunity for clarification of content.

- *"And K our tutor was with us helping…She talked us through it. It was the same content but she just explained it more in-depth. …. She was going through it on the screen".*

Once again, these students found the COPD case "*confusing*". Reasons given were because "we *had to graph results* and *we had to be quite computer savvy".* Students were uncertain about how to perform the spirometry experiments and how to interpret these results. Reading technical language relating to the experiments was also challenging:

- *"We weren't quite sure what the figures meant and what we were supposed to do with them".*
- *"I wasn't 100% sure in my group that we were doing it right in the first place".*
- *"The COPD was complex with things like lung capacity. It would be helpful if you had a sheet of paper next to you with all the different meanings and everything"*.
- *"It's so wordy; the language used is so technical reading it is so different to having someone explain it to you in simple terms"*.

The MI case was preferred and comments indicated that the steps used in the immersive process functioned as an effective learning scaffold.

- *"We had an idea of what to do, and what each point on the graph was, and what it meant".*
- *"We had been through it is class beforehand".*
- *"This was much more clearly explained".*

Simulation – manikin breaks down but scenario seemed real

In this simulation 'Hal' the manikin broke down: "*the machine turned off, but we thought it had died so we didn't know what to do".* But, with prompts and reassurance from staff in the Simulation Suite, students found the simulation experience useful, and (maybe because of the breakdown) the sequence of events and roles played resembled a real situation.

- *"The experience seemed the same as a real one except there were a whole lot more people around; there was doctors, registrars, crash team, like everyone".*
- *"He had a MI and we had to resuscitate".*
- *"We had to get the crash trolley and start CPR".*
- *"[It's real] to the point where we forget that the defibrillator is not actually going to give off a shock".*

Debrief

As before, the post-simulation debrief was the most effective part of the learning experience as it provides feedback on performance and reassurance for students.

- *"You talk about the strengths and weaknesses of everybody working together and what you did really well, and what you could have improved on, and you get to discuss it with who you were working with, with input from the lecturer".*
- *"They are really good at looking at what you did well. …And they took into consideration that we hadn't practice anything like that before".*

Action remedies

1. 'Hal' the manikin was sent to Gaumard to be repaired and was replaced by 'Susie'.

Cycle 5: Late September (n=12)

Twelve students (group 7, n=12) participated in a combined session, the fifth focus group cycle.

Teaching and learning

Nine students (75%) reported they could not log on to the online pre-case learning to prepare for the COPD case study.

- *"Well, because we made the passwords and stuff like that last year, … I couldn't remember what my password was and then when I did figure it out it all had to be in capital letters – which no one knew either. So a lot of people turned up to the first LabTutor and they hadn't pre read the pre work because they couldn't access it".*
- *"But once you emailed the Lab Technician she sorted it out".*
- *"But it you went to the first one without doing the pre-work then you couldn't move on".*

LabTutor experiment

While this group found the MI case *"really easy to do with lots of videos",* they experienced the same difficulties with the COPD case and the associated spirometry experiments as previously reported.

- *"It was really hard to navigate…. I didn't find it useful…. I didn't learn that much".*
- *"It didn't seem disorganised, it just lacked integration of like whey we were doing it".*
- *"It wasn't matched to our case study. It was just measurement and really in-depth things that I don't think we would know is our practice in general".*

Students offered the following suggestions for improving and redesigning the COPD LabTutor case learning experience:

- *"I think it would have been good if the whole group had gone through it together and as the steps went along and everyone had completed LabTutor the teacher could have explained what we were doing this for and everyone could have done that and we could have moved through it together".*
- *"The tutors could be better trained with working the programme".*
- *"Make it so each step in LabTutor introduced something new that you are learning, instead of the same videos".*
- *"Maybe introduce some clinical interventions and stuff".*

- *"Put less online so it could be explained…*

Simulation

The simulation experience was again marred by technical failure when Hal, the repaired manikin malfunctioned.

- *"The manikin broke…our one closed its eyes and went to sleep halfway through….the voice wasn't working".*
- *"Oh yeah, we had to stop…the resp. rate was like 70 or something".*

Students expected more direction from staff.

- *"In an actual ward … the RN should kinda direct you…you kind of expect the preceptor to be able to direct you".*
- *"I was the student and she said get the crash trolley and I was looking around the room.. it was outside the room and I didn't know".*
- *"There's no talk about practicalities …even moving the bed".*

Debrief –reassuring

As before, the post-simulation debrief provided reassurance and is a boost to confidence.

- *"If we had to do it again we would know what to do".*
- *"You feel better about doing it on the ward after you've done the simulation".*
- *"They are very good at linking back to practice, debrief always seems to do that".*
- *"The safety of knowing if you screwed up in the simulation nothing happens but you really know what you've done wrong, so you know what to do next time when you're actually out there".*

Cycle 6: November (n=16)

The final focus group (groups 8, n=7 & 9, n=9) interviews were held in the last weeks (October 31/November) of the semester. As no new themes emerged, a summary of the recurring themes and findings is outlined below.

Recurring themes

Teaching and learning - case material and video presentation of the patient profiles were particularly valuable. "*You could see the deterioration… yeah it was quite surprising, she was just really different".*

Case studies and videos make teaching realistic. "*I think you are more confident going into a simulation because you've actually known the patients, which is more realistic"*.

Technology – students reflected that there had been difficulties logging in to LabTutor and that they found the experiments confusing (especially the spirometry experiment) and difficult to do.

Tutorials - were appreciated and considered a necessary forum for learning. Students valued input from teaching staff.

Simulation – experiences positive overall. Students value learning by simulation but do not want it to replace clinical work.

Debrief – considered the most important part. Feedback from teaching staff in the debrief session is appreciated.

Summary of focus group findings

Focus group findings are summarised under four main headings; immersive teaching and learning, the LabTutor session, realism of the scenario, and student confidence.

