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Simulation in Higher Education

Guest Editors

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Editorial Board

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Editorial 6(SI1): Simulation in higher education

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Introduction

Welcome to the Journal of Applied Learning and Teaching's special issue on simulation in higher education!

The use of simulation-based education (SBE) in the education and training of various professional groups has expanded rapidly over the past 20 years (Eppich & Reedy, 2022). This is an expansion that has been driven by the recognition of SBE as a vital learning and teaching methodology. The methodology encompasses a wide range of modalities, from skills trainers and computerised manikins to the use of actors, virtual reality, and e-learning activities, to mention a few. This special issue captures a breadth of these SBE modalities and how they are employed across professions such as nursing, medicine, law, science, and teaching.

SBE is a continually evolving methodology. Its use can be traced back centuries when the military adopted it in various activities, such as jousting, and war games, such as chess, to develop battlefield skills (Bradley, 2006). Using healthcare simulation as an example, it has continued to evolve with the development of part-task trainers such as "Resusci-Anne®" (Laerdal Medical, Stavanger, Norway) in the early 20th century and progressing to the development of more sophisticated human patient simulators, which were computerised manikins capable of reproducing many human physiological responses (Decker et al., 2014; Harder, 2009). The evolution of SBE is further captured in this special issue with technologies such as gamification, virtual reality, and high-fidelity simulation.

Overview of the issue

Many of the articles in this special issue are focused on healthcare. This is unsurprising in the post-COVID era, where health providers around the world remain stretched, and educators have had to develop more innovative ways to educate our healthcare professionals with a decreasing number of practice placements available (Bridge et al., 2022). There is also an expectation from students that educationalists will engage a range of methods and tools for delivering information, for example, the increased use of gamification. The article by Shaik et al. highlights the MemoryTrail VR game, which helps students learn about brain anatomy and the nervous system.

VR is a feature in several other articles. Park et al. used VR to teach communication skills to preregistration nursing students; Grafton et al. used VR as part of an assessment tool to facilitate Objective Structured Clinical Examinations online when they could not be completed face to face due to the pandemic; and Pryor and Park used VR as part of a blended approach to teaching preregistration nurses about delirium. Other studies focused on immersive, interactive environments combined with flexible debriefing (see the contributions by Hill et al. and Mitchell et al.). Debriefing played a significant role in the simulation described by a second article by Mitchell et al., which addresses the very difficult topic of attempted suicide by ligature.

Boje et al. present a paper that represents a different but important aspect of simulation, detailing how a European collaborative developed and delivered an educational framework designed to prepare educators for the delivery of simulation-based learning strategies. The adequate preparation of the faculty delivering simulation-based learning is an essential element of using simulation successfully.

Moving away from nursing, Stirling et al. focus on medical education. High-fidelity simulation was used to create a ward environment to assess the capabilities of medical students to prioritise competing demands and work collaboratively within a simulated environment. Harper et al. investigate pedagogic approaches which promote collaboration and communication across multi-disciplinary undergraduate student groups, including nursing, medical, social care, and education students. Multi-disciplinary education in practice can be particularly challenging to facilitate, so the use of simulation, in this instance, is especially useful.

Outside of healthcare, the involvement of VR simulation continues to develop. Rababah gives a fascinating and effective application of this technology when teaching English language skills. The technology is also shown to be effective when used to generate laboratory simulations (Racey et al.). Racey et al. also involved the students as partners in the research. The paper highlights that although knowledge acquisition was the main purpose of the intervention, a key theme that emerged was that self-regulation of anxiety improved. Student involvement was also a key theme of the paper by Mulholland et al., which explored the role of students as pedagogic consultants. It highlights the challenges of this approach as well as the benefits it can bring to initial teacher education.

Other articles focused on teacher education. They include a contribution from Woodley et al., which used VR to develop classroom management skills for preservice teachers and the paper from McAllister and Harati, which shares an innovative use of an online decision-based simulation to help preservice teachers examine contentious issues, such as challenged books in elementary and middle school classrooms. The article by Fletcher explores the experience of law students in a moot court. He focuses on the use of high-fidelity simulation where courtroom scenarios were created.

There is an impressive breadth of disciplines that have contributed to the special issue from a wide range of countries, including the UK, USA, Denmark, Jordan, Singapore, and Australia. The research that has been undertaken in relation to simulation has also demonstrated a breadth of methodologies, including phenomenology, hermeneutics and studies involving mixed methods, demonstrating the value of both qualitative and quantitative research in this area. This special issue enables readers to consider simulation as an effective pedagogy that is being used internationally in a vast array of contexts. Going forward, it is essential that good quality research continues to underpin the use of simulation as a pedagogy in higher education.

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Design and development of MemoryTrail virtual reality game to study brain and memory processes in a fun and interactive manner

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Abstract

We designed and developed a virtual reality game, MemoryTrail VR, to learn about brain anatomy and the nervous system using a serious games design and assessment framework with a focus on purpose that was reflected in five elements: content, fiction and narrative, mechanics, aesthetics and graphics, and framing. We added a sixth element, motivation and memory, with the aim to bridge the gap between student engagement and the content being taught and, in doing so, aid in the retention of knowledge. This was executed through the introduction of knowledge interweaved in a storyline that was relatable to our undergraduate students from a local university in Singapore. The 21-item questionnaire data validated that MemoryTrail VR was a serious game designed with components which were mainly coherent and cohesive with its purpose. We found that using a structured framework to design and evaluate the game enabled us to collate meaningful feedback and identify specific areas for improvement for the next version of the game with the goal of eventually developing a serious game that is theory- and evidence-driven. There was a significant increase in the percentage of students who answered conceptual questions correctly when comparing the pre- and in-game quizzes, providing evidence of learning achieved by the students because of the gameplay.

Introduction

Current pedagogical approaches to teaching undergraduate students about the fundamental concepts surrounding brain structure and function are limited to the use of textbooks, videos, and lectures. In biology, lecturing has been reported to promote memorization of facts rather than fostering deep understanding in most students, and even high academic achievers sometimes gain little understanding of basic biology concepts via traditional lectures (Sundberg, 2002). To overcome these limitations, studies have emerged that investigate the efficacy of using digital teaching tools such as virtual reality (VR) for the visual appreciation of anatomy (Abdullah et al., 2021; Codd & Choudhury, 2011; Latini & Ryttlefors, 2020; Singh et al., 2019). VR enables interactions in a 3D environment that makes the learning experience immersive and relatable as compared to 2D alternatives (Dick, 2021), allows students to be more engaged with the content (Bonasio, 2019), and enhances retention of knowledge (Ekstrand et al., 2018).

We found several applications of VR for medical education in Singapore, including a dental anaesthesia simulation designed by the Keio-NUS CUTE Center (Yen et al., 2018), a VR in agitation management game developed by the NUS YLL School of Medicine (Bharade, 2022), AI virtual humans created by MediVR (*InteractAI Virtual Human*), and Project Polaris (to practice clinical procedural skills) developed by the NUS YLL School of Medicine in collaboration with Microsoft (*Microsoft*, 2022). Their motivation for adopting VR was so that experiential learning would be more accessible to their students, to train students in clinical soft skills such as ethics and communication and clinical anatomy, to introduce realistic clinical scenarios and in a low-risk setting. Specifically for learning brain anatomy, there is a VR Brain Exploration application developed by Sidequest. This game allows students to navigate within the brain and examine its subcomponents, which helps them to gain a deeper understanding of the structures and their positions in the brain (*VR Brain Exploration*, 2021).

Despite the efforts to create meaningful immersive experiences, sometimes VR games fail to sustainably engage students and/or result in knowledge retention (Rai et al., 2019). Serious games are digital games and simulation tools that are created for non-entertainment use but with the primary purpose of improving the skills and performance of play-learners through training and instruction (Loh et al., 2015). There are two considerations that are often overlooked when designing a serious game for education. The first is motivation – why do people play? There are several motivational theories; a notable one is the Self-Determination Theory (SDT), which explains the human motivation to perform an activity as being internally driven (Ryan & Deci, 2000). Crafting a motivational game using SDT and its subcomponents requires that players feel they are autonomous and in control of their own actions, that they experience competence in achieving the tasks within the game space, and that they feel somehow related to others who are either playing the game with them at that moment or who have played before.

The second often neglected consideration is episodic memory, which is information stored in a person's long-term memory that receives and stores information about temporally dated episodes or events and temporal-spatial relations among those events (Deci et al., 1999). Episodic memories are stored in such a way that each memory is identified by a personal "tag." Typically, such memories are recalled through association with a particular time or place and tend to be vivid as they are recalled (Malone, 1981). Often it is difficult to remember what was discussed or reviewed in class, but it is far easier to recall the look of the classroom, the position of the instructor's desk, and the location of the door. In a well-designed serious game, episodic memory provides the learner with the ability to recall the elements of the game or the game environment. With games, the visual cues are established in the mind of the learner, and if the experiences are geared toward real-life applications, then the memories of the learner will be strong and associated with what he or she needs to do in a particular location (Kapp, 2012).

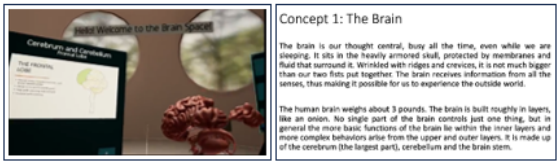
To address the above challenges, our team sought to design and develop a VR simulation to learn about the brain and nervous system using a Serious Games Design and Assessment (SGDA) framework with a focus on purpose that is reflected in five elements: content, fiction and narrative, mechanics, aesthetics and graphics, and framing (Mitgutsch & Alvarado, 2012). We added a sixth element, motivation and memory, with the aim to bridge the gap between student engagement and the content being taught and, in doing so, aid in the retention of knowledge. This was executed through the introduction of knowledge interweaved in a storyline that is relatable to our undergraduate students living in Singapore. Concepts were tagged to different junctures of the story. We hypothesise that through the inclusion of a story in the game design, the narrative would be able to provide a sensory experience that helps with students' engagement, thus improving their ability to understand and relate to the content. The simulation ends with a series of conceptual questions as the player cycles back to the starting point. A playtest was conducted on undergraduate students from a local university who completed a pre- and in-game quiz to determine the extent of learning and a design validation questionnaire with items relating to the six elements mentioned above.

Methodology

Game design

We adopted a step-by-step approach to designing the serious game, MemoryTrail VR, taking into consideration six game components that were carefully aligned with the purpose. (Mitgutsch & Alvarado, 2012).

Table 1: The purpose and six game components of MemoryTrail VR.

Components	Description
Purpose	The learning objective of MemoryTrail VR was for learners to gain knowledge about brain anatomy, the nervous system, and their function, with the aim of enhancing knowledge retention by incorporating game elements that trigger motivation and episodic memory. The goal of MemoryTrail VR was for the learner to cycle from the meeting point to the final destination by following the instructions and engaging in dialogue with the non-player characters. To arrive at the final destination, the learner must be able to answer a series of multiple-choice questions (conceptual) correctly.
Content and information	A designated environment was created within the game called the BrainSpace, which contains information about the different parts of the brain and the nervous system and their functions. There were seven concepts covered that include the brain, brain stem, cerebrum and cerebellum, limbic system, neuron, synaptic transmission, and nervous system. Learners could touch and dismantle the different parts of the 3D brain structure (refer to screenshots below). Each part was linked to its name and function in the form of a note.  Learners were transported into this space at specific junctures according to the narrative, for example in Scene 1, "Two friends decided to cycle from East Coast Park to Gardens by the Bay. This was part of a new scenic route in Singapore, the Eastern Coastal Loop. They met at a coffee place at Marine Cove, grabbed breakfast, planned their route, and started to cycle from there." The following question then appears, "How are we able to do all these things such as talk, move and function?" This was the trigger to transport the learner into the BrainSpace to gain information about concepts 1-3. We used corrective and immediate feedback that guided the learner toward the correct instructional outcome. This was designed in the form of multiple-choice questions (MCQs) at the end of the scenario, where the learner must answer ten questions correctly before he/she can race back to the final destination. The learner was provided with unlimited attempts and brought back to the BrainSpace to refer to the concepts if he/she answered incorrectly.
Game mechanics	The game was designed to be based on discovery, where learners find new information through sequential activities. Questions were introduced to stimulate curiosity amongst our learners and to lead them into the content. We spaced the information out proportionally over the six scenes. The game space consisted of specific spots along the bicycle trail and the BrainSpace. 3D objects were created to represent typical objects that you will find at a coffee place, park and ice cream stall. Learners could interact with the objects by pointing and clicking on it.
Fiction and Narrative	The storyline of the game followed the experience of two friends embarking on a bicycle ride along East Coast Park, starting from Coffee Bean at Marine Cove and arriving finally at Marina Bay Sands. The story consisted of six scenes (refer to screenshots below). An element of fun was injected in Scene 5 when the avatar showed off by cycling without hands, to impress the non-player character (NPC). An element of chance/tension was created in Scene 6 when a personal mobility device (PMD) rider suddenly appears, nearly knocking into the NPC. The ending scene was depicted as a competitive "race" between the two friends as they strive to reach their endpoint. The narrative ended happily and on a positive note. This narrative was chosen as it is an activity that is relatable to Singaporean young adults.  The learner played the role of the avatar who was the main cyclist. The NPCs were the second cyclist (the avatar's friend), local ice cream seller (scene 3), and PMD rider (scene 6). These were all dynamic characters with whom the learner engaged with via dialogues, both written and audio.
Aesthetics and graphics	The game was set in a realistic, 3D virtual environment of a bicycle trail along East Coast Park, Singapore. The route that the player took was adapted from the map of the Eastern Coastal Loop, with the starting point from Coffee Bean at Marine Cove and ending at Marina Bay Sands (refer to screenshots below). The whole environment was recreated from scratch in Unreal Engine based on a series of 360 photos taken during a site visit at the initial stage of the project, and GIS data from OpenStreetMap. 
Framing	The content of the game was framed for first year undergraduate students, both with and without a prior biology background. The content targeted the lower levels of Bloom's Taxonomy, namely remembering, understanding, and applying. The immersive and hands-on experience was designed to engage kinaesthetic learners. The narrative and dialogue were targeted at student learners between the ages of 18-22 and Singaporeans.
Motivation and Memory	Game elements and dynamics were designed to fulfil the three psychological needs, competence, autonomy and relatedness (derived from the Self-Determination Theory) to trigger intrinsic motivation in the learners. Learners were given the autonomy to explore the environment at their own pace and proceed to the various scenarios only when they were ready to do so. We tried to bring in relatedness by using familiar NPCs and environments. Competence was determined using conceptual questions. We designed the narratives to stimulate episodic memory in the learner, which are memories tied to strong emotions and are recalled through association with a particular time or place and tend to be vivid as they are recalled. Here are two examples. In Scene 3, "The two friends decide on the path to take and continue cycling towards Gardens by the Bay. Ten minutes later, the characters see an ice cream seller by the side of the path and stop. The ice cream man recognized character 1 and asked him how he has been. Both of them bought the mixed ice cream with bread and sat down on a bench to eat it. Character 2 asks character 1 how he knew the ice cream man. Character 1 shares that this ice cream man brings back sad memories for him. His ex-girlfriend and him used to cycle and stop by at this ice cream man regularly." In Scene 4, "The two friends finished their ice cream and felt happy. It was a beautiful day! Character 1 said that he was glad that they decided to go on this cycling trip together and appreciates his friend's company. In fact, he was beginning to develop feelings for his friend."

Game development

MemoryTrail VR was built using Unreal Engine 4 software, a powerful, feature-rich, open-source game engine with high levels of customizability. Blueprints (Unreal Engine's visual scripting system), C++ and Python were used to build the VR interaction systems along with the backend that collects and consolidates the data from the playtest. Microsoft Azure's text-to-speech feature was utilised to generate the

voiceovers and dialogues used in the game. The building of the game occurred in stages. Firstly, the background environment of the game was designed and created. This included the building of different structures, characters, and objects. We then proceeded to design the individual scenes of the game. Finally, the dialogue for each scene was added in, and all components were packaged together.

Playtest

A playtest was conducted on 53 undergraduate students from a local university in Singapore. The game setup included a VR-ready laptop and an HP Reverb G2 VR Headset and controller (Figure 1). Each gameplay lasted for about 15 minutes. After the completion of the game, the students were asked to fill up a design validation questionnaire via google forms. It contains 21 items, as detailed in Appendix A. These items covered the six components of the SGDA framework and motivation and memory. Students rated their experiences based on a Likert Scale ranging from 1 - 5 and an open-ended question to allow for detailed feedback. Before the start of the game, the students were asked to complete a quiz on brain anatomy and function deployed with Kahoot (Appendix B). It consisted of 11 conceptual questions and was used to determine the baseline of the students' knowledge of the concepts to be covered. After completing the scenarios, students attempted ten MCQs within the game and will have to answer all questions correctly to cycle back to the final destination. If the student had selected the wrong answer, they were prompted to try the question again. This was repeated until the student selected the correct answer. If a wrong answer was selected, students were also given the option to re-visit the concepts in the BrainSpace before trying the question again. MCQs were assigned randomly from a pool of 34 questions (Appendix C). The in-game quiz scores were compared against the pre-game data to determine if the students acquired new knowledge.

