Can a High Fidelity Simulation Tutorial Improve Student’s Written Examination Results? A Review of a Change in Teaching Practice

Key Points:

- Undergraduate nursing population is changing and they prefer technology enhanced learning (Jones et al. 2015).
- Students evaluated High fidelity simulation tutorials well. Examination results compared to the previous cohorts did not show an improvement however there were a variety of factors preventing a direct comparison of the results.
- Literature indicates that the debriefing after the High fidelity simulation is the most valuable learning experience and sufficient time should be allocated for this.
- Students struggle with an unstructured discussion and a structured debriefing tool should be used.
- Technology errors can deduct from fidelity of the simulation and cause disengagement with students (Cant and Cooper 2017).
- The INACSL Standards Committee et al. (2021) and the ASPIH (2016) have produced standards for simulation design which should be implemented to ensure an effective simulation design and assessment.

Keywords:

High fidelity simulation, tutorial, debriefing, fidelity, summative assessment, student examination

Reflective Questions:

- What other innovative teaching methods could have been used to prepare the students for their summative assessment?
- From your own experience how have you found debriefing discussions post simulation activities that you have been involved in?
• What other reasons could there be for the student’s lack of participation in the post simulation discussion? What are the possible solutions to address this?

Abstract

Background: Undergraduate nursing students prefer technology based learning. Simulation has been used within nursing education to provide skills acquisition and clinical exposure. Can high fidelity simulation (HFS) be used to teach tutorial content to prepare students for a written examination?

Aims: To design a pilot HFS tutorial

Methods: 203 2nd year undergraduate student nurses were timetabled to attend a HFS tutorial. Examination results at 1st attempt were compared to the previous cohort’s results.

Findings: 81% of the students from the HFS tutorial cohort passed at first attempt compared to 85% from the previous cohort.

Conclusion: HFS tutorial needs to be developed further incorporating simulation standards to further assess its ability to improve student’s written examination results. Students found the post simulation discussion difficult and wanted guidance for it. Involvement of the University’s skills and simulation team would be recommended for future cohorts to assist with design and facilitation.

Manuscript

Introduction

The current undergraduate student nurse population are from Generation Y and Generation Z, which Jones et al. (2015) identifies as a student population that prefers technology
enhanced learning. Within the United Kingdom since the introduction of tuition fees for pre-
registration nursing programmes in 2017 and removal of the Government funded student
nurse bursaries, there has been a reduction in the number of mature students applying for
pre-registration nursing courses (RCN 2019). Generation Z prefer technology based learning
as it provides them with greater ownership and flexibility in their learning (Romli et al. 2020).
As technology advances technically savvy students will expect their education to incorporate
more non-traditional elements of education delivery (Romli et al. 2020).

The aim of this paper is to review a change in how undergraduate nursing students were
taught their tutorial content in preparation for their written examination. The module was
designed to teach the students how to assess and safely care for adult patients with a variety
of acute illnesses using the ABCDE (A-E) assessment approach (RCUK 2021). The
summative assessment was a written examination based upon patient scenarios that the
students were given previously. Within the examination the students had to answer three
questions: describe the assessment that they would undertake for the patient in relation to
their observations, explain pathophysiology of patient’s clinical condition and provide rationale
to a particular aspect of nursing care related to the patient scenario. Historically the students
evaluated the module well but had poor examination results at first submission. High fidelity
simulation (HFS) has been previously used on the nursing course to provide exposure to
clinical situations and was well evaluated by the students. This paper will discuss a change to
teaching methods to incorporate the use of HFS for the students’ tutorials to improve their
examination results.

Literature Review

Simulation is an active learning approach which enables nurse educators to provide students
with exposure to complex clinical situations within a safe environment to develop and practice
their clinical, critical thinking and reasoning skills (Newton and Krebs 2020). Simulation in
conjunction with other teaching methods has been found to increase the knowledge gain of
undergraduate nursing students who identify a preference for different learning styles
(Shinnick and Woo 2015). Using simulation is beneficial for the development of clinical skills, problem solving and team working within healthcare (Sadka 2021). Simulation can be divided into two categories: low fidelity and high fidelity; the greater the fidelity the more believable the situation is (Cant and Cooper 2017). The fidelity requirement of the simulation session only needs to be as high as necessary to achieve the teacher’s learning outcomes (Kirkham 2018). Low fidelity simulation (LFS) can assist with students learning clinical skills such as blood pressure measurement (Cant and Cooper 2017). HFS may involve the use of an actor or a computerised mannequin to demonstrate realistic clinical scenarios and patient physiological parameters. The mannequin can also be used to demonstrate a patient’s deterioration, and may also be able interact with the learners to assist them with their communication skills (Au et al. 2016).