Immersive teaching and learning

There is a strong indication that the immersive process, especially seeing the videos and following an actual patient, worked as an effective teaching strategy. One student said: "*For me it was how she was expressing her mind telling me how she is feeling, telling us how long she had been smoking before she stopped. How she breathes when she is going for exercise and gets out of bed. I keep remembering it in my brain, I can't forget it"*. Students made connections between the person, learning activities and the simulation. "*You kind of already know the patient history before going in whereas with any other simulation you get some information on a sheet and you are expected to retain that going in to the actual room. So it's good to have a lead up to it which is gradual as opposed to a list or handover".* However, these connections were not as explicit in the fourth cycle, rather students perceived there to be repetition, typified by this statement "*the bits that were linked repeated themselves a lot"*. Hopefully, this comment reflects the fact that students were near the end of their second year course work and knew a lot more (see page 44 for student performance).

As staff were integral to the learning experience and they were required to facilitate the student learning they were required to further develop their technology skills to guide student learning effectively. This was part of the action research process to fine-tune the learning (D'Souza, Venkatesaperumal, Radhakrisnan, & Balachandran, 2013).

LabTutor

These results show that LabTutor is an effective teaching and learning platform, notwithstanding student difficulties in logging on and initial problems with using the drop down menu. The benefit of this technology is that it allows students to use online tools to learn at their own pace, and to revise where necessary. This caters for the needs of the millennial learner and once operational glitches have been remedied is a reusable and sustainable educational tool (Walsh, 2011).

Case studies presented in LabTutor programme were specially designed and produced for Otago Polytechnic School of Nursing to expand the learning and teaching resources to enhance student engagement in innovative technologies that that are interactive, relevant to the millennial learner. The two people presented in the video case studies were filmed in their own homes and in the hospital setting. Using visual media brought the cases to life; students got to know the person and could see health practitioners performing procedures, for example, a registered nurse taking an ECG. This more accessible format (compared to a paper-based case study) enhanced students' interest and enabled a better understanding of the person's medical condition.

> *"I found the case study really good because you could physically see someone with the disease process and see the symptom physically which really helped match it up…. That was really helpful….the real patients who actually had the diseases".*

Despite technological issues, which were attended to over the year, learning experiences appear to have been positive. Students began to link pathophysiology relating to the person's condition and the simulated nursing scenario involving the person presented in the LabTutor video. One student said: "*I think it was pretty good how you can meet the patient first so you've got that…identifying a person and them you get the anatomy and other stuff behind it and that reinforces it a bit more".* Learning experiences for both cases were positive.

Realism

Despite issues with the manikin, the equipment, roles played and simulation scenario seemed real. "*It's a lot more realistic having the videos beforehand, compared to other simulation where you just do the pre-reading and them we go in and it's just a dummy, and they are saying this is what the dummy's got and go and do your simulation".* However, the fact that most referred to the manikin as *"the dummy*" in the first part of the year suggested that the transference or the person's identity was not occurring. It was interesting to note that

no one referred to the manikin as a “dummy” in the latter part of the year when the manikin was not working properly. ‘Hal’, the manikin that eventually broke down was returned to the supplier.

Debriefing

The key to simulation is debriefing involving abstract conceptualization and reflective observation. Reflection and debriefing provide academics and students with the opportunity to examine action and decisions and allows the educator to correct errors, clarify mistakes, receive student feedback and exercise effective safe nursing care (Jeffries, 2007). Neil and Wooton (2011, pg162) state that “debriefing is a strategy nursing educators need to master, as efficacious debriefing frameworks can enhance student learning”. Students appreciated the benefits of receiving feedback on their performance and they learned from their own mistakes and those of others, feedback from academic staff helped them to understand the nursing process and the responsibilities commensurate with a second year student nurse’s role. This concurs with the findings of Shinnick, Woo, Horwich, & Steadman (2011) who asserted that feedback is essential as a process of reflection that is required to contribute to the transformation of knowledge into practice skills.

Learner Confidence and success

Students reported improved levels of confidence in learning by simulation and particularly valued the debriefing process; this provided reassurance and a boost to confidence. However, some did not like being watched and found the experience:

> “*[Q]uite stressful…I think it’s the fact that there are lecturers watching us. It can make it more stressful. If I had the same situation in the ward it’s different because you know there’s people observing and watching you. It does become slightly more nerve wracking that it would be on the ward”.*

Zulkosky (2012) found that students felt more confident and prepared when they had completed their pre-readings and that an effective debrief was an essential component of the simulation. Student confidence in simulated situations can be nurtured. The development of students who are able to think critically, apply their skills and communicate effectively is a consequence of this learning strategy. Continued exposure to the simulation environment further builds confidence and allows the student to see where their strengths and weaknesses may lie so that they can manage challenging situations in clinical practice. This concurs with Jensen (2013) who found that repeated exposure to simulation allowed for mastery over time improving clinical reasoning.

Qualitatative feedback from the online survey

Themes from the focus groups were supported by comments made in the open-ended questions in the online survey. This discussion relates to the case studies that were developed as teaching resources and gives further insight into the associated student learning experiences.

The MI and COPD cases

Learning experiences for both cases were positive. However, performing the spirometry experiments for the COPD case along reading and interpreting ECGs proved challenging for many students. The spirometry experiment was dropped for the last two groups and more work has gone into developing this case. Table 1 summarises common themes identified from the open-ended responses to the online survey.

Table 1: Themes from open-ended responses to the online survey

What was the **most valuable** part of the COPD learning experience?	Case study/video (31) Pre learning (13) Relating/knowing (12) Tutorial (9) Simulation (4) Debrief (3)
What was the **least valuable** part of the COPD learning experience?	Experiment/LabTutor (24) Communication problems (10) Failure of equipment (5)
What was the **most valuable** part of the MI learning experience?	Practical application (15) Simulation (14) Tutorial (13) Case study (12) Debrief (6) Pre learning (5)
What was the **least valuable** part of the MI learning experience?	ECG experiment (10) Lab Tutor (9) Simulation (5) Inexperience (4) Pre learning (3)

Most valuable part of the COPD case study learning experience

Table 1 shows that six themes were identified from 62 responses. Students perceived the case study to be the most valuable part of the COPD learning experience (31 responses). The case study included the video, notes and supporting medical documents relating to the woman presented in LabTutor. Using a case study benefitted students' learning because "*it*

was like having a real patient to get to know and learn about…. I was able to see the progression of the illness on the patient".