Figure 1: Photographs of students during the playtest of MemoryTrail VR.

Statistical analyses

Group mean values were analysed by either Student's unpaired test or one-way ANOVA with post hoc analysis using Tukey's test as appropriate using Graphpad Prism 6 software (GraphPad, San Diego, CA, USA). All data were presented as mean ± standard deviation (SD). Statistical significance was considered when the p-value was <0.05.

Results and discussion

Design validation questionnaire

After playtesting the game, the students completed the design validation questionnaire, consisting of 21 items (including three open-ended questions). The overall survey data revealed a total score of 69.3/90, demonstrating that the students tended to agree (neutral to agree range; 54-72) that the game elements were aligned with its purpose (Figure 2). Next, the questions relating to the different components of the adapted SGDA framework were critically analysed.

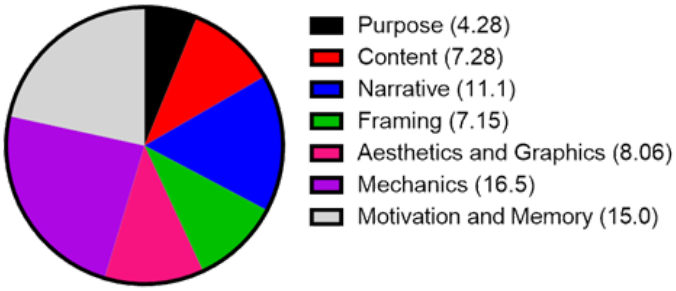


Figure 2: Pie chart illustrating the overall respective scores for each design validation component in the parenthesis.

We found that for the question related to the purpose (question 1, Appendix A), the game scored a score of 4.28/5, indicating that most of the students agreed that they were aware of what the game was testing them (Figure 2). Furthermore, for questions relating to the content, narrative, framing and aesthetics and graphics (Figures 3A-D), the game had a combined score of 7.28/10, 11.1/15, 7.15/10 and 8.06/10, respectively (Figure 2). These results suggest that students were neutral and tended to agree (>3.5 out of points on the Likert scale) that the content, narrative, framing and aesthetics of the game were coherent and cohesive to the purpose (Figure 3A-D).

Open-ended feedback revealed that students were engaged, could relate, and enjoyed flipping through the brain factsheet. While the purpose and content of the game were clear to them, it was suggested that the storyline could be more realistic or that there could be a clearer link between the storyline and educational content. It was proposed that more leading questions could be added in immediately after the concepts were shared. There was a suggestion that the dialogue could be made more relatable by using recordings of actual people rather than using an AI-generated voice (Table 1). Another feedback was to break down the concepts into specific functions instead of the general functions of each region of the brain and nervous system.

Regarding the mechanics of the game (Figure 4A), the game scored 16.5/20 (Figure 2). This showed that the students mostly agreed that the game was easy enough to navigate and the instructions were clear and easy to follow. Moreover, students provided feedback that they liked the narrative of the game and the relatability of the storyline. There was a suggestion to add more scenes so that the narrative and concepts could be intertwined better. Lastly, for questions pertaining to motivation and memory (Figure

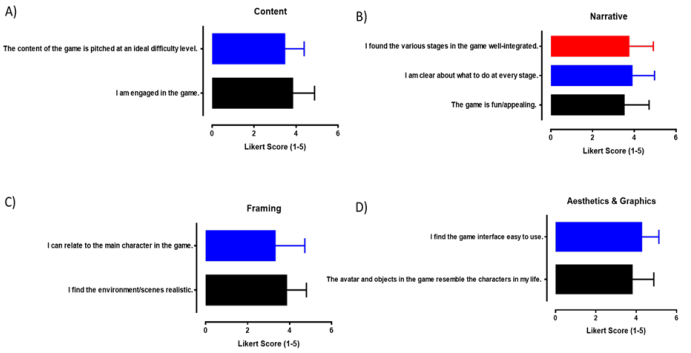


Figure 3: Likert score of the individual questions within the different components for design validation, including A) content, B) narrative, C) framing and D) aesthetics and graphics. All data were presented in mean±SD, n=53.

Table 2: Examples of students' open-ended feedback from the playtest questionnaire.

Student	Feedback
1	"game narrative is relatable and cute to university students"
2	"I feel that the narrative of the game is generally relatable in the Singaporean context where cycling is quite a common activity."
3	"The narrative helps to allude to the next concept. Can also insert questions related to the concept for player to answer immediately after introducing the concept. E.g. which part of the brain controls my hands - make the player answer the question"
4	"It helps reinforce the concepts"
5	"I liked the idea of flipping through the brain factsheet – but I think it needs to be clearer that players should click 'back to the real world' immediately, because I would have continued on to click next instead of the real-world button"
6	"can make the game feel more real by having more real looking characters/ environment"
7	"The narrative is too robotic and did not feel like I was talking to a person, also, I was not given a choice to interact with the person. Might be good if I am able to talk to the person with choices of response given to me."
8	"I did not understand the point of the narration. It could have been better linked to the content."

4B), the game had a score of 15.0/20 (Figure 2), suggesting that the students were neutral or tended to agree that they felt motivated to play the game and that it triggered their memory. Specifically, for questions 19 and 20, which asked if students felt that they were granted autonomy in the game or if they would play the game again, the game scored 3.45±1.28 and 3.64±1.23, respectively. Similarly, based on open-ended feedback, students felt that they would have preferred more freedom to make choices in the game. This could be because the game was designed in a linear manner where each scene would play consecutively. The players were not allowed to make decisions at each juncture of the game whether to proceed or not, and this may have reduced autonomy.

In summary, the overall questionnaire data validated that MemoryTrail VR was a serious game designed with components which were mainly coherent and cohesive with its purpose. We found that using a structured framework to design and evaluate the game enabled us to collate meaningful feedback and identify specific areas for improvement for the next version of the game. Our findings concur with Verschueren et al. (2019), who reported that the establishment of a well-defined framework that represents the consensus views of the serious games for the health

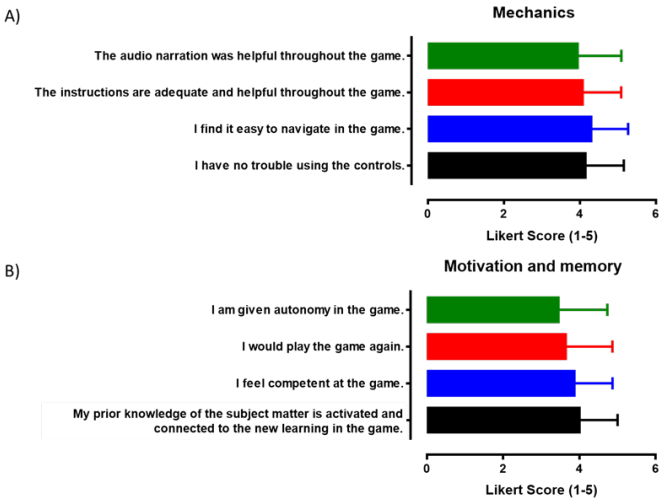


Figure 4: Likert score of the individual questions within the different components for design validation, including A) mechanics and B) motivation and memory. All data were presented in mean±SD, n=53.

research community would help developers improve the efficiency of internal development processes, as well as the chances of success. A consensus framework would also enhance the credibility of such games and help provide quality evidence of their effectiveness. We went a step further to include an additional component of motivation and memory that proved to be important, and we received feedback on how to improve our learners' motivation to play. For example, allowing for more autonomy for the players as they navigate the game. Notably, data on the perceived competence was encouraging and will be useful for us to gauge any improvements during iterative evaluation.

Assessment of learning outcomes from gameplay

As the purpose of the MemoryTrail VR game was to facilitate students' learning of brain anatomy and memory concepts, we needed to verify that learning was indeed achieved via the gameplay. A series of MCQs were used to assess the various concepts, as listed in Appendix C. A pre-game quiz administered using Kahoot was used to determine pre-existing knowledge, and it was observed that for the majority of the questions, less than half of the students were able to answer the questions correctly. It was noted that the weakest concepts were the parts of the neuron and its functions, the limbic system, and the cerebrum and cerebellum. Subsequently, the students completed MemoryTrail VR and were assessed using randomly assigned MCQs within the game derived from the same MCQs pool.

Overall, by comparing the mean percentage of students who answered the questions correctly between the pre-game and in-game quizzes, there was a significant (p= 0.0044) increase (25.7%) in the mean percentage of students who answered the questions correctly for the in-game quiz, suggesting that the students were able to acquire concepts related to brain and memory through the gameplay (Figure 5A). While there was a significant increase in the overall mean percentage of students who answered the questions correctly, we noted

that not all the questions were consistently improved, as some of the questions were answered incorrectly by the students even after the gameplay. From Figure 5B, out of the ten questions tested, there were six questions (questions 1, 2, 3, 7, 22 and 23) that a greater proportion of students answered correctly during in-game after the first attempt compared to students answering those questions during the pre-game quiz. MemoryTrail VR was designed to allow learners to make errors, and they were given the chance to revisit concepts and progress in the game after multiple attempts and finally answer the questions correctly. Interestingly, it was observed that most of the students were able to answer all of the questions correctly by their second attempt in the in-game quiz (Figure 5B).

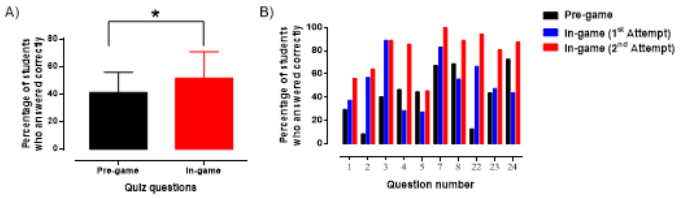


Figure 5: A) Percentage of students who answered questions correctly in the pre-game and in-game quizzes. B) Percentage of students who answered ten questions correctly in pre-game and in-game quizzes during their first and second attempts. All data were presented in mean±SD, * Significantly different from pre-game, unpaired Student's t-test, P<0.05, n=41-47.

To further determine which concepts of the brain and memory were acquired during the gameplay, we examined the percentage of students who were able to get the questions correct during their first, second or third attempts. Based on Figure 6A, we noted that for the 17 questions pertaining to the parts of the neuron and its functions, 56.5±12.6% of students who attempted the questions were able to get the question right on their first attempt. There was a significant improvement in the percentage of students that were able to answer the questions correctly by their second attempt (79.8±16.6%) and third attempt (90.8±12.2%). For the set of five questions relating to the nervous system, 65.2±27.5%, 89.4±10.1%, 93.3±6.5% of students were able to get the correct answer by their first, second, and third attempts, respectively. While the improvement was still observed after the second or third attempt, there was no statistical significance observed as the percentage of students who obtained the questions correctly was more variable at the first attempt (Figure 6B).

For the set of eight questions testing the parts of the brain and its functions, 42.9±25.8% of students answered the question correctly on their first attempt (Figure 6C). Furthermore, 67.4±13.3% and 88.9±8.3% of the students answered the questions correctly after the second and third attempts, respectively, which was a significant improvement from the first attempt. Similarly, for questions on the limbic system, cerebrum, and cerebellum, 52.7±12.3% of students answered the question correctly in their first attempt, with significant improvements after the second and third attempts (Figure 6D). Taken together, it was evident that

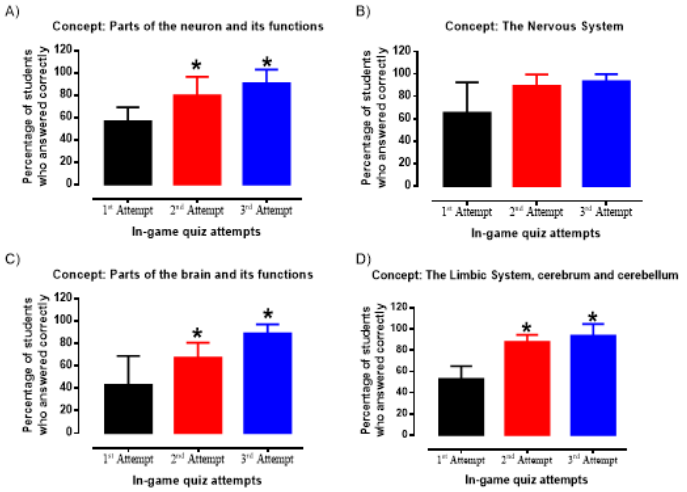


Figure 6: Percentage of students who answered in-game quiz questions correctly at first, second or third attempts to concepts pertaining A) parts of the neurons and functions, B) the nervous system, C) parts of the brain and its functions and D) the limbic system, cerebrum, and cerebellum. All data were presented in mean±SD, * Significantly different from the in-game first attempt, One-way ANOVA, Tukey's post-hoc test, P<0.05, n=3-17.

the majority of the students were able to select the correct answer on the second attempt for the question.

Our results verified that there was indeed evidence of learning achieved by the students because of the gameplay, specifically the significant increase in the percentage of students who answered questions correctly when comparing the pre- and in-game quizzes. We can conclude that MemoryTrail VR enabled students to understand, remember, and recall the concepts covered, as compared to their knowledge of the content before playing the game. Interestingly, results showed that students tended to do better for questions on the nervous system and limbic system. A possible explanation for this could be that the nervous and limbic systems were the last concepts to be covered before the students attempted the quiz. Another explanation could be that the nervous and limbic systems were more concise segments, thus allowing the students to digest the content easily, as there was less information to process at one time.

Conclusions

The result of this research demonstrated that the design and development of the MemoryTrail VR using an adapted Serious Games Design and Assessment (SGDA) framework was able to enhance the learning process of undergraduate students with respect to engagement, fun and learning outcomes. The various game elements enabled students to understand and appreciate the concepts and subsequently apply the knowledge gained during the quiz in an interactive manner. This study also highlighted the importance of adopting a structured approach towards the design of digital-based learning solutions that could help to guide the validation process to obtain meaningful feedback. Based on

the data obtained, we will reflect on the various components and make refinements to the current version of MemoryTrail VR with the goal of eventually developing a serious game that is theory- and evidence-driven.

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Appendices

Appendix A: Design validation questionnaire.

No.	Question	Answer Type	Component
1	I know what the game is testing me.	Likert scale – 1 to 5	Purpose
2	I am engaged in the game.	Likert scale – 1 to 5	Content
3	The content of the game is pitched at an ideal difficulty level.	Likert scale – 1 to 5	Content
4	The game is fun/appealing.	Likert scale – 1 to 5	Fiction/narrative
5	I find the environment/scenes realistic.	Likert scale – 1 to 5	Framing
6	I can relate to the main character in the game.	Likert scale – 1 to 5	Framing
7	The avatar and objects in the game resemble the characters in my life.	Likert scale – 1 to 5	Aesthetics and graphics
8	I am clear about what to do at every stage.	Likert scale – 1 to 5	Fiction/Narrative
9	I found the various stages in the game well-integrated.	Likert scale – 1 to 5	Fiction/Narrative
10	Do you have any feedback on the narrative of the game?	Open ended	Fiction/Narrative
11	I have no trouble using the controls.	Likert scale – 1 to 5	Mechanics
12	I find it easy to navigate in the game.	Likert scale – 1 to 5	Mechanics
13	The instructions are adequate and helpful throughout the game.	Likert scale – 1 to 5	Mechanics
14	The audio narration was helpful throughout the game.	Likert scale – 1 to 5	Mechanics
15	I find the game interface easy to use.	Likert scale – 1 to 5	Aesthetics and graphics
16	Do you have any feedback on the overall aesthetics of the game?	Open ended	Aesthetics and graphics
17	My prior knowledge of the subject matter is activated and connected to the new learning in the game.	Likert scale – 1 to 5	Motivation and memory
18	I feel competent at the game.	Likert scale – 1 to 5	Motivation, and memory
19	I would play the game again.	Likert scale – 1 to 5	Motivation and memory
20	I am given autonomy (a lot of freedom) in the game.	Likert scale – 1 to 5	Motivation and memory
21	Do you have any other feedback for us regarding the game?	Open ended	

Appendix B: Pre-game quiz questions on brain anatomy and function.

No.	Question	Concept
1	The cell that acts to relay electrical information to other nerve cells is a (n) ____.	Parts of the neuron and its functions
2	The neurons that are located in the brain and spinal cord are ____.	Parts of the neuron and its functions
3	Glial cells perform all of the following functions EXCEPT ____.	Parts of the brain and its functions
4	The role of the postsynaptic neuron in neural communication is to ____.	Nervous system
5	A myelin sheath functions to ____.	Parts of the neuron and its functions
6	The spinal cord ____.	Parts of the brain and its functions
7	Which brain structure controls learning, memory and emotions?	The cerebrum and cerebellum
8	Which brain structure plays a central role in homeostasis?	The limbic system
9	Which part of the brain coordinates motor movements and some spatial skills?	The cerebrum and cerebellum
10	Which part of the neuron contains the nucleus (where transcription and translation happens)?	Parts of the neuron and its functions
11	Which lobe of the cerebrum is involved in judgment and problem-solving?	The cerebrum and cerebellum

Appendix C: In-game quiz questions on brain anatomy and function.