There has been an increase in the use of HFS in nursing education since the 1990s (Au et al. 2016). Simulation has been found to increase nursing student’s knowledge and self-confidence, critical thinking and assessment skills (Lee et al. 2019). It has also been used as a teaching method for bridging the gap between taught theoretical content and practice within a healthcare setting (Newton and Krebs 2020). However, it can also induce high levels of anxiety which can diminish a student’s performance and deduct from their overall learning (Al-Ghareeb et al. 2019). The ASpiH (2016) recommend that psychological safety of the learner should be considered by the simulation facilitators as the learners can experience heightened levels of anxiety especially if simulation is used as an assessment method. However the relationship between anxiety and HFS was not recorded by Burbach et al. (2019), a study of 120 participants that took place within the USA. Anxiety can be difficult for people to admit to and assess which could explain the different findings.

Nursing students are required to have 2300 hours of clinical practice exposure, of which 300 hours can be spent within simulation (NMC 2021). Simulation has gained popularity within nursing education as a way to provide clinical exposure when clinical placement places within healthcare are limited (Roberts et al. 2019).
HFS is frequently used within medical education as it enables the learner to see physiological feedback in relation to their medical decisions without patient risk (Alluri et al. 2016). However, there is research which suggests that the learning achieved by HFS does not bear a statistically significant difference to that by LFS (Massoth et al. 2019). In fact HFS can have a worse performance in knowledge gained than LFS and can cause medical students to feel overconfident in their skills and performance (Massoth et al. 2019). Simulation continues to be used now to not only train medical and nursing students in clinical skills acquisition but also with interprofessional working relationships and team working, which are vital when caring for acutely ill patients (Stewart et al. 2010; Kirkham 2018).

Traditionally written assessments have been accepted as a method to assess student’s ability to care for acutely ill patients (Storm et al. 2015). Simulation within healthcare professional training provides a safe environment to practice clinical skills without compromising patient safety (Ryall et al. 2016). Previous reviews of literature have found that written and simulation assessments differ in their ability to assess learner’s knowledge and practical skill (Ryall et al. 2016). Simulation can be used formatively to identify and close gaps in participants’ knowledge and monitor progress towards achieving set learning outcomes (INACSL Standards Committee et al. 2021a). There was no literature found discussing the use of HFS as a teaching method in preparation for a written examination.

**Method**

The HFS tutorial was incorporated into the 2nd year undergraduate module. Within the last lecture before the HFS tutorials commenced the lecturing team brought a mannequin and equipment into the lecture theatre and demonstrated an A-E assessment (RCUK 2021) for the students, pausing after each step so that they had the opportunity to ask questions/clarify what was happening. The patient scenario used involved a patient showing signs of sepsis. This was one of the students’ module examination scenarios. The other HFS tutorial scenarios were drawn from the remaining module examination scenarios. These scenarios involved...
patients experiencing post-surgery pain, a myocardial infarction and a small bowel obstruction. These were chosen as they are conditions commonly encountered in clinical practice. There were nine HFS tutorials and the students were allocated one session to attend to. Each HFS tutorial had approximately 22 students. The learning outcomes for the HFS tutorial were:

- To work as a team to complete an A-E assessment on the patient (RCUK 2021)
- Document their assessment on appropriate paperwork
- At the end provide a handover of their assessment using the SBAR communication tool (Situation, Background, Assessment, Recommendation) (NHS 2010)

At the beginning of each HFS tutorial the students were split into three groups of approximately seven students each. Each group rotated around the three mannequin stations that were set up for them and facilitated by a lecturer, who was a registered general nurse. Within their group, two or three students would volunteer to work together to undertake an A-E assessment (RCUK 2021) upon a patient scenario whilst the remaining students within their group observed them. This task was chosen as within the students’ summative examination their first question was to write about an A-E assessment (RCUK 2021) they would have completed on the patient scenario. This was also the first examination question asked to the previous cohort (2016/2017).

The mannequins were high fidelity in that their physiological parameters responded to the intervention that the students made. The voice of the mannequin was provided by the lecturer.

When the students were not involved with undertaking an A-E assessment (RCUK 2021) on the mannequin their role was to make observation notes to aid their participation in the post simulation discussion. Each mannequin scenario lasted for approximately 10-20 minutes and ended with students providing a verbal handover of their assessment to the observing students and facilitator. Some students did not complete the full assessment and therefore handed over what they had managed to complete. The simulation was followed by a 20 minute unstructured discussion facilitated by the lecturer. During this discussion the students were asked how they
felt the scenario went, what was the rationale behind some of their decisions, and could ask any questions they might have related to the scenario.