Pre-learning (13 responses) was the second most valued part of the learning experience. Pre-learning encompassed completing online preparatory activities and watching the video. One student stated: '*I think the best thing about COPD was having the experience with the patient while also having all the relevant information in the pre case learning to make the learning more relevant".*

The third theme, relating/knowing (12 responses), i.e., "*being able to relate the signs and symptoms and what nursing actions to take"*, suggested that students were building knowledge and that this was assisting them to bridge the knowledge-practice gap that has been previously been identified (Neilson, et. al, 2013). The following comment shows how one student connected theory to practice: *I saw how the patient was effected and what they looked like and then relate that to practice, it helped me to understand COPD*".

Least valuable part of the COPD case study learning experience

Two major themes were identified from 49 responses. The least valuable part of COPD learning experience for students was performing and interpreting the results of the spirometry using the LabTutor platform (24 responses). Students stated that: "*we didn't know how to read the graphs, it was hard to know what to do and there wasn't anyone to help us"* and that *"the LabTutor experiment – the breathing exercise part was confusing".*

The second theme related to a lack of communication (15 responses). This particularly affected the first group of students as reflected in this statement: "*I was in the first group and entire thing was a complete shambles. We were not given enough information before the case study on how to access the learning material."* Sending emails to students well in advance of the scheduled tutorial and posting clearer instructions of Moodle rectified this issue. Equipment failure (5 responses), relating to "*a video that wasn't working...and equipment that didn't work at our lab tutor session*" was another problem that was remedied as staff and students became more familiar with using and troubleshooting the LabTutor programme.

Most valuable part of the MI case study learning experience

Six themes were identified from 73 responses. The most valuable part of this learning experience related to the practical application of emergency nursing skills (15 responses). The case study and simulation gave students a chance to *"have a practice run at what to do*

in a real life situation" as they were required to assess, evaluate and responding to a person experiencing the signs and symptoms of a myocardial infarction (MI) and then perform CPR. The underlying teaching and learning pedagogy of using a simulated scenario to provide leeway for students to make 'safe mistakes' is well established in the literature (Kaddoura, 2011; Lewis, Stachan & Smith, 2012; Luckter-Fleude, Baker, Pulling, McGraw, Dagnone, Medves, & Turner-Kelly 2010; Neilson, Noone, Voss, & Matthews, 2013). The student experience is captured in the following reflection.

> *"Being able to go through the motions of an emergency without any drastic consequences. I think the most valuable part was having the patient go into cardiac arrest. This hugely helped me to understand what to do in this situation and has widening my learning skills".*

Students value face-to-face tutorials (13 responses). The following comment shows how small group tutorials help some students to learn. "*Karole's class was helpful in tying it all together and ascribing meaning to the material. I find the tutorial helps my learning exponentially! Discussing in groups is perfect for the I way I like to learn".*

Least valuable part of the MI case study learning experience

Five themes were identified from 57 responses. The first related to the experiment, i.e., performing and reading an ECG (10 responses). One student commented: "*I did not get much out of the ECG tracing experiment. Reading the ECG was quite complicated and I did not find it that useful".*

The next theme related to using LabTutor (9 responses) and the perceived lack of technical and teaching support for some students as shown in the following comment.

> *"I found the Lab Tutor experiment useless as there was no one to help us when we got stuck. The part for recording heart rates and electrical impulses was confusing as there was no one there to explain it to us. I found the actual interactive tasks extremely difficult to understand. I didn't know what the figures or graphs meant"*.

This issue was remedied as part of the action research process by providing students with more technical support in future LabTutor sessions.

Simulation

The importance of simulation technology as an educational and evaluative tool is widely recognised in the nursing community (Luctkar-Flude, et. al, 2010). Simulation is also used extensively in allied health professions and other industries such as medicine, paramedicine, armed services and aviation (Motola, Devine, Chung, Sullivan, & Issenberg, 2013). It is

widely recognised as an effective tool to enhance cognitive development with opportunities for authentic learning in a safe environment (Motola et al, 2013).

Findings from the focus groups supported by comments made in the open-ended survey indicated that simulation was beneficial to development of decision-making and practical nursing skills in both scenarios. This is consistent others (e.g. Neilson, 2013) who established that simulation enhanced best practice in clinical learning. Similarly, Kaddoura (2011) reported that simulation fostered collaborative learning and increased student confidence in critical scenarios, while identifying gaps in student knowledge that may have gone unrecognised.

Simulation using manikins as patients provides students with opportunities to practice skills knowing that the recipients of their care patients are safe, thereby lessening anxiety. Their usefulness for teaching skills and evaluating the effectiveness of outcomes is well established (Sharpnack & Madigan, 2012)**.**

Simulation allows for critical assessment of actions, student reflection on their skills, and peer review. They also offer students the opportunity to critically analyse, reflect upon and examine the clinical decisions made by others, involved in their simulation's scenario (Jeffries, 2007). These results indicate that when students participate in clinical simulation the supportive environment promotes development of clinical skills, communication and critical thinking to ensure a high level of safe quality practice (Kaddoura 2011). A simulated learning environment helps to develop self-confidence and clinical decision making while applying students previous experiences and theoretical knowledge to a scenario where patient safety is not compromised This is supported by Tosterud, Hedelin, & Hall-Lord (2013) who also showed an increase in the ability of the student to prioritize care, work with in the team environment and improve their self-awareness.

Quantitative data collected at end of focus group interviews

Data were collected from each focus group to assess their overall learning experiences relating to the different learning activities. Four questions were asked.