No.	Question	Concept
1	The cell that acts to relay electrical information to other nerve cells is a(n) ____.	Parts of the neuron and its functions
2	The neurons that are located in the brain and spinal cord are ____.	Parts of the neuron and its functions
3	Glial cells perform all of the following functions EXCEPT ____.	Parts of the brain and its functions
4	The role of the postsynaptic neuron in neural communication is to ____.	The Nervous system
5	A myelin sheath functions to ____.	Parts of the neuron and its functions
6	During action potential conduction along a myelinated axon, the action potential appears to jump from ____.	Parts of the neuron and its functions
7	The spinal cord ____.	The Nervous system
8	Which part of the neuron contains the nucleus (where transcription and translation happens)?	Parts of the neuron and its functions
9	Where are neurotransmitter receptors located?	Parts of the neuron and its functions
10	Neurotransmitters affect postsynaptic cells by	Parts of the neuron and its functions
11	Functionally, which cellular location is the neuron's "decision-making site" as to whether or not an action potential will be initiated?	Parts of the neuron and its functions
12	The following steps refer to various stages in transmission at a chemical synapse. 1. Neurotransmitter binds with receptors associated with the postsynaptic membrane. 2. Calcium ions rush into neuron's cytoplasm. 3. An action potential depolarizes the membrane of the axon terminal. 4. The ligand-gated ion channels open. 5. The synaptic vesicles release neurotransmitter into the synaptic cleft. Which sequence of events is correct?	Parts of the neuron and its functions
13	The surface on a neuron that discharges the contents of synaptic vesicles is the	Parts of the neuron and its functions
14	The fastest possible conduction velocity of action potentials is observed in	Parts of the neuron and its functions
15	In the communication between a motor neuron and a skeletal muscle,	Parts of the neuron and its functions
16	The point of connection between two communicating neurons is called	Parts of the neuron and its functions
17	In certain large animals, this type of neuron can extend beyond 1 meter in length.	Parts of the neuron and its functions
18	The nucleus and most of the organelles in a neuron are located in the	Parts of the neuron and its functions
19	A simple nervous system	The Nervous system
20	The divisions of the nervous system that have antagonistic, or opposing, actions are	The Nervous system
21	Preparation for the fight-or-flight response includes activation of the _____ nervous system.	The Nervous system
22	Which brain structure plays a central role in homeostasis?	The limbic system
23	Which part of the brain coordinates motor movement and spatial skills?	The cerebrum and cerebellum
24	Which lobe of the cerebrum is involved in judgment and problem-solving?	The cerebrum and cerebellum
25	Calculation, contemplation, and cognition are human activities associated with increased activity in the	Parts of the brain and its functions
26	Which of the following shows a brain structure correctly paired with one of its primary functions?	Parts of the brain and its functions
27	If you were writing an essay, the part of your brain that would be actively involved in this task is the	Parts of the brain and its functions
28	The establishment and expression of emotions involves the	Parts of the brain and its functions
29	Failure of an embryonic neuron to establish a synaptic connection to another cell	Parts of the neuron and its functions
30	Short-term memory information processing usually causes changes in the	Parts of the brain and its functions

31	Learning a new language during adulthood alters activity in the brain's language processing locations by	Parts of the neuron and its functions
32	Forming new long-term memories is strikingly disrupted after damage to the	Parts of the brain and its functions
33	When Phineas Gage had a metal rod driven into his frontal lobe, or when someone had a frontal lobotomy, they would	Parts of the brain and its functions
34	Which of the following structures or regions is incorrectly paired with its function?	Parts of the brain and its functions

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Using virtual reality to teach nursing students communication skills when breaking bad news: A focus group exploration of participant experiences

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Abstract

Within higher education institutions, the use of virtual reality technologies has increased. However, while research is rich in the gaming and entertainment industries, the evidence within the field of undergraduate nursing is only just starting to emerge. The aim of this project was to explore 2nd-year undergraduate adult nursing students' perceptions of using virtual reality as an adjunct to simulation teaching. Using a qualitative approach to enquiry and purposeful sampling, 17 students participated in one of 3 focus groups. Their responses were audio recorded, transcribed verbatim and analysed using thematic analysis. Data was independently coded and emerging themes, which were identified, were compared, and agreed upon by the research team. Four central themes emerged including *fidelity, facilitation, facilities, and student learning*, which have been incorporated into a multimodal pedagogical model. For successful implementation of this innovative teaching strategy, it is suggested that academics need to be cognisant of the study's central themes, and how these interact and impact student satisfaction and levels of immersion.

Introduction

Globally, over the last decade, digital technologies have become essential resources for providing and supporting safe patient care and have emerged as helpful tools to tackle some of the most challenging healthcare issues in the 21st Century (World Health Organisation, 2022). Topol (2019) predicts that their use will continue to increase, eventually influencing 90% of all future healthcare interactions. Digital technologies have now also expanded beyond direct patient care delivery and innovations like virtual reality are now being used to educate and teach the future healthcare workforce (Dubovi et al., 2017; Schleicher, 2019; Hagge, 2021).

Virtual reality technology involves the utilisation of computer-generated graphics and advanced technology to produce engaging three-dimensional settings. These environments can be replicas of real-world settings or entirely fictional, existing outside the boundaries of reality (Jeon et al., 2020). The increasing popularity of virtual reality can be attributed to advancements in the gaming industry and the availability of affordable options like Google Cardboard and inexpensive 360-degree cameras. These developments have expanded the use of virtual reality in various fields, including education, by unlocking its potential as a powerful learning tool. In a recent systematic review conducted by Hamilton et al. (2020), the use of virtual reality in various domains was explored. Surprisingly, only 14% of the reviewed articles were related to medicine and healthcare, while most studies focused on virtual reality in science education.

While the exploration of virtual reality technologies as a teaching tool within healthcare has been previously limited to medicine and dentistry (Harrington et al., 2018; Huang et al., 2018), or as a tool to enable safe procedural skill acquisition (Ulrich et al., 2014; Smith & Hamilton, 2015; Dubovi et al., 2017; Chang et al., 2019; İsmailoğlu et al., 2020). The utilisation of virtual simulation learning platforms has become more prevalent in nursing education, especially amid the COVID-19 outbreak. These offered students a secure and supervised environment to hone their skills repeatedly, which they may not have had the opportunity to do in a traditional classroom setting (Prion & Haerling, 2020; Chao et al., 2021; Chang & Lai, 2021). They also provided a solution for students who, because of lockdown and shielding constraints, had limited clinical exposure (Goldsworthy et al., 2022).

One of the rare benefits of the pandemic was the opportunity to look outside of traditional educational practices and try new approaches. The benefits of virtual reality as a teaching method in nursing have thus been seen to have additional benefits outside of COVID-19, with the approach improving traditional hands-on teaching methods by its ability to remove teaching constraints such as space and time (Chen & Liou, 2022). Healthcare academics should, therefore, be encouraged to incorporate various technologies in the classroom and consider the underlying pedagogy, as simply introducing a virtual reality product into an existing session does not guarantee effective and impactful learning (Vogt et al., 2021). There is, therefore, an urgent need to consider the evidence base and conduct further research that will provide evidence of the most beneficial learning and teaching approaches to assist academics and enhance the usefulness of virtual reality in nurse education.

Literature review

Literature was searched using several online databases (CINAHL, EBSCO, PubMed, Science Direct, Web of Science, and Google Scholar). Articles were then filtered for relevance by perusing the abstracts. Key terms included 'Virtual Reality', 'Technology for Learning and Teaching', and 'Nurse Education and Pedagogy'. Several themes emerged from the literature, including the benefits of virtual reality for skill development, the ability to expose students to a diverse range of scenarios in a risk and stress-free environment and limitations associated with costs, accessibility, and learning transfer.

Skill development in an environment that is stress-free

Nursing students can benefit greatly from virtual reality platforms and programmes that provide realistic scenarios for skill acquisition, decision-making, and critical thinking. Across several contemporary empirical research studies (Chang & Lai, 2021; Saab et al., 2021; Chen & Liou, 2022), virtual reality environments and teaching practices have been considered stress-free by student participants.

Saab et al. (2021) adopted a phenomenological approach to understand 15 participants' viewpoints of learning through the medium of virtual reality. Findings revealed that students viewed this approach as safe and stress-free as it enabled them to practise nursing skills without the fear of failure or real-world repercussions. Participants also commented that they appreciated the flexibility and autonomy it afforded them, as they could revisit the scenario repeatedly, refine their skills and manage their own learning at a time convenient to them, which increased their feelings of confidence.

A mixed methods approach by Chang and Lai (2021) also provided similar results. Surveys and interviews were used to gauge students' stress perception and self-efficacy in learning nursing skills through virtual reality, and the findings indicated that participants perceived the use of immersive VR as a stress-free learning environment, students were less anxious and more comfortable when practising nursing skills in the virtual environment compared to traditional methods.

These findings were echoed in another 2022 study by Chen and Liou, who investigated the effects of immersive virtual reality on nursing education with the aid of a quasi-experimental design. 40 nursing students received training with the virtual reality equipment, and the other 40 students were provided with the same learning but through traditional teaching methods. Results revealed that less stress, associated with the use of virtual reality, increased confidence levels and improved learning outcomes.

Diverse scenarios that are free from risk of harm to patients

Another theme found when reviewing the literature was that the use of virtual reality platforms allows nursing students to experience a wide range of clinical scenarios, including rare or high-risk situations that they may not encounter during their clinical placements. It also has the potential to expose them to diverse patient populations, settings, and challenges without the risk of endangering patients (Cant et al., 2017; Foronda et al., 2020). Whilst it can be said that alternative forms of simulated teaching practices, such as high-fidelity simulation with the use of mannequins, and low fidelity with task trainers have been seen to offer students a range of clinical scenarios which can include sensitive topics that do not pose a danger to patients (Platt, et al., 2018), the added benefit of simulated practice with the use of virtual reality platforms is that it is less resource-intensive as it does not require staff, actors and medical consumables. Recently, Liu et al. (2020), Ma and Zheng (2020), and Shin et al. (2021) have published multiple systemic reviews and meta-analyses highlighting further advantages. According to the conclusions drawn from all three papers, virtual reality has the potential to be a more economical option as it eliminates the need for physical equipment and requires fewer teaching resources. In some cases, students may not require supervision and can use their own devices. Sessions can potentially be expanded to accommodate more students without requiring additional staff or resources. Alternatively, students can be encouraged to complete the work independently from a remote location, which diminishes the necessity for a physical classroom.

Limitations associated with costs, accessibility, learning transfer and cybersickness

However, the literature also reveals that the implementation of virtual reality technology in nursing education can be expensive, particularly at the early procurement stages, as the initial outlay for the equipment and software can be extremely costly (Baniasadi et al., 2020). Once the equipment is delivered, it is important to consider additional maintenance costs and technical support. To ensure a seamless and immersive experience, it is also crucial to review, invest in and enhance the infrastructure as Wi-Fi functionality can be affected by bandwidth and network limitations (Hamad & Jia, 2022).

The limitations of technology in replicating real-world scenarios may also affect learning transfer, and physical practice may be necessary for consolidating knowledge. This may offset the benefits of using this method instead of traditional teaching practices. Furthermore, a recent meta-analysis conducted by Chen et al. (2020) revealed no significant difference in skill acquisition between virtual reality and traditional teaching methods.

Cybersickness was also found by Hamad and Jia (2022) to be a downside to virtual reality. This is defined as an uncomfortable side effect associated with symptoms such as nausea, postural instability, disorientation, headaches, eye strain, and tiredness (Nesbitt & Nalivaiko, 2018). The effect of this can be increased if the user is standing rather than sitting if they use virtual reality for prolonged periods and if the user is predisposed to motion sickness or nausea (Laviola, 2000; Rebenitsch & Owen, 2014).

Methodology

Aims

This study aimed to explore undergraduate nursing students' perceptions of immersive learning delivered within a pre-registration curriculum. In particular, the study aimed to evaluate student experiences of using virtual reality as an adjunct to simulation teaching. The study had 3 main objectives:

- To evaluate nursing students' reactions to using virtual reality technologies.
- To gain an understanding of any perceived added value of using virtual reality as opposed to traditional teaching.
- To develop guidance on the integration of virtual reality into the classroom for other healthcare academics.

Study design

This study was part of a three-stream research project that looked at evaluating technology-enhanced learning within undergraduate nurse education. The virtual reality stream of the study adopted a qualitative approach to enquiry using realist evaluation and was targeted at second-year BSc adult nursing students. The realist evaluation methodology, rooted in the realism philosophy, was selected as an appropriate approach for this study as it provides explanations and insights into why virtual reality 360 videos may or may not be effective, for whom, and in what contexts (Intrac, 2017; Public Health England, 2021). Data collection for the 3-stream project commenced in June 2017 and was completed in November 2018.

Procedure

A short clinical scenario, that had the potential to help students meet their module learning outcomes, was developed, and scripted by academic staff. The scenario focused on communication skills and highlighted areas of poor practice related to breaking bad news. The script was acted out by staff and students and filmed using a Kodak 360o camera within the University's clinical skills centre. The footage was edited using Premier Pro (Adobe) and Kodak Pixpro 360-stitch software, to create an immersive experience when viewed through a virtual reality headset. The video was then uploaded onto a secure YouTube account.

To participate in the research, students were first required to view the 360o video, which was embedded into a classroom-based seminar. Before the timetabled seminar, students

received preparatory information, which included advice to bring their smartphones and earphones to the session.

During the seminar, the students were given an introduction to the equipment, which included guidance on accessing the video and prompts for using the 'cardboard' headsets. Cardboard headsets are a cheaper alternative that allows the maximum number of students to view the video at one time (Lee et al., 2017). To troubleshoot technical issues, the research team also ensured they were present at each teaching session to assist students with the technology. Students were first asked to watch the 360o video in unison and then allowed freedom to replay the video before a debrief of the session learning outcomes, which was facilitated by the lecturer.

Ethical considerations

Ethical approval for the study was granted by the University Faculty Ethics Committee (ethics reference, 655). All potential participants were fully informed about the purpose and aims of the research via an information sheet, which was given immediately after the conclusion of the seminar. Students who indicated that they wished to participate were then invited to attend a focus group, which was conducted in another part of the University on the same day. At the start of each focus group, additional information was provided and written informed consent was obtained from all participants.

Sampling and recruitment

The cohort was split into 8 groups of approximately 20 students, giving a participant potential of N=160. Volunteer sampling was utilised, and all but one group was offered the opportunity to participate in a focus group to discuss their experience. Focus groups were conducted within a few hours of the completion of the seminar and always on the same day. The one group, which was not offered the opportunity to participate, had experienced the seminar late on Friday before a week's holiday and therefore, no research staff were available to lead the focus group. The rationale for recruiting on the same day was twofold, it aimed to increase participation and also to ensure that the virtual reality experience was fresh in the participant's minds.

Data collection and analysis

Focus groups, as a data collection method, allowed participants to not only respond to the questions posed by the researcher but also provided them with the opportunity to engage in a discussion and debate about the topic, unlocking information about an issue that they might have not thought of if they had been interviewed on their own (Harvey & Land, 2021). All focus groups were conducted by an experienced researcher, who made it clear that they had not participated in the creation of the video scenario or the seminar materials and facilitation. The focus groups lasted for approximately one hour and the researcher used a standard set of prompt questions to facilitate discussion, which assisted with focus and continuity between the different groups, contributing towards the validity and rigour of the study (Gray, 2018).

Qualitative data analysis aims to comprehend the significance and provide a precise representation of it for others (Creswell & Poth, 2018). While there are multiple frameworks available for conducting qualitative analysis, there is no single definitive method for engaging with the data to facilitate understanding and interpretation. In this study, the data was audio recorded, transcribed verbatim, and analysed using thematic analysis. This process involved initial coding and identification of categories that were independently undertaken by members of the research team. This approach allowed for the transcripts to be checked and reviewed multiple times from a fresh perspective, with essentially a second and third layer of analysis, to minimise errors and enhance credibility and confirmability, as recommended by Green and Thorogood (2018). The data categories were then collaboratively reviewed before the final overarching themes were agreed upon.

Analysis and discussion

Participant characteristics

In total N=17 participants attended one of three focus groups conducted. Participants were all 2nd year BSc adult nursing students, consisting of students from 5 different seminar groups. There were 14 female and 3 male students. Four overarching themes emerged from the focus groups: facilitation, fidelity, facilitation, and student learning, which have been used to create the Three F Key Concept model (Figure 1) for successful implementation. Each theme is presented in turn and supported by verbatim quotes, which are attributed to individual sample participants.