The format and timings of the session and discussion were designed to be familiar to lecturers and students, as it resembled the skills and simulation teaching previously taught within the pre-registration nursing course. At the end of the HFS tutorial the students were given an evaluation form to complete (Appendix A). This was all conducted in line with the University’s clinical skills and simulation teaching strategy.

Results

Both cohorts were undergraduate adult student nurses in their 2nd year of a 3 year course. The majority of the module’s theory content was taught in the first semester (September to December). For the 2017/2018 cohort the HFS tutorial was delivered at the beginning of the second semester (January-April). The 2016/2017 cohort had a lecture preparing them for the summative examination at the beginning of the second semester. Both cohorts had clinical placements throughout the academic year; at least one of these was in an acute setting. The summative examination for both cohorts was after the holiday break in April.

Table 1

Table 1 shows a summary of results, based on marks released to student's post-moderation:

<table>
<thead>
<tr>
<th>Cohort</th>
<th>No students taking module</th>
<th>Passed at 1st attempt</th>
<th>Minimum mark</th>
<th>Maximum mark</th>
<th>Average mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016/2017</td>
<td>223</td>
<td>189 (85%)</td>
<td>14%</td>
<td>96%</td>
<td>59.01%</td>
</tr>
<tr>
<td>2017/2018</td>
<td>203</td>
<td>165 (81%)</td>
<td>14%</td>
<td>90%</td>
<td>49.49%</td>
</tr>
</tbody>
</table>

Figure 1

Figure 1 shows the spread of students marks across the grade boundaries.
Discussion

The HFS tutorial did not show an improvement in student’s examination results at first attempt compared to the previous year. However, a direct comparison between the results of the 2016/2017 and 2017/2018 cohorts is difficult for numerous factors. The 2016/2017 results are missing data from 55 students. Between the two academic years the format of the summative examination changed from two questions worth 50% each (2016/2017) to three questions worth 50%, 25% and 25% (2017/2018). Describing the A-E assessment (RCUK 2021) for the patient scenario was still the first question for both cohorts. Finally during the 2016/2017 assessment moderation process the exam results were increased across the board as it was deemed that the students’ submissions had been under-marked across the exam markers. This did not happen with the 2017/2018 results.

On reviewing the student evaluation forms post the HFS tutorials (Appendix A) one of the themes was that they found the HFS tutorial to be helpful, but not the unstructured discussion afterwards due to lack of guidance. This was unexpected as the format of the HFS and the
discussion was similar to what they had completed previously within the course and there
were no unsatisfactory reports from those occurrences.

The debrief discussion is the most important aspect of simulation based learning (ASPiH
2016). The debrief discussion is where the learner gains new understanding and learning,
linking theory to practice through reflecting on what they have participated in and observed
(INACSL Standards Committee et al. 2021b). Although there is no specific guidance on the
duration of the debriefing process there should be adequate time allocated for assisting the
learner to achieve the learning outcomes, address any elements they which to discuss, and
identify gaps in knowledge (INACSL Standards Committee et al. 2021b). Due to timing
constraints in the HFS tutorial the post simulation discussion was only allocated approximately
20 minutes. This was not sufficient time for all groups to have a meaningful discussion.

Although the terms are used interchangeably it should be noted that feedback and debriefing
are different - feedback is a one way conversation (Reierson et al. 2017). Discussion with
other lecturers who facilitated the HFS sessions also summarised that the post simulation
discussion tended to be lecturer feedback rather than student led. Some of the student
evaluations commented upon this and that different lecturers provided different information
regarding their scenario and correct care. Gantt et al. (2018) study into comparing different
debriefing methods found staff and students preferred a facilitated debrief, where students
and the facilitator discussed the simulation events fully, giving students opportunity to express
their emotions regarding the experience and ask questions. As there were nine sessions to
facilitate all the students being able to attend a HFS tutorial and each session required three
lecturers to facilitate, it was difficult to ensure consistency between all the facilitators. A
structured debriefing tool rather than the unstructured discussion that happened would have
been beneficial to provide consistency (Secheresse and Nonglaton 2019). Using a structured
debriefing tool instead of an unstructured discussion would also provide the participants with
comprehensive, reflective feedback (Reierson et al. 2017). The ASPiH (2016) recommend
that novice faculty members are provided with debriefing training as the skills of the debriefer
correlate closely the participants’ satisfaction with the experience. However, within the HFS tutorial debriefing training did not occur.