Q1. Overall, how effective did you find the immersive style of learning?

Q2. How effective did you find the learning relating to the MI and COPD case study?

Q3. How much did you like this as a style of learning?

Q4. What was your general perception of this style of learning?

Table 2 provides a summary of the mean scores of student responses to the first question: How effective did you find each part (listed as 1 to 5 in the table) of the immersive style of learning? The rating scale used is 1 = low, and 5 = highly effective.

Table 2: Overall effectiveness of immersive style of learning

	COPD	MI
1. Theory lecture and on line learning	3.9	4.03
2. LabTutor session	3.71	4.09
3. Group tutorial	4.12	4.12
4. Manikin simulation and debrief	4.06	2.92
5. Post simulation written reflection	2.83	2.17
Averaged score	**3.72**	**3.47**

The following three figures show the responses to Questions 2- 4.

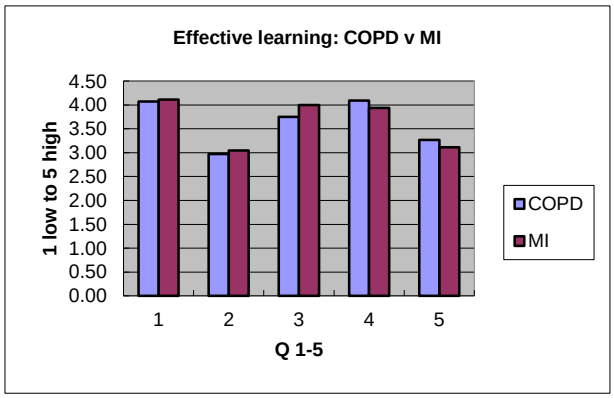

Figure 2: How effective did you find the learning relating to the COPD and MI case study?

Figure 2 shows that students preferred COPD as effective learning over MI. Students slightly liked MI over COPD as a style of learning. Overall, the group tutorial (Q3) is the most highly rated learning style for COPD and MI. Written learning is lowest rated for both.

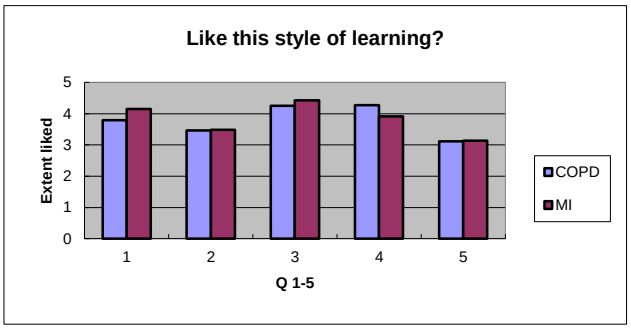

Figure 3: How much did you like this as a style of learning?

Figure 3 shows that broadly, the pattern of responses is the same for both *effective* and *liked* learning styles. Generally, there was little difference in responses to each question for either COPD or MI.

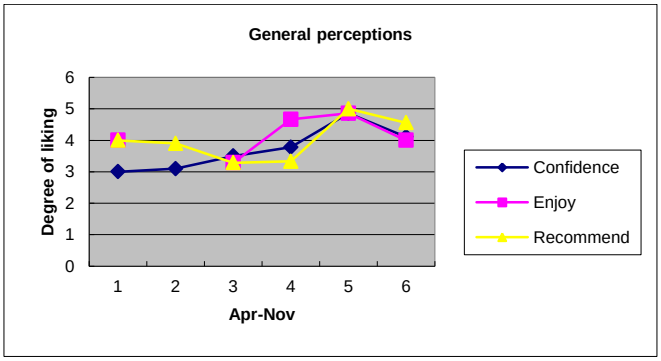

Figure 4: General perceptions of the immersive learning process

Figure 4 summarises student perceptions of the immersive learning process; confidence improved, students enjoyed the process, and would recommend it to others. Positive responses grow over the year for confidence, enjoyment, recommend to others.

The online survey

The online survey was designed by Dr Karole Hogarth, Dr Liz Ditzel, Raewyn Lesa with input from Dr Marian Baxter (ADI). Stuart Terry from Otago Polytechnic assisted us to set up and use the Qualtrics survey tool. A small pilot test was undertaken before the test went live.The purpose of the survey was explained to students who then decided if they wished to

participate in the study. Signed consent forms were collected in a labelled box. Students were invited to use the computers in the LabTutor classroom to complete the survey, or to log on to Moodle and do it in their own time. The survey was administered in the last week of November. Students were offered a selection of fresh fruit and chocolate bars as to thank them for completing the survey. Eighty two students completed the survey representing a 73% response rate.

Table 3 (see over) shows the results of this survey. Different response indicators were used for the different items, but for all statements, 1 equalled the highest level of agreement or satisfaction, and 5 the lowest level.