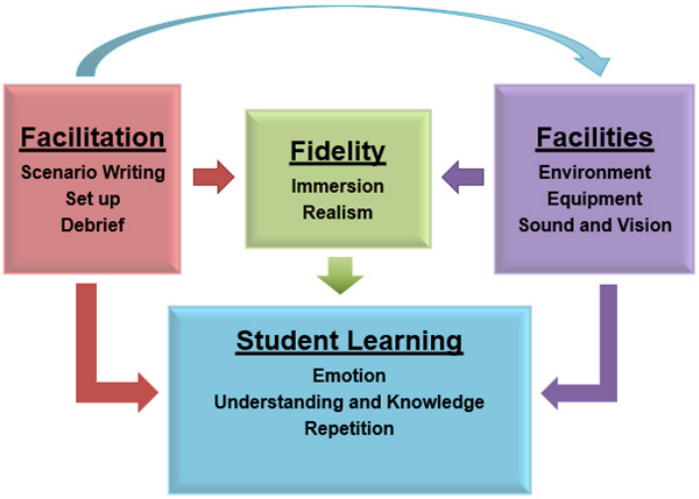

Figure 1: The Three F Key concept model.

Theme 1: Facilitation

The role of facilitation for virtual reality implementation was identified as a key theme which influenced the levels of fidelity experienced by the students as well as the overall student learning. Facilitation was characterised by the sub-themes of scenario writing, the setup and the debrief.

Participants suggest that careful consideration of the content, the timing of delivery and the target audience can all impact engagement. In this study, second-year students felt that the virtual simulation would have had a greater impact in the first year, particularly before any clinical practice.

> "I think the technology and the scenario might be good for first-year students who are very anxious about basic life support." (FG3 / P4)

> "That's what I mean about being in the situation….. For me, that would be a great thing to see before I went into practice." (FG1 / P1)

Developing scenarios that are closer to reality, that stretch and challenge individuals may be key to greater immersion and more effective learning.

> "Like I'm going into the third year soon and I thought it was quite a simple video and it was something we've gone over before. So, it's like drawing on previous learning experience but I thought it could've been a lot more challenging." (FG1 / P2)

Scenario realism was seen to impact fidelity, which may be why participants believed that virtual reality as a teaching strategy should not be overused or implemented as a replacement for real-life simulation facilitation.

> "Yeah, it was like a good gap between like normal seminars and practicals." (FG2 / P5)

> "I don't think it should replace anything; I just think it should be in addition to." (FG2 / P6)

> "I don't think it should be overused though. I think it should be like a treat." (FG1 / P1)

It is clear that careful planning and preparation are required to deliver virtual simulation away from traditional simulation settings and the role of a technical facilitator is crucial. Participants noted that the facilitator's presence and their level of input were important to their learning and overall experience.

> "She was really good actually. She knew what she was doing, she knew how to fix them, how to work it but she knew exactly what to do." (FG1/ P2)

In addition to assisting with technical issues, the participants pointed out that the facilitators' role was vital in keeping students focused on the aims and outcomes of the session and that if they had been left to view this as a self-directed study, the learning would not have been as effective.

> "New stuff like that, is always done better in class. Some people won't do it or do it properly, so it is better to do it in class with, like a member of staff directing you." (FG1/ P2)

> "I did benefit from talking about it afterwards, rather than just sitting at home. I think people just wouldn't put the glasses on and it wouldn't be the full experience I don't think, at home." (FG2 / P6)

However, there was some suggestion that the pre-brief was not helpful.

> "I think if you want to get people to take it more seriously and pay more attention, then a suggestion would be, to not put the prompts on the board before putting the headsets on." (FG3 / P4)

Instead, they preferred discussing what they had discovered after watching the video and expressed the need for the facilitator to lead this debrief to gain and share student feedback.

> "I thought the feedback at the end was quite good. Then we went on and spoke about de-escalation like different aggressive patients, like inappropriate patients and all of that." (FG1 / P1)

> "Talking about the video was quite good…..you know seeing things in real life, erm, and talking about it was interesting." (FG1 /P3)

> "You get other people's views as well, like the stuff you didn't notice." (FG2 / P4)

For some participants, this short, virtual experience, which was followed by a detailed debrief, was beneficial. It instilled a sense of inclusion and reduced feelings of anxiety sometimes associated with in-person simulation.

> "It kind of brought everyone back at the end, everyone kind of had time to say what they thought." (FG1 / P2)

> "I felt less pressure. 'Cos, I don't tend to like when we do the like, role play or those kinds of thing. I don't tend to enjoy them. So, I felt a lot more relaxed and found it easier to get involved." (FG2 / P3)

Theme 2: Facilities

The facilities theme encompasses four sub-themes including the equipment, the learning environment, sound, and vision, all of which were reported by the participants to have a direct influence on the levels of immersion, fidelity and student learning, and as the model illustrates is also closely aligned with facilitation.

Students were asked to bring their own headphones; however, ambient noise was reported by some participants as being a negative factor and had a direct impact on their ability to listen to what was being said.

> "I did feel like I was in it, but I could hear everyone else talking." (FG1 / P1)

> "I think there was a difficulty with sound, even though I had earphones in, I struggled to hear a lot of what was going on. There was a lot of movement, shuffling and other kinds of background noise that made it difficult." (FG3 / P4)

Linked with sound, the importance of the overall quality of the video was also found as a sub-theme and was often mentioned by participants to have a direct impact on

feelings of immersion. As the students viewed the video via their own devices, through cardboard headsets, the quality differed as some mobile devices could not show the video at higher resolutions. Consequently, those who had devices with higher resolutions and better images appeared to experience higher levels of immersion than those with poorer video quality.

> "Yeah, it was a lot more immersive, you could see the picture really well and the sound was really loud." (FG3 / P3)

> "Graphics is a big thing though like if you have the better quality, you're more involved in it. Because for me I couldn't properly see things, so you were just listening really. You weren't paying as much attention because you couldn't hear and see very well." (FG3 / P1)

Students also commented on poor Wi-Fi connection, equipment failure and suitability, and even access as some participants reported having to borrow a fellow student's phone to view the video.

> "Like the technology, like some of our mobile phones weren't working quite right or took ages to buffer and stuff."(FG2 / P7)

> "Well, I couldn't even get my phone to work." (FG2 / P3)

> "Yeah, it all depends on the quality of the phone. Some people had newer phones, some people had older, and some people had smashed screens so needed to borrow mine." (FG1 / P1)

The cardboard headsets used to view the video were also an equipment topic which was commented on by many participants, with both positive and negative perspectives being voiced.

> "The goggles themselves were pretty good. They block out all the other lights and stuff, so that was good. A good piece of equipment." (FG1 / P2)

> "It felt like double magnification. Like, quite distorted. It reminded me of the glasses I used to wear when I was younger. You know like it just wasn't… the quality just wasn't very good. Like, for me it was like, very blurry." (FG2 / P3)

> "I think a better headset would've been better. They weren't comfortable." (FG3 / P3)

As well as the equipment, the learning environment emerged as being equally important. All seminars were conducted in standard seminar rooms with up to 20 students taking part and simultaneously watching the video. Students suggested larger rooms that facilitated safe movement would have been beneficial.

> "Yeah, maybe if it was like in a different setting. Obviously, not in something bizarre, but because it was like in a classroom layout, if we were maybe in a hall." (FG3 / P5)

> "Would've been better to do it maybe in a bigger space with no tables. So, you could walk around a bit more freely." (FG1 / P1)

Theme 3: Fidelity

Fidelity relates to the degree of exactness with which the real world is reproduced (McMahan et al., 2012) and this emerged as a central theme which was influenced by facilitation and facilities and comprised of the subthemes, scenario realism and immersion (the perception of being physically present in a non-physical world).

Although levels of immersion were expressed by most participants, for some, the scenario narrative was overdramatised and exaggerated which reduced immersion and therefore, fidelity.

> "It made you feel like you were there, and I did like the video, but I think what would've made it better for me would've been an even more realistic scenario." (FG1 / P2)

> "There were little things that would quite often happen, like the curtain being left a little bit open; that's quite believable. However, I think some things were a bit exaggerated." (FG2 / P4)

> "It's not what you would say unrealistic, but it was quite exaggerated. So, I think for me, for future virtual reality videos, I would have liked to have seen something a bit more realistic." (FG1 / P3)

> "Cos half the things that were going on, you know wouldn't happen in reality, so it was overdramatised." (FG2 / P2)

Levels of immersion and realism for fidelity were also found to be influenced by the location in which the video was viewed by participants. This was exhibited by participants who felt that being in the same or a similar clinical location when watching the video would contribute to the levels of immersion felt.

> "Maybe even in the clinical skills bit itself so when you take the glasses off, you are kind of there." (FG1 / P1)

Theme 4: Student learning

Whilst acknowledging that the facilitation and the facilities theme have a direct impact on fidelity, the 3 F's (facilitation, facilities, and fidelity) together and individually play a central role in student learning. Simulation in healthcare is time and resource-intensive, which often means students are not provided with the opportunity to repeat simulation sessions. Creating a virtual reality real-world clinical scenario was reported by participants as being important for supporting student learning as it allowed for repetition.

> "I liked how you could watch the video as many times as you wanted to. You could be like: "Oh, I missed a bit" and do back." (FG2 / P6)

> "Yeah, you could re-watch it and you could think of things you've missed, whereas you'd miss a lot I think if you'd just watched a video or listened to someone." (FG1 / P7)

Participants articulated that although the video was watched individually, it felt interactive and fun, which helped with engagement and that this along with the facilitation and debriefing, increased knowledge and understanding.

> "I could turn about and do my own thing, so I guess it was more like an interactive thing." (FG1 / P2)

> "I wasn't bored I was engaged all the time. Like sometimes I do switch off, but I didn't switch off I think." (FG1 / P1)

> "I feel like it's more memorable, because it's something different, like another learning opportunity that you've kind of given us." (FG2 / P7)

The final subtheme of emotion was found to influence students' learning experiences, as increased feelings of immersion were associated with feelings of emotion, particularly if the students had not witnessed this scenario in clinical practice.

> "I think like, emotionally, you feel like you're there and like… like you're breaking bad news, like sitting in a side room with the family or something. Which is good cos sometimes you don't get to be in the room when you're a student in those situations." (FG2 / P4)

> "For me, …to actually be there and experience it for the emotional side and to see what's going on." (FG3 / P3)

The findings highlight that to enhance student learning, it is vital to consider the elements associated with facilitation, facilities, and fidelity and that these need to be addressed collectively and not in isolation from one another. Current emerging research (İsmailoğlu et al., 2020; Jeon et al., 2020; Liaw et al., 2021; Petersen et al., 2022) examining and exploring the use of virtual reality technologies, have found similar findings, especially regarding facilities and facilitation, which are considered paramount for increased fidelity. According to Ulrich et al. (2014), giving students prior exposure to equipment and session preparation can help them familiarise themselves with the equipment and potentially reduce problems with the headsets and video-playing devices during the actual teaching session. It is also important to consider potential issues with the technology and equipment until it becomes more widely used, and to factor in a troubleshooting plan in any material development (Foronda et al., 2014).

Verkuyl et al. (2021), Brown et al. (2022) and Goldsworthy et al. (2022) have also concluded that group debriefing enhances clarity and depth of learning as this allows students to reflect on their experiences. Location was found by Saab et al. (2021) to be important from a safety aspect as students needed a safe area to practise by trial and error. The findings from this study echoed these views as students stated they needed room to truly benefit from the 360o perspective; they found the pre-brief and introduction to the hardware beneficial and attributed the debrief and facilitator-led discussion to be advantageous for their knowledge and learning and created a more inclusive environment as opposed to roleplay or simulation.

Based on the results, it is evident that the quality of headsets, availability of equipment, and ambient noise levels have a significant impact on immersion and fidelity, which in turn affect student learning. It is imperative to have reliable equipment that enhances immersion through proper visual and noise management to improve the overall student experience and facilitate effective learning. Moreover, the environment, number of students in each session, effective session planning, and facilitator skills can also be adjusted to enhance immersion.

Limitations

Several limitations have been identified and are worthy of consideration. Firstly, due to the limited sample size and the involvement of only one BSc nursing cohort, findings from this study may not be applicable to other student populations or academic settings. Additionally, as only one scenario was viewed by the students, the scores of responses are limited. To broaden the efficiency of the pedagogical model, it would therefore be beneficial to replicate this project with a larger and more diverse cohort of students and also to review a range of videos and scenarios to see if they trigger varying reactions.

Notwithstanding the limitations, the responses from the students have provided valuable insight into the positive and negative aspects associated with virtual reality technology implementation which have proved pivotal in the creation of the Three F Key concept pedagogical model which has the potential to be used by other institutions to assist academic staff when considering incorporating virtual reality and 360 videos into their curriculum.

Conclusion and recommendations

In conclusion, as technology continues to advance and develop at a rapid pace (Health Education England & Royal College of Nursing, 2019; Topol, 2019), educators must embrace alternative teaching strategies (Council of Deans of Health, 2022). Virtual reality technologies could be seen as one possible answer as they are considered a good, supportive, flexible, and affordable alternative to running and facilitating repeated simulated sessions and bridging the theory-to-practice gap (Smith & Hamilton, 2015: Ulrich et al., 2014; Schleicher, 2019). However, new technologies, such as 360o videos, are not easily implemented and present challenges and complexities which academics need to circumnavigate. To assist educational establishments to evolve and expand their teaching repertoire and to enhance

the student experience when integrating virtual reality technologies, the findings from this research study and the Three F pedagogical model will hopefully provide a suitable framework for other institutions to utilise to circumnavigate some of the challenges that can be found.

It would be beneficial to assess the effectiveness of this teaching approach in incorporating virtual reality technology into various fields of study. This can help enhance the existing evidence on the challenges that arise and determine whether the model needs to be customised for different professions or if it can be widely implemented in higher education institutions.

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Application and evaluation of interactive virtual technologies in nursing students' learning and clinical skills assessment. A mixed methods study

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Abstract

Background: During the 2020 iteration of a Bachelor of Nursing Clinical Health Assessment skills course delivered in Singapore, the sudden cancellation of all face-to-face classes due to the pandemic resulted in innovative strategies being quickly created to enable students to successfully complete Objective Structured Clinical Examinations online. However, the realism of the experience was rudimentary. After exploration of a range of technologies, a mixed reality (interactive virtual patient) application was developed within the Microsoft Power Apps platform, implemented and evaluated for the 2022 iteration of the Clinical Health Assessment course.

Methods: A mixed methods exploratory design was used with quantitative and qualitative data collected regarding student performance and user experiences.

Results: The data suggested positive user experiences, with 60% feeling the application involved them and 80% reporting consistency with real-world experiences. Students' assessment item results from the 2022 iteration were also compared to previous iterations of the course and showed comparative alignment across the ranges of marks.

Conclusion: The mixed reality (interactive virtual patient) application provided a realistic and interactive user experience as well as an effective means of online clinical skills assessment.

Introduction and background

Over recent years, the global COVID-19 pandemic and resultant biosecurity measures have brought many challenges for universities and colleges, including those providing nursing education programs. While many courses can be taught and assessed effectively online, delivery and assessment for courses that focus on clinical skills have been somewhat more challenging (Crawford et al., 2020; Dewart et al., 2020; Grafton et al., 2021). As the COVID-19 pandemic began to impact Singapore in early 2020, a Clinical Health Assessment (CHA) skills course in a Bachelor of Nursing (BN) program provided by an Australian university for nurses in Singapore was rapidly moved online. While tutorials and lectures were able to be delivered online with relative ease, more imaginative and innovative strategies were quickly developed to provide the clinical skills laboratories and the Objective Structured Clinical Examinations (OSCEs). The strategies developed and used at that time, although somewhat rudimentary, were effective in teaching and assessment, provided a supportive learning environment, and enabled course learning outcomes to be met, and thus maintained academic continuity for students (Grafton et al., 2021).

Education for healthcare practitioners is ever-evolving as new and emerging technologies impact on the way education is provided (Co & Chu, 2020; Mtshali & Harerimana, 2019). Research recommends that nursing programs continue to adapt and transform (Ion et al., 2021) and report on the successful use of virtual learning platforms not only to conduct effective teaching but also to facilitate students' clinical learning experience (Co & Chu, 2020; Choi et al., 2022; Manakatt et al., 2021; Schmitz et al., 2021). As the COVID-19 pandemic unfolded from early 2020, and face-to-face teaching and assessment were no longer practicable, many institutions moved to online alternatives (Crawford et al., 2020). The World Health Organization (WHO) warned, in mid-2020, that the global pandemic would be persisting for the foreseeable future (WHO, 2020). At the end of the 2020 teaching semester, and with the possibility that the next iteration of the course would also need to be online, it was decided to explore opportunities for crafting a mixed-reality experience combining simulated patients and a virtual learning environment to further enhance the students' sense of reality and interactivity for the 2022 iteration of the CHA course and particularly for the OSCEs.

The interdisciplinary research team

The project was initiated in 2021 with the aim of developing and testing the use of virtual or mixed-reality applications for online simulated learning and clinical skills assessment. The research team was led by the BN Program Director (Singapore) and initially included the principal academic convenor for the CHA course and the BN Health Technical Services team leader. Experience with applications and virtual and augmented technologies was brought to the team via the addition of a senior academic from the School of Pharmacy and Medical Sciences and two academic staff from the College of Art and Immersive Design.