A further theme from the student’s evaluations of HFS tutorial was a frustration with some of the equipment. There were problems with one of the mannequin’s network connection and therefore not reflecting its programmed physiological parameters and changes. This deducted from the fidelity of the simulation and could reduce student engagement in the situation (Cant and Cooper 2017). The INACSL Standards Committee et al. (2016) recommend using various types of fidelity to create a realistic simulation experience. However Johnston et al. (2017) found that some students still struggle to engage in simulation in an appropriate manner despite trying to make the experience as realistic as possible. Alconero-Camarero (2021) found that students had greater satisfaction with LFS, although this might be because HFS generally involves more complex clinical cases and technology which can be a barrier to learning.

Within the School of Nursing there is a dedicated Simulation and Skills team that develop and teach the simulation content that is taught to the students throughout their course. As the HFS tutorial was not a session designed by them, they were not involved in setting up or facilitating any of the tutorial sessions. The lecturers who facilitated and set up the mannequins each day work as part of a theoretical nursing team - although they help facilitate some of the simulation departments study days they are not involved with the design and setup of each session and are unfamiliar with troubleshooting some of the equipment. The ASpiH (2016) recommend simulation technicians are involved with the design of simulation scenarios and evaluating their effectiveness. It would have been helpful to have a member of the Simulation and Skills team involved in designing and facilitating the HFS tutorial.

Limitations

The INACSL Standards Committee et al. (2021) and the ASpiH (2016) have produced standards of best practice regarding simulation design, outcomes and objectives, assessment
and staff involvement. These were not incorporated when designing the HFS tutorial. These standards recommend using simulation as a formative assessment to assess skill sets such as teamwork, communication and leadership. Assessing the effectiveness of the HFS tutorial via the students written examination results was perhaps too broad and subject to other factors such as student individual learning styles, effecting correlation. The intention of a formative assessment is to improve learner performance (ASPiH 2016), therefore perhaps this review should have used participants’ evaluation of knowledge pre and post the HFS tutorial rather than the written examination results in their summative assignment.

The results from the HFS tutorial are from 2017/2018. This was the last year that the HFS tutorial was used due to the University staff shortages for 2018/2019 cohort and then a revision of the curriculum for 2019/2020 academic year due to the changes to the Standards for Pre-registration Nursing Programmes (NMC 2018). The module still incorporates simulation as the experience was evaluated positively by the students, however it is now a formative assessment which the students then have to write a reflective report on for their summative assessment. Due to the impact of Covid-19 and subsequent lockdowns 2021/2022 will be the first cohort of students to complete the formative simulation and write a reflective report.

**Conclusion**

In conclusion this paper has discussed using HFS tutorial to prepare undergraduate nursing students for a written summative examination. The use of HFS tutorial did not show an improvement in the student pass rates at assessment, though various identified confounding variables make direct comparisons of results difficult.

The INACSL Standards Committee et al. (2021) and the ASPiH (2016) provide standards for simulation design which would need to be incorporated for further HFS tutorials. Student evaluations of the HFS tutorial indicated that they enjoyed the teaching session. There were some areas that could have been improved such as using a debriefing tool during the debriefing discussion and having a sufficient amount of time allocated for this. A member of
the Skills and Simulation team should also be involved in designing and facilitating the HFS tutorial.

The use of HFS tutorials needs to be developed further incorporating the changes to HFS tutorial design discussed to make more significant conclusions about their impact on improvements to students learning. The HFS tutorials student participants’ results and evaluation data would need to be reviewed to provide continuous ongoing areas for the HFS tutorial to be improved (ASPiH 2016).

Manuscript Word count: 2914 excluding references, abstract, keywords, key points and reflective questions.

References


The evaluation from given to students to complete post their HFS tutorial.

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree or disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
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<td>I found the simulation on Sepsis in the lecture theatre to be engaging, informative and relevant to the module.</td>
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<td>Comments:</td>
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<tr>
<td>I found the simulation session that I attended to be engaging, informative and relevant to the module.</td>
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<td>Comments:</td>
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<tr>
<td>I found the simulation session that I attended to be helpful to help me understand my summative assignment</td>
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<tr>
<td>Comments:</td>
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<tr>
<td>I found the feedback discussion to be valuable for my learning.</td>
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<td>Comments:</td>
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<tr>
<td>I feel I was able to contribute to feedback discussions regarding myself and my colleagues.</td>
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