Table 3: Results of online survey

	Per cent		
Item	Agree (1&2)	Neutral 3	Disagree (4&5)
Preparation			
1. At the beginning of the immersive learning experience was there enough information to provide direction and encouragement?	**86**	9	5
2. Were the purpose and objectives of the immersive learning experience easy to understand?	**92**	6	1
7. Was the pre-case online learning effective preparation for the immersive case study?	**91**	5	4
Level			
3. How appropriate was the immersive learning experience for your level of knowledge and skills?	**93**	6	1
4. Were you encouraged to solve problems independently throughout the immersive learning experience?	**85**	4	1
Teaching resources: LabTutor and case study			
8. How challenging and interesting was the LabTutor experiment?	**62**	30	7
9. How useful was the case study tutorial?	**93**	5	1
Simulation			
10. Did the simulation remind you of the case study patient?	**84**	10	6
11. Did the simulation allow you the opportunity to prioritise nursing assessment and care?	**73**	6	1
12. The clinical assessment cues were appropriate and directed to promote my understanding.	**91**	6	2
13. The simulation allowed me to analyse my own behaviour and actions.	**87**	11	1
17. Real-life factors from the case study were built into the simulation scenario.	**82**	7	0
18. Using the simulator allowed me to experience a realistic nursing situation.	**76**	16	8
Debrief			
15. The debrief experience enhanced my learning of the case study			
19. There was an opportunity in the debrief to obtain guidance and feedback in order to build knowledge.	**93**	5	1
Learning			
23. The learning materials motivated me to learn.	**88**	9	4
24. It is my responsibility to learn what I need to know from this learning activity.	**91**	8	1
25. It is the lecturer's responsibility to tell me what I need to learn during class time.	**69**	23	13
26. I know how to get help when I do not understand the concepts.	**85**	14	1
Effectiveness			
5. How effective did you find this immersive style of learning?	**87**	6	6
6. Did you like this immersive style of learning?	**81**	11	7
16. Participating in the immersive learning case study increased my understanding of holistic nursing care.	**81**	14	5
20. The methods used in this learning activity were helpful and effective.	**72**	6	1
21. The immersive approach provided a variety of learning materials and activities that promoted my learning.	**92**	6	1
22. The immersive experience has helped me develop skills and knowledge to undertake nursing care in a clinical setting.	**90**	9	1

Table 3 shows high levels of satisfaction for the different aspects of the immersive learning process. The item with the lowest rating was item 8: 'How interesting or challenging were the

LabTutor experiments?'. This response concerns the previously noted issues and difficulties experienced by students during the year with the experiments conducted on themselves.

Student exam performance

A mid-year exam for BN607000 Pathophysiology (111 students) was held in June. The exam comprised multiple choice and short answer questions. All 111 students had completed the same pathophysiology lecture and directed learning requirements for COPD and MI. However, because students were divided into four groups to accommodate their different clinical placements; 52 had had a medical rotation (MR) and the immersive learning experience LabTutor (LT) and Simulation (S) intervention in the first semester. Of this group, 26 had MR/LT/S early semester (EI), and 26 had MR/LT/S late semester (LI). Exam marks for these different cohorts[3] were compared using unpaired t-tests ($p<0.05$).

Results: Students who had completed their medical rotation and LabTutor case studies and simulation (the immersive learning experience) before sitting the mid-year exam (group 1, n=52) achieved a higher mark (M= 66%) than those who had not (group 2, n=59; M= 62%). A two sample t-test showed that this difference (4% higher for group 1) was not significant ($p = 0.088$)[4].

When the exam results from specific taught content (respiratory and cardiac)[5] were analysed, a two sample t-test revealed a significant difference between groups in marks for that content; Respiratory (group 1, M=2.7; group 2, M=2.2, p=0.0017), and Cardiac (group 1, M= 5.8; group 2, M=5.2, p=0.022). This finding shows that students who had had the immersive learning experience and been on a medical placement performed better in these content areas than those without these learning experiences. This result was not surprising, as we would expect the different experiences to reinforce and augment student learning and result in a higher level of achievement.

[3]Cohort (EI, LI, no intervention [NI]) first semester pathophysiology (overall [O], cardiovascular section [C], respiratory section [R]).Significant differences existed between EI/LI (combined) and those who had **not** had the first semester learning experience (NI) for Cardiac (p=0.022) and Respiratory (p=0.0017), with a trend toward significance compared to O (EI/LI vs NI).

[4]EI (p=0.021) but not LI was significantly different to NI for O. For R, both EI (p=0.0013) and LI (p=0.018) were significantly different to NI; for C, EI (p=0.0076) but not LI was significantly different to NI. There was a significant difference between EI and LI for Cardiac (p=0.033), but not for Respiratory.

[5]Two LabTutor and Simulation (LT/S) patient case studies were used (cardiovascular, respiratory) in the exam. For each case study students had five hours directed learning (lecture, pre-case learning, experiment, case-study tutorial, and simulation) over one teaching week. The medical rotation (MR) included three weeks supervised full-time clinical work on a medical ward.

Implementation of the research findings

LabTutor uses a computer interface and plug in components through which students measured physiological outputs and perform associated laboratory tests such as ECG and spirometry. Students compared their own data to actual patient data to generate a report. Results and case studies were discussed in tutorials. Each LabTutor module had electronic patient case studies with medical notes, test results, X-rays etc. These resources kept students engaged with learning, provided a platform for discussion of complex patient care, and provided clear links between pathophysiology and clinical practice.

In 2014 ADInstruments upgraded LabTutor to 'KuraCloud', a cloud-based Learning Management System (LMS). KuraCloud offers the same electronic patient case studies and videos but is easier for students to use and academic staff can independently edit and update content without the third party interface of ADInstruments. Academic staff can easily tailor case studies in KuraCloud to meet individual course learning objectives. KuraCloud learning analytics (measurement systems) also enable academics to determine student course participation and engagement.

In 2015 in response to feedback from students involved in this study, KuraCloud learning packages have been designed to meet the learning objectives of the BN607000 Pathophysiology course. The main teaching and learning resource is now the electronic case study supported by a lecturer-led tutorial rather than student's gathering their own data, i.e., the hands-on tutorial experiments such as spirometry and ECG recording have been dropped. The case study effectively integrates student learning across theory and clinical courses. Simulations are now being run across Years 1, 2, and 3 of the Bachelor of Nursing degree programme. Staff continue to become more adept with KuraCloud technology and the context/context of simulation as a teaching tool, and students are actively engaging with it. The ability of staff to edit content means that current topic in health in nursing can easily be added. The School is also exploring how to best equip a bigger learning Suite as simulation is embedded into our curriculum.

Conclusion

This project achieved the first objective, ‘to integrate technology-enhanced simulation and LabTutor to apply pathophysiology, nursing assessment and theory for clinical case studies’. Our data clearly demonstrated that the immersive approach was effective for second year nursing students, and using visual teaching media such as patient case studies was the preferred teaching strategy. Qualitative data showed that students liked the immersive experience, were engaged in their learning. Statistical analyses of mid-semester exam results identified a significantly improved performance for those who had had both the immersive learning experience and medical nursing clinical rotation. This immersive approach to learning using the new KuraCloud platform has been adopted as core learning strategy within the Bachelor of Nursing degree programme.