It is reported by Leigh and Brown (2021) that interdisciplinary research teams may face challenges not usually found within one's own discipline, such as different epistemological beliefs and research practices, as well as discipline-specific language. In this project, the different disciplines and members of the research team brought different perspectives and skills and gave rise to creativity that would not ordinarily be found in a team from within the same discipline (Grant et al., 2023; Zhang & Wang, 2021). From a graphic and design perspective, it was an opportunity to experiment with different technologies to provide a sense of realism and believable spatial construct (Grant et al., 2023). From a nursing perspective, any new virtual solution would need to facilitate the OSCEs to be able to be performed and assessed in real-time, to maintain the rigour and integrity of the assessment (Grafton et al., 2021). Having a diverse interdisciplinary research team provided a valuable opportunity to experiment with different technologies at the development and testing stages and helped reshape the project as a whole in the search for a solution that delivered the 'best fit for purpose.'

Methods

Considerations and development of the interactive virtual patient application

With the course convenor in Australia and students in Singapore and the Objective Structured Clinical Examinations (OSCEs) needing to be completely online, several considerations were prioritised for development. The application would need to be of low or no cost, require no specialised equipment, be accessible on any electronic device, be able to be applied in "virtual private rooms/channels" for OSCE assessment purposes and include culturally appropriate aspects for Singapore. The app would also need to function seamlessly within existing platforms used on the university's course sites.

Through experimentation with different educational technologies as well as technologies from outside the educational paradigm, an interactive virtual patient application (abbreviated by the research team and referred to in this paper as the VR App) was built using the 'Microsoft Power Platform' with life-like and stylised virtual patients designed using 'Unreal Engine' and 'Meta-Human Creator' (Epic Games Inc., 2004-2023). Three virtual ethnically appropriate patients were created, with two scenarios for each virtual patient, providing different body systems assessment options. The research team experimented with the appearance and functionality of the application on a range of devices, including laptop computers, tablets, and mobile phones, and with different browsers, to mimic the different ways students may access their course content and online assessment. Further detail of the development and operationalisation of the VR App can be found in another publication by the authors (Grafton et al., 2023).

One month prior to the OSCEs, students were given access to one virtual patient in the initial version of the VR App via an open OSCE practice channel on the course Teams site. Students were asked for feedback on appearance,

functionality and user experience. A small number of students who had completed the OSCEs online in the previous iteration of the course participated in a live demonstration of the interactive virtual patient application (VR App), allowing those students to compare the process for OSCE using the VR App to the previous online OSCE process. Feedback from both groups of students facilitated the final refinements of the VR App. The virtual patient in the OSCE practice channel was then updated to the final version of the VR App. The VR App with the remaining two patients and their scenarios was embedded in the private examiner's channels on the course Teams site for the formal OSCEs. Private channels were selected for examiners, with students given access, one at a time, to an examiner's channel to facilitate uninterrupted privacy and confidentiality during each individual student's exam.

Recruitment, sample and data collection

All students in the course (n=104) were made aware from the start of the semester that an application was being developed for use for online OSCES as a pilot research project. As such, they would have the opportunity to provide anonymous and confidential feedback, should they consent to do so, and that feedback and statistics would also be garnered from the university's standard student evaluation of the course (SEC) questionnaires. All students were reassured that they would be provided with clear instructions on the use of the application and ample opportunity to practice before their formal OSCEs. An online survey was developed for the students' experiences survey, comprising 16 questions in two sections. Ten of the questions were statements with responses provided on a 5-point Likert scale, and the remainder were a mix of open questions related to their experience, learning, and questions related to the technology they used. Section one questions were based on the Student Experience Questionnaire (SEQ) from the Quality Indicators for Learning and Teaching (QILT; Australia), which focuses on aspects of the higher education experience that are measurable, linked to learning and development outcomes, and potentially able to be influenced by institutions (QILT, 2022). Section two questions were developed from Witmer and Singer (1998) and Busselle and Bilandzic (2008). The student survey can be seen in Appendix A.

After completion of the OSCEs, students were sent an email seeking their voluntary participation. The information included a participant information sheet and consent details outlining that completion of the survey would be anonymous, would not influence or impact their grade, the right to withdraw at any time, and the link to the online survey. Descriptive statistics were used to analyse the data. The examiners were also sent a similar online survey amended slightly to reflect their role in the OSCE process, using the VR App. The qualitative data were not subjected to any formal analysis such as content or thematic analysis but were used to provide insights and highlight aspects that students experienced through the process.

Ethical approval

To evaluate user experience, ethical approval was sought and given via the University Ethics Committee REF 2022/260. This included the sanctioning of participant information and informed consent procedures. Ethical approval was also granted to include statistics of OSCE results to compare the 2018, 2020, and 2022 iterations of the course.

Results

Quantitative data

Responses were received from 25 of 104 students (24%) and two of the three examiners. Anecdotal feedback throughout the semester was encouraging and positive, and the results of the final survey were positive. In general, students reported that they received clear instruction and that the opportunity to practice, as well as using the VR App for OSCES, was engaging and allowed them to effectively demonstrate the appropriate skills. In terms of the visual effects, and realism, 60% of students reported they felt involved or very involved with the visual aspects of the VR App, and 80% reported that the virtual scene and patient were consistent with real-world experiences. This was particularly heartening, given that the students were already practicing nurses, so had real-world experiences for comparison. A summary of quantitative results is provided in Figure 1.

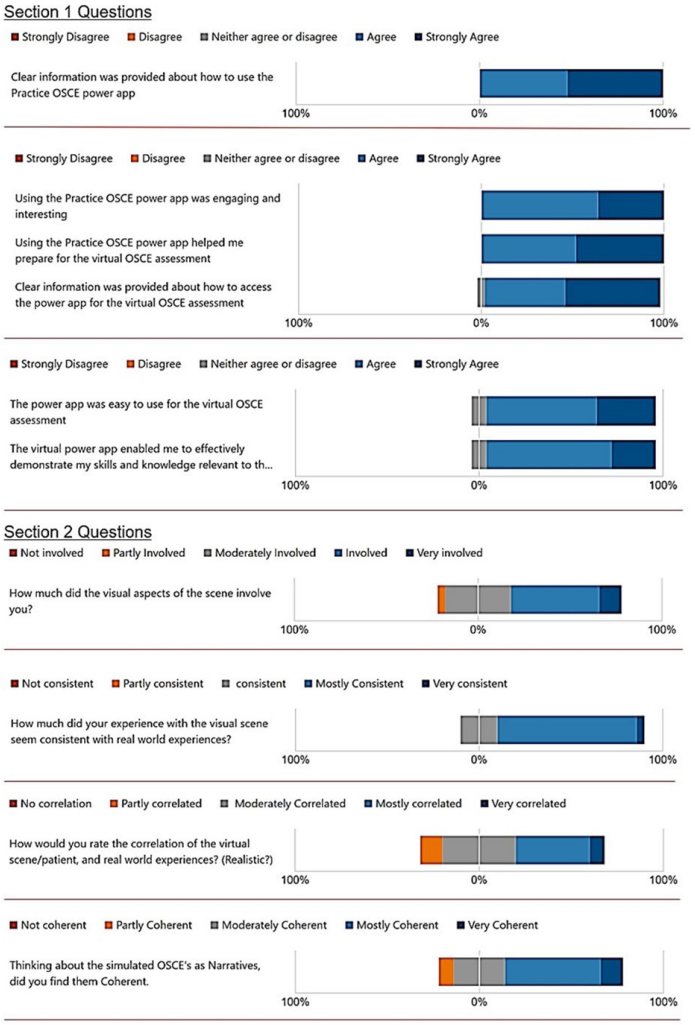

Figure 1: Student experience of the VR App - quantitative responses.

Of the three examiners involved, two completed the examiner version of the survey. These yielded favourable agree/strongly agree responses in relation to the questions posed. The examiner version of the survey can be seen in Appendix B.

A comparison of statistics for student results for the OSCEs was made for the 2018 iteration, when these had been completed face-to-face, the 2020 iteration (the first online OSCEs), and the 2022 iteration, where the OSCEs had been completed using the VR App. Despite variation in number of students in each cohort and the different processes for the OSCEs, it is interesting to note that the number of students (calculated as a percentage of the respective cohorts) is similar across most of the different grades for all iterations, although slightly higher for the 2022 iteration. Details of statistics of the number of students and percentage of the cohort for each grade band and median mark are provided in Table 1.

Table 1. Comparison of OSCE results across iterations.

Results / Year	2018 (n=296)	2020 (n=375)	2022 (n=104)
Grade	**No. of students (%)**	**No. of students (%)**	**No. of students (%)**
Fails (<50%)	11 (3.72)	7 (1.86)	3 (2.88)
Pass (50% - 64.5%)	64 (21.62)	82 (21.87)	11 (10.57)
Credit (65% - 74.5%)	59 (19.93)	82 (21.87)	28 (26.93)
Distinction (75% - 84.5%)	92 (31.09)	116 (30.93)	34 (32.69)
High Distinction (85 - 100%)	67 (22.64)	88 (23.47)	28 (26.93)
Median	**53.5 / 70 (76.42%)**	**52 / 70 (74.28%)**	**54 / 70 (77.14%)**

Qualitative data

The qualitative feedback produced some interesting insights, although no formal qualitative analysis, such as content or thematic analysis, was used. This qualitative feedback was also positive, with one student summing up the experience.

> The Practice OSCE Power App was very interesting to use and was very engaging. It can be used at any time for practice, which I had done several times before the OSCE assessment. I feel like I'm communicating with a real patient when I practise. I feel confident in the virtual OSCE assessment. During the class, I got a clear explanation of how to access the… App for the virtual OSCE assessment (S14).

Of particular interest to the research team was the student feedback on the ease of use, level of realism and interactivity. Students commented that they found the interactive virtual patient application (VR App) easy to navigate and use for their OSCE:

> The app is very engaging, interesting and user-friendly. it helped me effectively prepare for the assessment and, overall, was very useful and effective for the students (S25).

> It is smooth throughout the whole process despite accessing at a different time zone. I took my OCSE while I was in London and the examiner in Singapore (S12).

Students also felt it was realistic and liked the visuals and level of interactivity:

> It was interesting and exciting having the visuals (S23).

> I am able to draw on the avatar (the patient). I feel like talking to real patients (S14).

> I'm impressed that I could actually see the abdominal, chest area, face etc., clearly. It really helps me to visualise the actual sites properly for physical assessment (S19)

> The scene is like a ward setting, and the patient is quite realistic for a virtual model (S3).

There were some suggestions for development to add to the realism, such as the addition of vocal patient responses, sound effects (e.g., heart sounds or bowel sounds), or visual effects.

> The patient looks realistic. However, if the scenario patient has bruises, they should be included on the patient (S8).

Of the students who completed the survey, most reported that they used laptop computers, and used the recommended browser (Google Chrome) to access their exam, although the convenor noted throughout the week of OSCEs that many students successfully used tablets and mobile phones, and some used other browsers. While some students needed support with technical issues such as camera and microphone settings and controls for sharing their screen, these were able to be successfully resolved with the convenor in the 'OSCE waiting room', validating the usefulness of the waiting room concept. There were no reported technical difficulties with the VR App for the OSCEs, and all 104 students were able to complete all sections of the OSCE via the application. One student reported that the application loaded slowly on their device, but they were able to complete all sections of the exam within the allocated time.

Feedback from the examiners was also very positive and encouraging:

> The app was easy to use, and the content page was easy to follow (Examiner 1).

> I thought the face of the patient for the neurology assessment could be improved: The instruction guide was easy to follow. I think this is a very good app at the University level internationally (Examiner 2).

A summary of the project and results was reported on a poster presented at the 2022 NETNEP 8th International Nurse Education Conference (Grafton et al., 2022).

Data from the Student Evaluation of Course (SEC) survey

In higher education, student evaluation surveys have become commonplace. Despite inconsistencies in how the data are used, the aim of such surveys is one of quality assurance, to improve teaching and the student learning experience (Borch et al., 2020). The student evaluation of the course (SEC) for the 2022 iteration of the CHA course yielded responses from 35 of 104 students (33.7%). Students rated the course highly overall, with scores of 4.5 – 4.6 on a 5-point Likert scale. A question on the use of online technologies was included in the SEC survey and yielded a mean score of 4.5 on a 5-point Likert scale, with 75% of students agreeing or strongly agreeing that the online technologies provide access and resources for effective learning.

In qualitative comments in the SEC, some students commented specifically about the interactive virtual patient application (VR App):

> The team… is showing their effort, innovation and creativity to support the course throughout the pandemic period. The creation of the app for CHA is proof.
>
> I found that they catered well for the OSCEs with the help of the app developed.

Learnings from the research team

An unexpected outcome of the interdisciplinary team approach was the learning that occurred for individual team members. Literature on interdisciplinary research teams identifies that where team members clarify communications, are open to different perspectives, and provide opportunities for individual reflection, real learning can occur, and the potential of the project is likely to be maximised (Leigh & Brown, 2021). From a nursing perspective, the experience brought greater knowledge and skills with technologies, and greater confidence in using such technologies to create interactive, engaging online experiences for students. Non-nursing team members reported an increased understanding of nurse education needs and that this led to more innovative creativity and experimentation with how technologies and graphic design programs may be used and adapted for purposes outside their own discipline. A hallmark of this project was the cohesiveness of the research team, characterised by an unwavering commitment to the project, clear and regular communications, and mutual respect and openness to learn something new. Democratic leadership, openness to embracing new knowledge and skills from different disciplines, and respectful equity within the interdisciplinary team are identified as key elements for collaborative co-learning and creativity and make the most of individual members' strengths for the benefit of the project (Lorenzetti et al., 2022).

Discussion

Although the student response rate for the interactive virtual patient application (VR App) user experience survey was relatively low, with only 24% of students returning the survey, the feedback demonstrates that the application did provide the desired effective, realistic and interactive online user experience as well as direction for possible future development. The results presented in this paper also demonstrate that the application developed for this course did provide an effective means of completing OSCEs for the students, thus enabling all students to complete all assessment requirements and meet the learning outcomes of the course. Several aspects of assessment quality were of interest to the convenor and Program Director (Singapore), including the validity of the online version as an assessment item and the comparison of student OSCE results across this iteration and previous iterations. Literature reports that an OSCE provides an accurate, reliable form of assessment of nurses' clinical skills competence (Chen et al., 2021). In the 2020 iteration of the CHA course, the OSCE had been completed online for the first time for this course. At that time, the process, rigour and validity of the online OSCE format were reviewed and approved by the School of Nursing of the Australian university and the Singapore Nursing Board accrediting the course in Singapore and reported by Grafton et al. (2021). It was determined that the online format did provide a valid and effective alternative to face-to-face OSCEs and did effectively assess the relevant course learning outcomes. For the 2022 iteration of the course, the learning outcomes, scenarios, marking criteria and online process remained essentially the same; thus, the validity was considered established. The essential difference was the development and use of the interactive virtual patient application (VR App) for OSCE assessment with the aim of providing a more realistic interactive user experience in the online environment. From the results reported, this aim was achieved.

In terms of student marks and grades for the OSCEs, it is noted that there is a higher percentage of students in the credit grade and a slightly higher percentage of students in the distinction and high distinction grades for the 2022 iteration compared to the previous iterations. This may be due to the smaller student cohort in the 2022 cohort than in previous iterations, allowing for more contact with the convenor and promoting greater engagement (Karas, 2019). It may also be a testament to the quality of the VR App and the support provided for students, in terms of detailed instruction for use and opportunity to practice, which are reported to develop familiarity with the technology and reduce anxiety (Choi et al., 2022; Lee & Xiong, 2022).

As the pandemic continues its impact, and bio-security restrictions continue to ebb and flow in response to risk, it could be argued that the pandemic has provided a catalyst for the rapid development, expansion and innovative use of education technologies (Khamis et al., 2021; Manakatt et al., 2021; Miller & Guest, 2021). For the Clinical Health Assessment course, the ongoing suspension of all face-to-face teaching and assessment provided an ideal opportunity to explore and evaluate virtual reality technologies and integrate knowledge and skills from different disciplines in order to provide a more realistic online user experience than the previous experience. In an uncertain world, educators need to be prepared to deliver courses online (Matthias et al., 2019) and be prepared to adopt immersive and interactive technologies to enhance learner experience (Cho et al.,

2022). The creative and innovative use of technologies such as the VR App reported in this paper can facilitate realistic and interactive learning and assessment when face-to-face classes are not possible.

Limitations

The main limitations of this project were the relatively small number of students who responded to the user experience survey, having only one site and one method of data collection. It is recognised, however, that participation was voluntary, and as full-time working registered nurses (RNs), time and focus were likely prioritised to completion of their studies amid work and family commitments in the midst of the ongoing COVID-19 pandemic.