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Appendices

Ethics approval

4 April 2014

Liz Ditzel
School of Nursing
Otago Polytechnic

Re: 577 Immersive Learning in Nurse Education

Dear Liz

This letter is to let you know that your project "Immersive Learning in Nurse Education" has met the approval of the reviewers for the Otago Polytechnic Research Ethics Committee.

We wish you the best for this interesting project and remind you to send us a brief review of the findings of the project for our records.

Sincerely,

Bridie Lonie
Chair - Ethics committee

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Focus group interview schedule

FOCUS GROUP INTERVIEW SCHEDULE - Introduction

- Want to look at your experience with immersive learning model. See whether it's more effective than the more traditional model (without the mannequin). Also, if it's working and how it could be improved. So *your* experience is really important
- Going to ask you to discuss your experience with 1 or 2 immersive models: COPD, MI. Also, how this compares to the trad 3-step model. I'll go through all this in a moment
- First, the focus groups are *confidential.* I'm going to tape, but none of you will be identified. Tapes are transcribed and made anonymous because we want you to speak freely about the goods/bads of your experience.
- Take approx 45 minutes
- As you know, the immersive learning has 5 steps. I'll take you through each of these one by one. Want to find out what each was like for you, thoughts you had *at the time.* Further thoughts now. Particularly interested in what worked well, not so well.
- So, to remind you, the 5 steps were:
  1. Theory lecture and OLL
  2. LabTutor session - physiol, hands on, vid clips
  3. Group tutorial
  4. Simulation with the mannequin and reflective afterwards
  5. Written reflection [directed learning worksheet]

Any questions?

QUESTIONS AND PROMPTS

1. **Theory lecture and directed online learning (OLL)**: theory content in trad lecture format earlier in year + self-directed study online: meet patient and pathophysiology.

- Recall lecture? How find it? Helpful / boring?
- How meet patient? What make of this / p's case?

COPD vs MI - diffs? **Same?**

2. **LabTutor session: physiological experiment / compare own data to p. Vid clips + whiteboard.**

- How find hands-on? How find comparing your data to p's?
- Which vids recall? Like? Useful?
- Move between vids, whiteboard useful?
- Good prep for mannequin simulation?
- Groups of 3 good size or not?

COPD vs MI - diffs? **Same?**

3. **Group tutorial: discuss and link physiological data with management of LabTutor case .**

- Did it expand on LabTutor? Your experience?
- What recall off top of your head now?
- Helpful / not? How?

COPD vs MI - diffs? **Same?**

4. **Simulation: mannequin in laboratory. [Integrates steps 1), 2) & 3.**

- What was mannequin experience like? General Mannequin reactions?
- How real? [prompts:] Feel like real p care? How better *or* different to actual p's / ward?
- Confidence higher/lower after? Eg particular interactions? Dealing with real p?
- How useful dealing with others: 'RN' and family member?
- How useful was the reflection after? Good for learning?

COPD vs MI - diffs? **Same?**

5. **Written reflection: directed learning worksheet on the case.**

- How find written reflection?
- Help consolidate learning / experience? How yes or no?

COPD vs MI - diffs? **Same?**

GENERAL

- How like this overall?
- Links between steps make sense? What change / improve / remove?
- How much like this way of learning?
- How much enjoy overall? Particular steps?
- Other comments? Anything I've missed?
- *Trad - how different? Which prefer, why?* [Not for this round - not expanded]

We would like you to rank some of the learning experience you've had.With 1 as low and 5 as high, circle one number in each line. Use NC for no comment / no change

Thinking about both the COPD and MI modules, how *effective* did you find this style of learning?

	Not effective			Very		NC
1. Theory lecture and OLL	1	2	3	4	5	0
2. LabTutor session	1	2	3	4	5	0
3. Group tutorial	1	2	3	4	5	0
4. Simulation + reflective/debrief	1	2	3	4	5	0
5. Written reflection (directed learning)	1	2	3	4	5	0

Thinking about both the COPD and MI modules, how much did you *like* this style of learning?

	Didn't like			Greatly liked		NC
i. Theory lecture and OLL	1	2	3	4	5	0
ii. LabTutor session	1	2	3	4	5	0
iii. Group tutorial	1	2	3	4	5	0
iv. Simulation + reflective/debrief	1	2	3	4	5	0
v. Written reflection (directed learning)	1	2	3	4	5	0

Thinking of both COPD and MI:	**Not at all**				**Very much**	**NC**
How much did your clinical confidence improve?	1	2	3	4	5	0
How much did you enjoy this as a learning method?	1	2	3	4	5	0
How much would you recommend it to others?	1	2	3	4	5	0

Focus group participant information form

General Introduction:

The School of Nursing is conducting a research project to evaluate the effectiveness of implementing a more immersive approach to teaching. The study will explore the impact of using case studies combined with LabTutor (ADInstruments) and Gaumard Scientific manikins in clinical simulation on nursing student's learning experience.

What is the aim of the project?

- This research aims to evaluate the effectiveness of using a novel, immersive, integrated teaching approach in nursing education.

What type of participants are being sought?

- Second year nursing students enrolled in the Bachelor of Nursing programme.

How will potential participants be identified and accessed?

- A recruitment poster will be displayed on the Year 2 Moodle site, School of Nursing noticeboards and in the Simulation Suite. Potential participants will be asked to respond by email, to provide contact information on a 'tear-off' strip provide on the recruitment poster. Completed slips will be collected in a sealed research study 'drop-off' box at the School of Nursing Reception counter.

What will my participation involve?

- Should you agree to take part in this project you will be asked to participate in a focus group session lasting no longer than 50 minutes.
- Focus groups will be conducted out of normal class times and at the convenience of the participants. A focus group schedule will be posted on Moodle and you will be sent an email (or text message if preferred) confirmation of the day, time and venue when this is known.
- An experienced professional facilitator who is nor a School of Nursing staff member will conduct the focus groups.
- Should all participants agree, focus group discussion will be recorded and transcribed. This helps us recall information, especially from larger group discussions.

How will my anonymity/identity be protected?

- Your identity will be protected at all times. A pseudonym or number system (person A, B, etc.) will be assigned to each participant for transcription purpose.
- No real names or personal information will be used in the transcripts.
- The content of the data will be seen by the focus group facilitator, the person transcribing the interviews and myself.
- The project leader will check the written transcripts, before the data is used to ensure that they do not include any inadvertently disclosed demographic information.
- The person transcribing the focus group session will have signed a confidentiality agreement regarding non-disclosure of any data transcribed to anyone else, and will not have access to your identity.
- Other focus groups participants will know information you choose to share. All group participants will be asked to keep the contents, and specifically who said what, confidential.

What data or information will be collected and how will it be used?

- Information about your experience of the immersive learning simulation scenario will be collected. To help you to prepare for the focus group, we will send you some questions to reflect on involvement, for e.g., *what did you like or dislike about the immersive learning experience?*
- Once complete, the written report will be available for staff and students of nursing (and other interested parties) to read via the School of Nursing research website and Otago Polytechnic.
- Results of this study will be presented to ADInstruments and Gaumard Scientific, and may also be used in future academic journal article or conference presentations.

Data storage

- The data collected will be securely stored in such a way that only those mentioned above will have access to it. All printed or handwritten notes and any audio or digital tapes of focus groups recordings will be secured in a locked filing cabinet in the School of Nursing.
- Written work will be completed on a personal computer that is password protected.
- In line with Otago Polytechnic policy, the raw data will be stored in secure storage for a period of seven years, after which it will be destroyed.

Can participants change their mind and withdraw from the project?

- You can change your mind and withdraw from participation at any time.
- You can withdraw your data (e.g. what you say) up until the time the focus group begins, after this time you can decline to take part in any or all of the focus group but your data cannot be removed from the study.

Are there any risks to participants?

- The focus group questions will require you to share information about your immersive learning experience. The questions will not be personally intrusive. You will not be identified in anyway.

What are the benefits of the research?

- The results of this research will help us to understand the student's learning experience and we as nurse educators need to do to modify our teaching practice and nursing curriculum.

What if participants have any questions?

- If you have any questions about the project, wither now or in the future, please feel free to contact me Dr Liz Ditzel (Project leader), Level 2, School of Nursing, by email liz.ditzel@op.ac.nz.

Participant information form for online survey

General Introduction

The School of Nursing is conducting a research project to evaluate the effectiveness of using case studies combined with LabTutor and high fidelity manikins in clinical simulation.. The final part of the study will evaluate the effectiveness of using this immersive approach to teaching for Year 2 nursing students.

How will potential participants be identified and accessed?

- An electronic participant information form will be posted on Year 2 Moodle shell and linked to the BN607 course documents. .
- Printed copies of the participant information and consent forms will be taken to student laboratories on November 26th.
- Questions relating to the project will be answered by staff not involved in Year 2 teaching .
- Students agreeing to participate can place signed consent forms into a locked 'Immersive Project' drop box in the School of Nursing Reception foyer.
- A link to the online survey will be opened on Moodle.

What data or information will be collected and how will it be used?

The online survey:

- Survey questions relate to different aspects of Year 2's immersive learning experiences and will take around 15 minutes to complete.
- Multiple-choice questions use a numerical rating scale (1 to 5)
- Open ended questions include a 'no response' option to be used should you not wish to provide information. Responses will be collated to identify and report common themes.

Retrospective data analysis:

- Marks from BN 607000 summative assessments that relate to the case study learning content will be analysed to gauge the effectiveness of the immersive learning experience.
- Data analysis will not be undertaken until all students have completed Year 2 courses (February, 2015).

Study results:

- Once complete, the written report will be available for staff and students of nursing (and other interested parties) to read via the School of Nursing research website and Otago Polytechnic.
- Results will be presented to ADInstruments and Gaumard Scientific, and may also be used in future academic journal article or conference presentations.

How will my anonymity/identity be protected?

- Should you agree to participate, data will be 'de identified' by removing student identification numbers before responses are analysed by a researcher who is not associated with this course.

Can participants change their mind and withdraw from the project?

Online survey:

- You can change your mind and withdraw from participation at any time by not completing or submitting the online survey.
- You can withdraw responses to the survey by sending an email requesting that your data be withdrawn up until 5pm, 18th December, 2014.

Retrospective data

- You can withdraw consent for your assessment marks to be used for this study by sending an email requesting that your data be withdrawn. Consent can be withdrawn up until 5pm, 18th December, 2014. However, after this time your data cannot be removed because preparations for analysis will have commenced.

Data storage

- Data collected will be securely stored in a locked filing cabinet in the School of Nursing.
- Written work will be completed on a personal computer that is password protected.
- In line with Otago Polytechnic policy, the raw data will be stored in secure storage for a period of seven years, after which it will be destroyed.

Are there any risks to participants?

- No risks are anticipated. The questions are not personally intrusive.
- You will not be identified in anyway.

What are the benefits of the research?

- The results of this research will help us to understand the student's learning experience and we as nurse educators need to do to modify our teaching practice and nursing curriculum.

What if participants have any questions?

- If you have any questions about the project, wither now or in the future, please feel free to contact me Dr Liz Ditzel (Project leader) by email liz.ditzel@op.ac.nz. You may also contact Dr Karole Hogarth, by email karole.hogarth@op.ac.nz.

Immersive Learning Evaluation Survey (Online)

Thinking about the overall immersive learning experience that you had this year (i.e. the combination of online learning, theory lectures, patient case studies, LabTutor and simulation), please indicate the extent to which you agree or disagree with the following statements.