Conclusion and recommendations

From the results of this study, it is concluded that the interactive virtual patient application (VR App) developed and implemented via Microsoft Teams in the Clinical Health Assessment course provided an effective, realistic and interactive user experience for online Objective Structured Clinical Examinations (OSCEs). While shown to be valuable when face-to-face classes and clinical assessments are not possible, there is potential for the use of such applications to provide a valuable platform for learning and practice of clinical skills, not only in nursing but also in fields such as medicine. This is consistent with other studies that report the use of virtual, augmented and mixed-reality applications as an effective means for supporting learning and clinical skills practice (Schmitz et al., 2021; Zhao et al., 2020). Thus, this paper adds to the growing body of research on the effectiveness and practical use of virtual, augmented and mixed-reality technologies in health education. Drawing on student feedback in this study, further development to incorporate more advanced interactivity, such as vocal responses and movement of the virtual patients, is currently being explored.

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Appendices

Appendix A: 2201NRS CHA: Power apps and OSCES – student experience online survey.

Section 1: The following questions relate to your experience using the power app to facilitate practice and completion of your A2 OSCE assessment.

Question	Strongly disagree	Agree	Partly	Disagree	Strongly Disagree
1.Clear information was provided about how to use the Practice OSCE power app					
Comment:					
2.Using the Practice OSCE power app was engaging and interesting					
3.Using the Practice OSCE power app helped me prepare for the virtual OSCE assessment					
4.Clear information was provided about how to access and use the power app for the virtual OSCE assessment					
Comment:					
5.The power app was easy to use for the virtual OSCE assessment					
6.The virtual power app enabled me to effectively demonstrate my skills and knowledge relevant to the scenario					
7.On what electronic device did you access and complete your OSCE? (e.g., smart phone, table, laptop).					
8.Please identify the browser you used to access the power app:					
9.Please comment on your experience of navigating and using the app on your device:					

Section 2: The following questions relate to the experience of Power app virtual reality compared to real life experience:

10.How much did the visual aspects of the scene involve you?	Not involved	Partly Involved	Moderately Involved	Involved	Very involved
11.Can you comment on aspects of the scene or patient that you may have been visually attracted to or found visually deterring?					
12.How much did your experience with the visual scene seem consistent with real world experiences?	Not consistent	Partly Consistent	Moderately Consistent	Consistent	Very consistent
13.How would you rate the correlation of the virtual scene/patient, and real world experiences? (Realistic?)	No correlation	Partly correlated	Correlated	Mostly correlated	Very correlated
14.Thinking about the simulated OSCE's as Narratives, did you find them Coherent.	Not coherent	Partly Coherent	Moderately Coherent	Mostly Coherent	Very Coherent
15.Please comment on the overall narrative (involving both text and images) in regard to your level of engagement and comprehension?					
16.Please comment on any perceived inconsistencies in the narrative and what aspects you may have found more or less engaging?					

Appendix B: 2201NRS CHA: Power apps and OSCES – examiner experience online survey.

Section 1: The following questions relate to your experience using the power app to facilitate assessment of students.

Question	Strongly disagree	Agree	Partly	Disagree	Strongly Disagree
1. Clear information was provided about how to access and use the power app for the virtual OSCE assessment					
Comment:					
2. The power app was easy to use for the virtual OSCE assessment					
3. The virtual power app enabled me to effectively assess student my skills and knowledge relevant to the scenario					
4. On what electronic device did you access and complete the OSCE assessments? (e.g., smart phone, table, laptop).					
5. Please identify the browser you used to access the power app:					
6. Please comment on your experience of navigating and using the app on your device:					

The following questions relate to the experience of Power app virtual reality compared to real life experience:

7. How much did the visual aspects of the scene involve you?	Not involved	Partly Involved	Moderately Involved	Involved	Very involved
8. Can you comment on aspects of the scene or patient that you may have been visually attracted to or found visually deterring?					
9. How much did your experience with the visual scene seem consistent with real world experiences?	Not consistent	Partly Consistent	Moderately Consistent	Consistent	Very consistent
10. How would you rate the correlation of the virtual scene/patient, and real world experiences? (Realistic?)	No correlation	Partly correlated	Correlated	Mostly correlated	Very correlated
11. Thinking about the simulated OSCE's as Narratives, did you find them Coherent.	Not coherent	Partly Coherent	Moderately Coherent	Mostly Coherent	Very Coherent
12. Please comment on the overall narrative (involving both text and images) in regard to your level of engagement and comprehension?					
13. Please comment on any perceived inconsistencies in the narrative and what aspects you may have found more or less engaging?					

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Evaluation of a blended learning, simulation-based education package for first-year nursing students

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Abstract

Delirium is a neuropsychiatric syndrome that is sudden in onset and represents an acute medical emergency. Nurses must be able to recognise this change in presentation and seek support to assess and treat the underpinning conditions driving delirium. This paper reports a study undertaken at one university in the North-East of England. The study adopted a mixed methods approach to evaluate and explore first-year student nurses' perceptions and experiences of a blended delirium education package (online and in person). It also explores if students believe this will change or influence their practice.

Data were collected via an online questionnaire from 49 students following the completion of an online supported learning package and linked classroom-based simulation. Quantitative data were analysed using descriptive statistics. Qualitative data were thematically analysed using Braun and Clarke's (2006) thematic analysis principles. Both data strands were integrated to highlight core experiential themes.

Two themes were identified: Acknowledging the complexity of delirium and bridging the online-supported learning and classroom teaching and learning activity. This study demonstrated that a blended approach to delirium education is well-received and positively supports student nurses' understanding of delirium and confidence in practice. Still, there is a need for further refinement in educational practice.

Introduction and background

This paper reports on a novel education intervention to support first-year adult nursing students in the United Kingdom to understand and recognise delirium. It presents a mixed methods analysis of the intervention and highlights key areas for exploration and further curriculum advancements.

Delirium is known to be an acute neuropsychiatric syndrome which typically has one or more underpinning, causative medical illnesses (Bellelli et al., 2021). Broadly, it is believed that delirium affects up to 50% of hospital inpatients over the age of 65 and around 60% of people living in care homes or post-acute care settings (British Geriatric Society, 2019).

Delirium is increasingly being recognised as a medical emergency which represents complex dysfunction of the brain and may increase the risk of dementia by up to 10% (Rockwood et al., 1999; Caplan et al., 2020). Whilst the exact aetiology of delirium is still not fully understood, it is increasingly recognised to be linked with inflammatory pathways, hypoxia, impaired glucose metabolism (Wilson et al., 2020), and ultimately, represents an "acute brain failure" (Inouye et al., 2014).

Delirium presents an acute change in attention and awareness and hence, the historical association with 'confusion'. However, this does not represent the true scope of delirium presentations and risks as it only identifies the overtly changed, often agitated or distressed presentations of hyperactive delirium. It is well documented that delirium can manifest as hypoactive, with people seemingly sleepy or drowsy or exhibiting mixed, fluctuating presentations. Nevertheless, the manifestation does not mean either is more severe, and those with hypoactive delirium are placed in a dangerous position of having the evolving medical emergency overlooked.

Another confounding factor when considering delirium is the multitude of terms and names used to represent the condition or describe it in medical notes. Steis and Fick (2012) undertook a documentary analysis of nursing notes to assess if nurses documented delirium or recognised it clinically. They found that whilst nurses did document features of delirium, using descriptors indicating both hyperactive and hypoactive motoric subtypes, they did not associate them with delirium as a clinical condition. Rather, they documented confusion, delusions, and restlessness; failing to overtly consider a delirium diagnosis. Latterly, Pulle et al. (2015) found on review of medical records, eight keywords or phrases that indicated delirium presentations (Table 1) in patients over 70 who were to have planned orthopaedic, vascular, or general surgery. Nursing documentation of altered mental state and Deliri* had 100% positive predicted rates of subsequent delirium diagnosis. Interestingly, this American study included terms of encephalopathy. Whilst not a frequently used term in the study finding, it raises the question of variance in terms of delirium and the impact this may have when considering the international literature. Slooter et al. (2020) present the argument that delirium definitions are present and congruent across the International and American diagnostic manuals (American Psychiatric Association, 2013; World Health Organisation, 2019), whereas encephalopathy is an encompassing general term relating to global disturbances of brain function (Slooter et al., 2020), and terms such as acute encephalopathy, acute brain failure and altered mental state are not used consistently and do not represent a clinical diagnosis or diagnostic criteria. In addition, Slooter et al. (2020) recommend against using terms such as acute confusional state, acute brain dysfunction/failure and altered mental state in research and clinical practice as they lack construct or face validity. However, they recognise that the terms may be relevant in educational practice. For clinicians, having a shared terminology or language is paramount in ensuring successful multidisciplinary teamwork and accurate communication (Rabol & Ostergaard, 2011; Stuhlinger et al., 2019). The use of standardised tools and the language associated with these can support and strengthen the nursing voice within their teams (Van De Steeg et al., 2014).

Table 1: Delirium documentation trigger words.

Trigger words
AMS/Altered Mental State
Deliri*
Alert and Orientated
Hallucin*
Confus*
Reorient*
Disorient*
Encephalopathy

Adapted from Pulle et al. (2015).

Whilst psychiatrists and specialist practitioners may utilise the formal diagnostic manuals and classifications for delirium diagnosis, nurses of all levels of training and in all fields of nursing need to be equipped with the knowledge, skills, and abilities to recognise a potential delirium, articulate its presence to appropriate clinicians, and undertake associated nursing interventions. There is a plethora of tools used to support identification, such as the Confusion Assessment Method (CAM) (Inouye et al., 1990), which has multiple speciality variations (Marcantonio, 2019; National Institute for Health and Care Excellence, 2023), 4AT (MacLullich et al., 2014) and Single Question in Delirium (SQiD) (Sands et al., 2010). All have key components of recognising a change in cognition from a baseline but require a varied amount of time, training, and competence level. Considering the variation of tools available, and their utility in practice, Pryor (2021) found that in a sample of UK-based mental health nurses, there was a disconnect between a high awareness level of tools available to support delirium recognition and assessment, their actual use in practice, and a lack of consistency of tools selected for use. In addition, selected tools of assessment need to be seen as useful in order to be used, or risk devaluing professional autonomy (Gabbay & Le May, 2016; Bryce et al., 2018; Emme, 2020). There is a risk that binary metric-based tools may be perceived as organisational requirements (i.e., daily audits or bundles of pre-determined care) and not as influential to care decisions if they are seen as reducing people and their presentations to numbers or scores (Pryor, 2021).

Contemporary recommendations from the United Kingdom (based on an appraisal of diagnostic sensitivity, specificity and considerations of implementation, evidence quality and applicability to a range of practice areas) are that delirium assessments should be completed using the 4AT (National Institute for Health and Care Excellence, 2023). Whilst diagnostic tools are useful, student nurses need to first understand that delirium recognition is routed in non-clinical, person-specific, 'soft signs', then consider delirium assessment, leading to the formulation of a nursing plan. These signs and symptoms may include people being more confused, having difficulty following conversations, being less aware of their surroundings than usual, being frightened of dreams which may carry on when awake, visual and aural hallucinations, being worried people want to cause them harm, increased restlessness or agitation, movements slowing or being more drowsy than usual, reduced diet and fluid intake, and seemingly having a change in their personality (Health Improvement Scotland, 2020).

Historically, delirium has received little attention in nurse education, and discussions of new or acute 'confusion' do not represent the critical mass of physiological processes at play. Delirium education for nurses is evolving, with recent studies into novel and innovative ways to support delirium education in undergraduate curricula being published. In America, Davis and Nye (2017) utilised clinical simulation exercises to support assessment and communication skills in delirium care for older people experiencing delirium. More recently, responding to the need to transfer learning online due to the COVID-19 pandemic, Mitchell et al. (2021) in Northern Ireland created a delirium awareness podcast for first-year student nurses centring on delirium recognition, management, and prevention. Both interventions seem well received in education practice.

At the study's Higher Education Institution, prior to the substantial curriculum redesign in 2019, minimal focus was placed on delirium within the undergraduate nursing curricula. With rising awareness of delirium as a preventable and treatable condition and the complexity of diagnostic and descriptive terms representing the delirium presentation, education and support resources were developed. Initial integration of delirium education took place in the final year of the three-year degree pathway; however, this was considered to be too late in the nursing learning journey. The recent redesign of curricula has seen delirium education embedded into the first semester of the first year.

The United Kingdom's educational standards for preregistration nursing are set out by the Nursing and Midwifery Council (Nursing and Midwifery Council, 2018a; 2023). To allow approved Higher Education Institution's flexibility and creativity in the nursing programmes, the Nursing and Midwifery Council's nursing educational standards are reviewed and updated regularly (Nursing and Midwifery Council, 2023). While regular updates can lead to the challenge of frequent changes to curriculum and programme delivery, it does ensure that the educational requirements of 21st-century nurses are met and support local education institutions to be accountable in their educational approaches (Nursing and Midwifery Council, 2023).

The educational intervention

The session reported in this paper was created under the 2018 Nursing and Midwifery Council education standards (Nursing and Midwifery Council, 2018a). The module, which is delivered in Semester 1, Year 1, is a hands-on skills module that reflects the Nursing and Midwifery Council standards of proficiencies for registered nurses (Nursing and Midwifery Council, 2018b) in its learning outcomes. The Annexe B nursing procedures that were the focus of the session evaluated included symptoms and signs of deterioration and sepsis and symptoms and signs of physical ill health (Nursing and Midwifery Council, 2018b). Recognising sepsis and patient deterioration is a fundamental skill and topic that is scaffolded throughout the Higher Education Institution's 3-year BSc adult nursing programme.

In response to the nature of education delivery brought about by the COVID-19 pandemic and the subsequent return to learning with a hybrid of online and face-to-face delivery, the module adopted a novel delirium education. The module achieved this by merging a blended learning pedagogy of online-supported learning resources with face-to-face, scenario-based and simulation-based education. This supported students to recognise, understand, and consider the management of people presenting with delirium. Integrating online learning in higher education institutes to facilitate learning and student experience is not a new paradigm (Raymond et al., 2016; Dziuban et al., 2018). However, in recent years, programmes such as nursing have seen an increase in the method of delivering learning and instructions (Juan, 2021; Janes et al., 2023).

Blended learning has been defined as "a method of teaching that integrates technology and digital media with traditional instructor-led classroom activities, giving students more flexibility to customise their learning experiences" (Panopto, 2019).

Blended learning approaches may take three forms: one in which learners have the opportunity to exert control over the pace at which they learn using online resources, one in which learners utilise online learning and classroom-based activity, and one in which online and classroom-based learning are integrated and complementary which aids deeper learning and understanding. The latter is also known as the flipped classroom pedagogy (Janes et al., 2023).

The delirium learning intervention was developed to include an Online Supported Learning package that was to be completed prior to undertaking a face-to-face learning session with case-based activity centring on the art of noticing and recognising the acutely unwell adult in relation to sepsis and delirium. The delirium online learning package was written by two academic staff who had significant practice and academic experience relating to delirium practice and education. The face-to-face session was devised by the education module leader, drawing upon the aims and objectives of the education programme of study and delirium education package.

The delirium resource evaluated in this study was specifically created to be an online-supported learning-based activity, with students engaging in the resource as part of their self-directed study hours. The delirium resource sits within a Year 1 (all fields) nursing module, which has learning outcomes focused on developing nursing assessment skills such as taking and recording vital observations and the art of noticing skills.

The Delirium Online Supported Learning package used several strategies to illustrate delirium information and to engage students in delirium learning; these included case study activities, videos, imagery, and text. The knowledge gained from the resource included what delirium is, how it is defined, assessment tools for delirium, predisposing and precipitating factors, signs, and symptoms, reducing the risks of delirium, treatment, and nursing considerations for care.

Consolidation of learning the delirium online supported learning was undertaken in a face-to-face, classroom group activity. The blended approach in this instance, therefore, adopted a flipped classroom pedagogy. While the session's primary focus was on the topic of sepsis, one of the three activities presented students with two standardised patient case studies: one patient had risk factors and signs and symptoms of sepsis and the other had delirium of unknown medical origin. The two case studies provided students with patient information such as past medical history, their most recent set of vital observations, medication and any need for medication assistance, sensory needs, signs and symptoms, recent behaviour, and lifestyle information. Students were asked to review the information and answer the following questions:

- What do you think is wrong with the patient?
- What is your rationale?
- What else have you noticed which is significant?

Answers and rationale were then discussed as a group at the end of the session once all activities had been completed. All scenarios held components that could point to a potential delirium, but an extrapolation of underpinning rationale and actions was required.

Methodology

Study aims

This study aimed to:

- Evaluate and explore first-year student nurses' perceptions and experiences of a blended delirium education package (online and in person).
- Explore if students believe this will change or influence their practice.

Methods

In keeping with the study's aims to explore and evaluate student experience, a pragmatic mixed methods approach was developed. Crossing traditional research polarities of constructionist and positivist methodologies, a pragmatic approach affords researchers the opportunity to situate their research in an alternative paradigm: one which embraces the presence of single and multiple realities and explores these through empirical inquiry (Creswell & Plano Clark, 2007). Pragmatism recognises the complex contexts in which research sits, including social, historical, and political influences (Creswell & Creswell, 2018). As a result, pragmatic research is grounded in what works, for whom, and with what application or solutions (Patton, 2002).