1 At the beginning of the immersive learning experience was there enough information to provide direction and encouragement?

_____ Definitely yes (1)
_____ Probably yes (2)
_____ Maybe (3)
_____ Probably not (4)
_____ Definitely not (5)

2 Were the purpose and objectives of the immersive learning experience easy to understand?

_____ Definitely yes (1)
_____ Probably yes (2)
_____ Maybe (3)
_____ Probably not (4)
_____ Definitely not (5)

3 How appropriate was the immersive learning experience for your level of knowledge and skills?

_____ Very Appropriate (1)
_____ Appropriate (2)
_____ Neutral (3)
_____ Inappropriate (4)
_____ Very Inappropriate (5)

4 Were you encouraged to solve problems independently throughout the immersive learning experience?

_____ Always (1)
_____ Most of the Time (2)
_____ Sometimes (3)
_____ Rarely (4)
_____ Never (5)

5 How effective did you find this immersive style of learning?

_____ Very Effective (1)
_____ Effective (2)
_____ Neither Effective nor Ineffective (3)
_____ Ineffective (4)
_____ Very Ineffective (5)

6 Did you like this immersive style of learning?

_____ Definitely yes (1)
_____ Probably yes (2)
_____ Maybe (3)
_____ Probably not (4)
_____ Definitely not (5)

7 Was the pre-case online learning effective preparation for the immersive case study?

_____ Very Effective (1)
_____ Effective (2)
_____ Neither Effective nor Ineffective (3)
_____ Ineffective (4)
_____ Very Ineffective (5)

8 How challenging and interesting was the LabTutor experiment?

_____ Extremely challenging and interesting (1)
_____ Very challenging and interesting (2)
_____ Neutral (3)
_____ Not very challenging and interesting (4)
_____ Not at all challenging and interesting (5)

9 How useful was the case study tutorial?

_____ Very Useful (1)
_____ Useful (2)
_____ Neutral (3)
_____ Useless (4)
_____ Very Useless (5)

10 Did the simulation remind you of the case study patient?

_____ Definitely yes (1)
_____ Probably yes (2)
_____ Maybe (3)
_____ Probably not (4)
_____ Definitely not (5)

11 Did the simulation allow you the opportunity to prioritise nursing assessment and care?

_____ Definitely yes (1)
_____ Probably yes (2)
_____ Maybe (3)
_____ Probably not (4)
_____ Definitely not (5)

12 The clinical assessment cues were appropriate and directed to promote my understanding.

_____ Strongly Agree (1)
_____ Agree (2)
_____ Neither Agree nor Disagree (4)
_____ Disagree (5)
_____ Strongly Disagree (6)

13 The simulation allowed me to analyse my own behavior and actions.

_____ Strongly Agree (1)
_____ Agree (2)
_____ Neither Agree nor Disagree (3)
_____ Disagree (4)
_____ Strongly Disagree (5)

14 The simulation allowed me to see how I would cope in a real clinical situation.

_____ Strongly Agree (1)
_____ Agree (2)
_____ Neither Agree nor Disagree (3)
_____ Disagree (4)
_____ Strongly Disagree (5)

15 The debrief experience enhanced my learning of the case study.

_____ Strongly agree (1)
_____ Agree (2)
_____ Neither Agree nor Disagree (3)
_____ Disagree (4)
_____ Strongly Disagree (5)

16 Participating in the immersive learning case study increased my understanding of holistic nursing care.

_____ Strongly Agree (1)
_____ Agree (2)
_____ Neither Agree nor Disagree (3)
_____ Disagree (4)
_____ Strongly Disagree (5)

17 Real-life factors from the case study were built into the simulation scenario.

_____ Strongly Agree (1)
_____ Agree (2)
_____ Neither Agree nor Disagree (3)
_____ Disagree (4)
_____ Strongly Disagree (5)

18 Using the simulator allowed me to experience a realistic nursing situation.

_____ Strongly Agree (1)
_____ Agree (2)
_____ Neither Agree nor Disagree (3)
_____ Disagree (4)
_____ Strongly Disagree (5)

19 There was an opportunity in the debrief to obtain guidance and feedback in order to build knowledge.

_____ Strongly Agree (1)
_____ Agree (2)
_____ Neither Agree nor Disagree (3)
_____ Disagree (4)
_____ Strongly Disagree (5)

20 The methods used in this learning activity were helpful and effective.

_____ Strongly Agree (1)
_____ Agree (2)
_____ Neither Agree nor Disagree (3)
_____ Disagree (4)
_____ Strongly Disagree (5)

21 The immersive approach provided a variety of learning materials and activities that promoted my learning.

_____ Strongly Agree (1)
_____ Agree (2)
_____ Neither Agree nor Disagree (3)
_____ Disagree (4)
_____ Strongly Disagree (5)

23 The immersive experience has helped me develop skills and knowledge to undertake nursing care in a clinical setting.

_____ Strongly Agree (1)
_____ Agree (2)
_____ Neither Agree nor Disagree (3)
_____ Disagree (4)
_____ Strongly Disagree (5)

22 The learning materials motivated me to learn.

_____ Strongly Agree (1)
_____ Agree (2)
_____ Neither Agree nor Disagree (3)
_____ Disagree (4)
_____ Strongly Disagree (5)

24 It is my responsibility to learn what I need to know from this learning activity.

_____ Strongly Agree (1)
_____ Agree (2)
_____ Neither Agree nor Disagree (3)
_____ Disagree (4)
_____ Strongly Disagree (5)

25 It is the lecturer's responsibility to tell me what I need to learn during class time.

_____ Strongly Agree (1)
_____ Agree (2)
_____ Neither Agree nor Disagree (3)
_____ Disagree (4)
_____ Strongly Disagree (5)

26 I know how to get help when I do not understand the concepts.

_____ Strongly agree (1)
_____ Agree (2)
_____ Neither Agree nor Disagree (3)
_____ Disagree (4)
_____ Strongly Disagree (5)

THANK YOU for completing this survey.