A mixed methods approach was chosen to support 'completeness' within the study by combining qualitative and quantitative data. This offers a more comprehensive account than what could be derived through quantitative or qualitative data alone. Mixed methods approaches are clarified by Creswell and Plano Clark (2007) and Teddlie and Tashakkori (2009) as the inclusion of both qualitative and quantitative data collection methods to be used in one study rather than multimethod where several different qualitative or quantitative data collection processes are undertaken. Importantly, mixed methods approaches are employed when there is a clear aim to integrate or mix the two strands of investigation with purpose and rigour. This offers strength to inferences made and a greater sense of completeness and understanding (Morse, 2003; Tashakkori & Teddlie, 2003). For this study, a single-phased, triangulation design achieved a fit with the research purpose, allowing for the simultaneous collection of qualitative and quantitative data to draw together the strengths of both types of data collection (Figure 1). These are identified in sample size traditions: with quantitative studies usually requiring a large sample size, and qualitative requiring less. However, where sample sizes may be smaller, the addition of qualitative data offers depth and detail to the study (Patton, 1990; Cresswell & Plano Clark, 2007). The use of a single triangulation design supported a comparison between the qualitative experience and perceptions of the participants with the statistical data. This served to validate and expand the understanding of the student experience past a numerical understanding.

An online, post-learning package questionnaire was completed by participants. The questionnaire was devised and housed in the JISC™ online survey system. The questionnaire consisted of a blend of 12 Likert items and associated qualitative free-text response options. This allowed for the generation of statistical data and a deeper qualitative understanding of the respondents' thoughts and opinions.

Data analysis

Quantitative data was analysed using simple non-parametric tests (descriptive statistics). This is in keeping with the study's aims to evaluate and explore perceptions rather than hypothesis testing or comparison analysis.

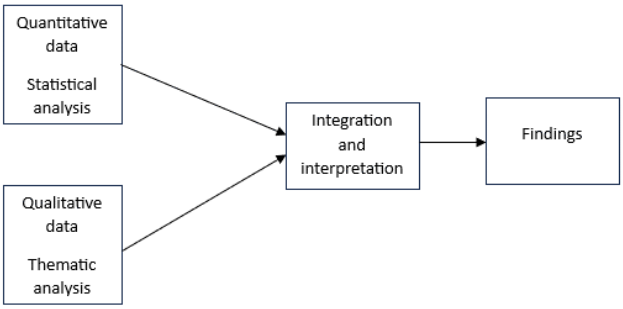

Figure 1: Research design.

Qualitative free-text responses were thematically analysed using Braun and Clarke's (2006) six-step approach to thematic analysis consisting of familiarisation, initial code generation, thematic search, review, defining and naming themes, and production of the report. Both authors conducted an analysis of qualitative responses independently prior to review and confirmation of the final three themes. The final analysis integrated qualitative and quantitative data to offer depth context to the understanding of the participant experiences.

Ethics

This study was granted ethical approval by the host university's Faculty of Health and Life Sciences (ethics reference 2022-0291-105).

Sampling and recruitment

All enrolled first-year adult nursing students at one United Kingdom Higher Education Institution were timetabled for workshop activity and instructed to complete the online supported learning as part of their undergraduate education (N=270). Purposive sampling was used to recruit participants following the timetabled sessions. Students were provided with information about the study and a link to an online questionnaire via the Learning Management Portal announcements system and linked emails. Follow-up announcements and a linked email were sent two weeks following the final education session. Potential participants were informed that their participation was voluntary, and all data was anonymised at the point of questionnaire submission. n=49 participants completed the questionnaire. All participants confirmed that they had completed both parts of the education strategy at the start of the questionnaire.

Findings

Two key findings can be drawn from the integration of the qualitative and quantitative data. These are an acknowledgement of the complexity of delirium and a bridge between online supported learning and classroom teaching and learning activity.

Acknowledging complexities of delirium

The blended activity increased the participant's confidence in delirium identification and ability to discuss delirium with their teams. Prior to undertaking the package, 44.9% (n=22) of participants expressed that they felt they knew what delirium was, with just 36.7% of participants (n=18) expressing confidence in recognising delirium (Figure 2). However, only 24.5% (n=14) felt they had cared for someone with delirium before.

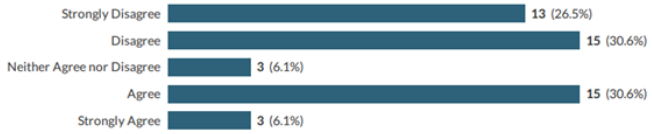

Figure 2: Agreement level "Before completing the online supported learning and attending the session, I felt confident in recognising delirium".

Following the blended learning activities, 89.8% (n=44) felt increased confidence in identifying potential delirium, and importantly, 89.8% (n=44) of the participants felt more confident in discussing delirium with their teams in practice after the sessions (Figure 3).

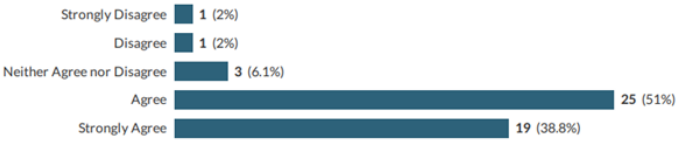

Figure 3: Agreement level "After the session I felt more confident I could identify potential delirium".

Whilst it could be identified that most participants did not have prior practical experience of delirium care provision, this needs to be considered with caution as the findings show that they also were unaware of the complexity of delirium and the full range of presentations. It may suggest that the participants did not recognise delirium prior to undertaking the learning activities, but that they may be better placed to recognise it now. Three participants' comments highlighted this, regarding their experiences of delirium care provision prior to the education package, in addition to acknowledgements of the complexity of delirium.

> [I] knew a lot around hyperactive delirium but not much about hypo delirium.

> … it was useful to be reminded that delirium is not always challenging behaviour - it can present as quiet and withdrawn, which I had never experienced.

These participants indicated that there is a need to draw attention to the complexity of delirium. It is not only the overt behaviour that indicates the presence of delirium. One participant suggested that an important factor in the education package was the articulation that delirium is

often multifaceted and may have many predisposing or precipitating factors.

> Knowing that delirium can be caused by numerous things.

Overall, the results show that there was a self-perceived improvement in confidence to recognise. This was coupled with a participant demonstrating that the importance of delirium recognition had been conveyed through education, irrespective of their current ability to recognise it.

> I was disappointed in myself I did not recognise the diagnosis in class.

Bridging the online supported learning and classroom teaching and learning activity

91.8 % (n=45) indicated agreement that the education package had improved their understanding of delirium; with the same proportion in agreement that the blended approach of preparatory online supported learning and classroom activity helped them to learn (Figure 4).

Figure 4: A combination of online-supported learning and classroom activity-supported learning.

Overall, 96% of participants reported that the materials on the online learning portals enhanced their learning, with only 4.1% (n=2) disagreeing. Further qualitative analysis indicated that for one participant, the volume of content in the [online supported learning] may have been hard to remember and time-consuming, with expectations of familiarity with content hard to achieve.

> lectures expect us to remember everything for an [online supported learning package] that is like taking us nearly two and a half hours to do (while taking notes, and not including side reading) and is full of so much information.

In addition, it was found that whilst the materials and classroom activity were useful and supportive as a total package, the qualitative text indicated that the balance struck in the classroom activity did not meet the students' expectations. They indicated that there was an overt focus on sepsis, and whilst delirium was present, they did not consider that to be the main facet of the face-to-face activity.

> The session was largely focused on sepsis, but the [online supported learning] was very helpful on delirium.

> [Online supported learning] yes, workshop session not as much. It only got spoken about when we did the case studies.

The participants showed a desire for more delirium-specific work to be added to the curriculum, matching, enhancing, and replicating the broader teaching and learning approach undertaken. This was coupled with requests for more time dedicated to delirium.

> Maybe include a delirium simulation alongside the sepsis one.

> ...more time to have a go at the simulation.

Whilst this indicates that there is a need to review the balance between the content and delivery, participants commented positively about the activities and overall strategy used. Specifically, the participants found the best features of the programme to be the interactive components and tutor support.

> The interactive quizzes and useful information...

> ... keeping it interactive and having to work out a diagnosis, as well as moving around different activities in smaller groups.

> [Online supported learning]: you learn at your own time and pace and anywhere. Classroom- face-to-face learning is also important as you have a better understanding of the subject in question, where you have the opportunity to ask questions and have things explained in detail.

Overall, there was satisfaction among participants in the quality of the teaching and learning strategy, and they found it intellectually stimulating (Figures 5 and 6).

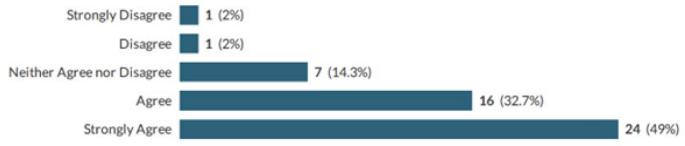

Figure 5: Agreement: Overall I am satisfied with the quality of the Delirium online supported learning and workshop session.

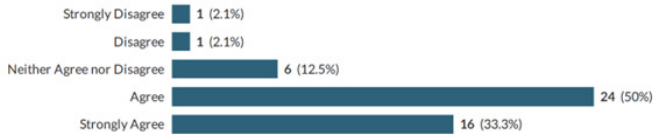

Figure 6: Agreement: The delirium content was intellectually stimulating.

Discussion

This study reports a novel delirium education intervention that exemplifies blended learning, flipped classroom pedagogy in which online and classroom-based learning are integrated and complementary to aid in deep learning of delirium. The inclusion of a standardised patient case study discussion offers an additional link to the growing field of simulation in nurse education. Including a delirium-simulated workshop additionally supports the new education standards published in January 2023 (Nursing and Midwifery Council, 2023). These standards have seen a transition from the more traditional methods of teaching to a contemporary pedagogy, with key changes including increased flexibility around simulated learning (Nursing and Midwifery Council, 2023). Simulation is defined as a technique to replace or amplify real experiences with guided experiences, often immersive in nature, that evoke or replicate substantial aspects of the real world in a fully safe, instructive and interactive fashion' (Health Education England, 2020, p. 6) Simulation-based education in nursing is considered an empowering and valuable teaching pedagogy that allows students and nurses to develop knowledge, skills and attitudes in a safe and controlled environment. This enables them to be reflective, make clinical decisions and do problem-solving, which provides preparation for clinical practice (Theobald, 2021; Martins et al., 2023) and managing of deteriorating patients (Bliss & Aitken, 2018). Health Education England (2018, 2020) recognises and supports the role of simulation and immersive learning in developing the healthcare workforce. While technology is predominately associated with recreating real-life simulated scenarios, simulation-based education can adopt multiple approaches that do not have to include technology and these can include verbal simulation, role play and standardised patients (Gaba, 2004). In addition, the simulation-based education strategy for learning and teaching is not exclusive to only including the simulation of clinical hands-on skills, with the approach also including the simulation of non-clinical soft skills (Sterner et al., 2023).

Delirium education in undergraduate students is evolving rapidly; however, the literature focuses predominantly on medical education. This study adds to the current body of literature that specifically focuses on nurse education. Echoing Mitchell et al. (2020), this study shows that supported education pertaining to delirium recognition, treatment, and management facilitates confidence within nursing students and supports interprofessional communication. This study clearly indicated an increase in the participant's confidence to discuss potential delirium presentations with members of the healthcare team. This is paramount to high-quality delirium care and supports positive steps towards prevention early recognition, treatment, and management. Whilst other healthcare professionals are vital for delirium care, nurses in hospital settings (Irving & Foreman, 2006; Fisher et al., 2015), and in care home environments spend more time with patients or residents than other healthcare professionals (Siddiqi et al., 2011). Therefore, a critical focus should be placed on nurse education regarding delirium, commencing at the start of education preparation to support, enhance and refine their understanding and insight into delirium. More broadly, it is recognised that health professionals in general have deficits in knowledge, confidence and skills pertaining to recognition, treatment and management of delirium (Sinvani et al., 2016). Studies by Fisher (2015), Copeland et al. (2017), and Copeland and Barron (2020) concur that across both medical and nursing undergraduate education, delirium provision is sporadic, inconsistent, and devised as per the individual universities' priorities and agenda. This is echoed in the UK Nursing and Midwifery Council Education standards (2018), in which delirium is not specified as to be included in the curricula, either as a condition to be taught or in terms of other content provisions. As with medical education, it falls to the specific university to decide upon inclusion and content. Investigating the nursing delirium education provision and content in Scotland, Copeland and Barron (2020) found a varied strategy. Concerningly, curricula appeared to be based, in some instances, on dementia principles and guidance which may add to the complexity, confusion and ill-preparedness of student nurses to support people with delirium. Whilst delirium and dementia share some similarities, and may co-exist in complex patient presentations, they are distinctly different conditions requiring specific tailored approaches and care interventions (Pryor & Clarke, 2017; Pryor, 2021).

As such, this study and educational intervention may support clinician education and practice to support the wider evolving multidisciplinary team awareness and confidence regarding delirium.

It is therefore proposed that for future sessions, the delirium workshop will adopt a verbal simulation approach to teaching and learning with delirium case studies supporting students in a safe environment to develop their knowledge, skills, attitudes, self-efficacy and self-confidence in caring for the delirium patient. The flipped classroom approach will first be adopted with students engaging with a delirium online supported learning package, before taking part in a simulated live delirium workshop. The flipped classroom tool, compared to other traditional methods, has been found to successfully engage students in learner-led learning whilst maintaining the ability to have tutor input and direction (Kemp, 2020) and improve overall levels of learning (Shikino et al., 2022). However, finding a balance in combining face-to-face with technology and self-directed learning is important to ensure that they enrich traditional teaching methods (Merrou et al., 2023). The balance for the delirium workshop was created with the intention that the online supported learning will complement and support the facilitation of the face-to-face classroom activities that aim to engage students in verbal simulated discussions of delirium patients. Shikino et al. (2022) support this approach with live classroom time being specifically allocated to consolidating new learning materials and knowledge (in this case, the online supported learning), which is aided through the support of an academic and through collaboration with peers. Their study which explored the flipped classroom approach for improving interprofessional collaborative competency in delirium care, found an improvement in collaborative practice straight after the learning occurred, as well as 3 months post-learning (Shikino et al., 2022). The use of patient case studies and/or scenarios is another key aspect of creating a successful simulation activity. Martins et al. (2023) outline the importance of creating case studies/

scenarios for simulation, with them needing to not only align with the learning outcomes but also be interactive and reflect real clinical practice situations and evoke real feelings and emotions.

In this study, the case studies for the face-to-face workshop were created by an academic who has clinical experience and expertise in delirium as a condition as well as in the care and management of patients with delirium. By using the verbal simulation strategy via the creation of delirium patient case studies, the simulated workshop will be sustainable for future teaching deliveries as it removes the costly requirement for high-fidelity simulators and staff who are trained to use them. This is a common barrier to simulation within healthcare (Ferguson et al., 2020).

Conclusion and recommendations

Early inclusion of delirium education supports student nurses in starting to feel confident in delirium discussion and understand the complexity of the condition. The rapidly evolving education context towards blended and simulation approaches is changing the landscape of nurse education. This study demonstrates that a blended approach, including simulation via a standardised patient case study, can contribute positively to the student learning activity and demonstrate engagement and a desire for more learning. There is a need to ensure focus is retained in blended approaches, and clear demarcations between conditions and symptoms may support first-year nurses in grasping the principles of care before moving towards more critical and integrated cases and presentations.

The outcome of this evaluation study of current delirium teaching has resulted in planned changes to the learning materials within the first-year skills module. The curriculum was redesigned to incorporate a standalone delirium workshop which sits within the pedagogy of simulated learning. This inclusion addresses the requirements of the 2023 educational standards and Higher Education Institution's requirement to acknowledge such changes and to take action within two years of their publication (Nursing and Midwifery Council, 2023).

As a direct result of this study, it has been recommended that instead of combining a delirium simulation-based learning experience with the sepsis session, delirium would be removed from the sepsis simulation and afforded its own independent simulation. When looking to replace existing materials with the new delirium content, it was important to consider the students' voices from module feedback along with the Nursing and Midwifery Council annexed proficiencies (Nursing and Midwifery Council, 2018b). As delirium presentations signify an acute medical condition and should be seen as a medical emergency, the session would address the symptoms and signs of physical ill health annexe B nursing procedure proficiency and therefore, help consolidate other sessions within the module. In addition, as delirium has cognitive and emotional effects, it addresses the annexe B procedures of symptoms and signs of physical distress and signs of cognitive distress and impairment.

Furthering education outside of Higher Education Institutions and nursing, it is recommended that education takes an interprofessional and transdisciplinary approach to support positive communication and recognition of the valuable insight and skills that all members of the disciplinary team can contribute in terms of delirium care and knowledge. This may support nurses' and other professionals' recognition and awareness of all types of delirium, and how to manage and treat them appropriately.

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Integration of clinical simulation into a post-registration neurological course: Insights from the students on the use of a flexible approach to debriefing

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Abstract

Background: This hermeneutic-phenomenological study explored the integration of simulation-based training and flexible debriefing techniques within a post-registration neurological course for registered nurses. It aimed to understand the potential of these teaching strategies to enhance clinical skills and encourage confidence in neurological practice.

Aim: The research sought to explore the lived experiences of post-registration neurological nursing students, emphasising their interaction with clinical simulation and flexible debriefing methods to enhance their learning experiences.

Methods: Adopting a hermeneutic-phenomenological research design, the study examined the experiences of ten registered nurses, gathering data through semi-structured interviews and focus groups. The resultant data offered a rich understanding of their engagement with the simulation-based course.

Findings: The thematic analysis of the data revealed four dominant themes: (1) self-evaluation and critique, (2) group discussion and collective learning, (3) confidence building, and (4) interface of theory and practice. These themes provided a nuanced understanding of the participants' experiences with the course and its pedagogical strategies.

Conclusion: The findings accentuated the transformative role of high-fidelity simulation, complemented with flexible debriefing techniques, in enhancing the participants' self-confidence, neurological knowledge, and clinical skills. Despite some challenges relating to reconciling student expectations with the reality of mannequin-based simulation, these insights illuminate the intrinsic value of flexible debriefing as a pivotal tool in supporting other pedagogical strategies, thereby enriching the overall student experience within this post-registration neurological course.

Introduction

The evolution of simulation as an educational tool in nursing has gained significant traction, propelled by advancements in technology that facilitate the preparation of students for clinical practice, enhance patient safety, and mitigate risks (Basak et al., 2016). Its educational merits, particularly in the recognition of deteriorating patients and the integration of theory and practice, have been demonstrated in studies which have documented perceived improvements in patient care (Morris et al., 2019).

Simulation-based training can range from low fidelity, involving case studies and/or static mannequins, to high fidelity simulation, which incorporates advanced computer-integrated mannequins that can emulate a wider range of technical and non-technical skills (Basak et al., 2016). Regardless of the level of simulation, the facilitation of learning and the use of debriefing and reflection on the experience are often regarded as the bedrock of learning in clinical simulation (Arnold et al., 2017).

Typically, high-fidelity simulation entails a single simulation scenario followed by a debriefing session (Lopreiato, 2016). However, the unpredictable nature of patient encounters in a real-world setting and the potential for knowledge attrition over time might impede the learners' ability to apply the knowledge acquired during simulation-based training (Sittner et al., 2015). In this context, the use of flexible debriefing techniques can enhance the learning process by allowing for the adjustment of debriefing methods based on the learners' needs and the specific context.

Neurological simulation: Contextualising local factors

Neurological simulation constitutes an integral part of a ten-week post-registration course introduced in 2020 to augment other teaching pedagogies. This course is primarily attended by registered nurses and is delivered by academics and clinicians with neurological expertise. The key facilitator for the simulation is a critical care practitioner and academic with expertise in simulation.

The simulation session employs a hybrid model incorporating both high and low-fidelity simulation activities. These sessions are held in the clinical skills centre, with an aim to consolidate and challenge learners by linking theoretical knowledge to practise when caring for neurological patients. The high-fidelity simulation focuses on a traumatic brain injury scenario, emphasising the need for a rapid and accurate neurological assessment, treatment implementation, and re-evaluation of a deteriorating patient. The key learning objectives for the high-fidelity simulations include identifying relevant components of a neurological examination, recording an accurate Glasgow Coma Score, conducting an SBAR handover, considering investigations, diagnosis, and potential treatments for the deteriorating neurological patient, and working effectively within a group to share roles and make decisions.

A structured framework is used, which includes a pre-brief, flexible micro-debriefs during the simulation, and a formal debrief at the end of the simulation. The pre-brief aims to orient learners to the simulation experience and create a psychologically safe environment. During the pre-brief, learners are allocated into two groups to discuss the scenario and potential roles before entering the clinical skills room. The first group assesses the stable patient (mannequin) with a traumatic brain injury using the Airway, Breathing, Circulation, Disability, Exposure (ABCDE) assessment framework, documenting their findings before handing over to the second group, who have been observing. The second group is then expected to assess and manage the deteriorating patient, necessitating an ABCDE review, neurological assessment, and the initiation of relevant investigations and treatment. Meanwhile, the first group assumes the role of observers.

A blended approach to debriefing is employed, integrating micro-debriefing and feedback using a flexible debriefing technique, facilitated by the academics. This is followed by a formal debrief at the end of the simulation. This formal debrief incorporates individual reflections, feedback, and shared discussions. According to Verkuyl et al. (2019), the deliberate use of more than one debriefing approach can be more effective and should be tailored to the learners and the simulation context.

The research study discussed in this article involved a cohort of learners who completed both simulations on the final day of a Neurosciences course in March 2022. The complete study is presented in another article (Derbyshire et al., 2023). However, this article will focus solely on the findings of the high-fidelity simulation and the use of a blended approach to debriefing using flexible debriefing techniques.

The study

Research purpose, aim and objectives

The purpose of this study is to deeply investigate the integration of simulation-based training and flexible debriefing techniques within a post-registration neurological course for registered nurses. Specifically, it aims to illuminate how these pedagogical strategies impact the learning experiences and clinical skills development of the participating nurses. By exploring the lived experiences of these students, the study intends to unravel the various dimensions of their engagement with these teaching methods. It seeks to understand the role these strategies play in fostering self-evaluation, group learning, and confidence building and how the interface of theory and practice provided by simulation shapes their neurological knowledge and skills. Further, the study aims to discern the challenges presented by mannequin-based simulation and how flexible debriefing can mitigate these to enrich the overall student experience.

The research question guiding this study is: How does the integration of simulation-based training and flexible debriefing techniques impact the learning experiences and clinical skills development of registered nurses in a post-

registration neurological course?

Aim

The aim of this study is to explore the impact of integrating clinical simulation and flexible debriefing techniques into a post-registration neurological course on the clinical skills development, self-confidence, and learning experience of registered nurses.

Objectives

1. To understand the lived experiences of post-registration neurological nursing students in terms of interacting with clinical simulation and flexible debriefing methods.
2. To analyse the role of clinical simulation and flexible debriefing methods in promoting self-evaluation, critique, and confidence-building among registered nurses.
3. To evaluate the influence of clinical simulation and flexible debriefing methods on group discussion and collective learning among participants.
4. To explore the impact of the interface of theory and practice provided by the clinical simulation on the participants' learning experience and clinical skills development.
5. To assess the challenges and benefits related to the use of mannequin-based simulation and flexible debriefing techniques in the post-registration neurological course.

Methodology and methods

This study employed a hermeneutic-phenomenological research design as proposed by van Manen (2014). This design is nested within the interpretive paradigm, which recognises reality as a socially constructed entity (Bogdan & Biklen, 1998).

Semi-structured interviews were selected as the primary data collection method in this research. This method is widely recognised as an effective tool in qualitative research due to its ability to facilitate in-depth exploration of individual experiences (Brinkmann, 2013). Four participants opted for individual interviews, whereas the remaining six preferred to participate in small focus groups of three, following their simulation session.

The interviews and focus groups were conducted by a member of the research team who was not directly involved in the simulation, thus ensuring impartiality. Each interview and focus group lasted between 25 and 40 minutes. The combination of both individual interviews and focus groups added depth and breadth to the data, yielding multiple perspectives on the shared experience of the simulation (Baillie, 2019).

Participant sample

All participants in this study were registered nurses with diverse neurosciences experience. They held various clinical positions and grades while concurrently being enrolled as university students. After registering for the Neurosciences course in March 2022, these participants were selected and briefed on the study's requirements during an initial meeting. The study included a total of ten participants, which is in alignment with the recommended sample size for phenomenological research (Hennink & Kaiser, 2022).

Ethical considerations

The study received ethical approval from the Ethics Committee at Northumbria University. Prior to their participation, all participants provided written consent. They were fully informed about the purpose of the study, the procedures involved, as well as potential risks and benefits. The research was conducted adhering strictly to the ethical guidelines for educational research (British Educational Research Association, 2018).

Data analysis

A qualitative approach, specifically thematic analysis (Braun & Clarke, 2006), was utilised in the data analysis process for this study, guided by the principles of hermeneutics. The hermeneutic phenomenology framework, as proposed by Ajjawi & Higgs (2007), was followed. This includes six steps: immersion, understanding, abstraction, synthesis and theme development, illumination and illustration of the phenomenon, and integration and critique. The systematic nature of this six-step process strengthens the credibility and trustworthiness of the study findings (Braun & Clarke, 2019). This approach is particularly adept at exploring individuals' lived experiences, providing insight into their perspectives and interpretations of a phenomenon (Nowell et al., 2017). Each member of the research team conducted the analysis independently, with the final themes being agreed upon following a group discussion. This approach fostered a rigorous and collaborative analysis of the data.

Findings

The following four key themes emerged from the narratives: (1) self-evaluation and critique, (2) group discussion and collective learning, (3) confidence building, and (4) interface of theory and practice. These themes will be explained and supported by verbatim quotes with their participant number.

Theme 1: Self-evaluation and critique

All participants were very self-evaluative during their interviews, both within micro-debriefs and the Rapid Cycle Deliberate Practice (RCDP) (Peng & Schertzer, 2023) during the simulation and the debriefing at the end of the session, where they reflected on their performance and appeared to be very critical of themselves:

> I knew I was being too critical of myself as it does makes me nervous, but I actually did much better than I thought during the assessment. (P2)

> During simulation, it is expected that you perform. We are being observed by colleagues and the lecturer, and when getting asked questions, I was worried I was going to freeze, but everyone was there to help; I know I am hard on myself. (P6)

However, the more experienced nurses were more confident and recognised the importance of reflection and self-evaluation but could see how simulation made some of the other participants feel:

> I was fine, but some people were really critical of themselves, but there was no need – they were all good. I personally took a lot of learning from this, and I was not worried about how I was in the situation; it is all part of the learning. (P1)

Theme 2: Group discussion and collective learning

The findings showed that the blended approach to debriefing was crucial for all participants as they learnt from each other's experiences as a whole group.

> It was good to discuss our roles before the simulation as a group and then during and after the event. The briefing with … was so helpful for learning. (P1)

> I realised I did not have a clear role in the simulation, but I was able to see what others did as an observer... But I still learnt from this, and this was discussed during the simulation and in the debrief. (P6)

The debrief at the end of the simulation appeared to provide the best opportunity for group discussion and learning:

> The debrief was good for us all to discuss how we did but also breaking up the scenario and discussing what happened to the patient. (P2)

The debriefing session was crucial for all participants as they learned through discussion and debate in small groups. They reflected on their roles, regardless of whether they had a direct role during simulation or as an observer, with both roles seen as equally important.

Theme 3: Confidence building

The findings showed that for most participants, simulation had helped boost their confidence and this was helped by the micro-debriefs during the simulation, where they were questioned by the facilitator and encouraged by their peers:

> I personally took a lot of learning from the simulation, and it made me think I knew a lot more than I thought, helped by the group and people I work with in practice who know me well and know how I work. (P2)

> Positive feedback in the simulation from others… and some of my colleagues helped to boost my confidence. (P6)

> The tutors in the simulation were good at giving positive feedback to everyone... We all wanted to know more, so our care was better, and this made me feel more confident. (P5)

Some participants did not feel confident initially and felt others from a more critical care background had more confidence:

> I know I did nothing wrong, but I think I could have been better, I watched the other group and thought they were really good; they have ITU experience and have one-to-one care, and they just showed a much better knowledge… than me. (P8)

Despite the lack of confidence in some of the participants, it was clear that the blended debriefing approaches helped most of the participants to develop some confidence with a realisation that they had more knowledge and skills than they previously thought. Positive feedback from others, including the facilitators and peers, was seen as important for confidence and subsequent learning.

Theme 4: Interface of theory and practice

Lastly, participants acknowledged that the simulation and debriefing approaches were not just a test of their knowledge but an opportunity to learn and apply the skills taught during the course:

> During the discussion, we talked about some of the theories and why we did certain things, which linked back to our classes and how the skills and knowledge could be applied to this scenario. (P3)

> The facilitators pulled out the knowledge from us and helped us to link the theory to practise during the session and in the briefs. (P9)

The aim was to enhance their performance through such discussion and subsequent care in the real world of neurological practice:the best opportunity for group discussion and learning:

> The debrief was good for us all to discuss the patient, what went wrong... how we could improve our performance in the future. (P2)

> It was about the learning we gained from the course and how we could use it in practice, and we all wanted to know more so our care was better for patients. (P6)

There were challenges highlighted by some of the participants in relation to the reality of the mannequins, which made it difficult to link theory to practice, and this

was an issue discussed both during simulation:

> The dummies were not very real, especially for neuro patients, so in the simulation, I was looking more at the monitor, and this means you miss out on the real person, not like practice, and we all… discussed that in the debrief. (P2)

> [I] feel silly talking to the mannequins…it does not feel real, and this can affect the learning. (P9)

Discussion

The exploration of student experiences regarding the integration of clinical simulation within a post-registration neurological course, with a specific focus on a blended approach to debriefing, revealed significant findings. The emergent themes of (1) self-evaluation and critique, (2) group discussion and collective learning, (3) confidence building, and (4) interface of theory and practice encapsulate the lived experiences of the participants, who were registered nurses and postgraduate students. These themes echo the tenets of hermeneutic phenomenology and highlight their relevance in the context of clinical education (Smith et al., 2009).

The theme of self-evaluation and critique was prominent among the students. Hermeneutic phenomenology underscores the significance of reflective interpretation in understanding lived experiences, a concept that resonates with the demands of neurological nursing (van Manen, 1990). The tendency towards high self-criticality among novice nurses, as described by Fawaz, & Hamdan-Mansour (2016), was evident in some participants' narratives, suggesting a struggle with self-confidence in simulation-based learning. However, experienced practitioners, like P1, valued self-evaluation as a critical part of their learning process. Such a perspective aligns with Benner's (1984) stages of clinical competence. It indicates that self-reflection and critique play a vital role in progressing from novice to expert, particularly in the specialist field of neurological nursing.

Group discussion and learning, another emergent theme, played a central role in the blended debriefing approach, reinforcing the power of collective learning within clinical simulations (Rudolph et al., 2008). This finding resonates with Gadamer's (1975) assertion of understanding as a dialectical process. The enriched understanding gained from these discussions elucidates the importance of peer interaction and shared learning in the complex field of neurological care. The value placed on both active and observer roles within the simulation echoes Heidegger's (1962) hermeneutic stance, suggesting that varying perspectives can contribute to a deeper and more comprehensive understanding.

Confidence building was a crucial theme, shedding light on the psychological aspects of integrating clinical simulation into post-registration neurological nursing education. The blended debriefing approach, coupled with positive feedback, significantly influenced the participants' confidence levels, supporting Liaw et al.'s (2014) findings regarding the role of simulation in enhancing self-efficacy. Participants' narratives revealed a transition from initial self-doubt to increased confidence, reflecting Heidegger's (1962) concept of 'being-in-the-world', where individuals interpret and make sense of their experiences. This process is especially vital in the context of neurological nursing, where the complexity of care necessitates high levels of confidence and competence. The theory-practice interface emerged as a significant theme within the neurological course. Participants appreciated that the simulation and debriefing provided an opportunity for learning and applying theoretical knowledge to practice, a viewpoint aligning with Gadamer's (1975) theory of knowledge evolution through reflective practice. However, the challenge of realism in mannequin-based simulation posed some difficulties in effectively linking theory to practice. This finding suggests the need for enhancements in simulation realism or high-fidelity simulations in neurological nursing education, as advocated by Hayden et al. (2014), to bridge the theory-practice gap more effectively.

These findings reinforce the need to support students' reflective skills and self-evaluation, encouraging critical thinking within their learning journey (Mann et al., 2009). The positive impact of group discussion and learning emphasises the importance of a collaborative learning environment, fostering a shared understanding of complex neurological care scenarios, as suggested by Dreifuerst (2015).

The role of confidence-building within the blended debriefing approach has significant implications for nursing educators. Incorporating strategies to enhance students' self-efficacy in clinical simulations, particularly in challenging neurological care situations, is paramount (Bandura, 1994). This process is greatly facilitated by constructive feedback and support from educators and peers.

The connection between theoretical knowledge and clinical practice, as highlighted in this study, signifies the need for a holistic approach to nursing education. This blend of theory and practice is critical in facilitating meaningful learning experiences, thus enabling students to apply their knowledge effectively in real-world clinical situations (Benner et al., 2010).

However, the challenge of simulation realism indicates an area for potential improvement. The use of higher fidelity simulations or the integration of virtual reality could offer more realistic learning experiences and further enhance the theory-practice link.

Hence, the integration of clinical simulation within a post-registration neurological course, utilising a blended approach to debriefing, offers valuable opportunities for learning. The emergent themes of self-evaluation and critique, group discussion and learning, confidence building, and theory-practice interface, viewed through the lens of hermeneutic phenomenology, provide crucial insights into the lived experiences of students. These findings inform nursing education strategies, supporting the development of competent and confident practitioners in the specialist field of neurological care. The challenge of simulation realism, however, suggests an area for future development to further bridge the gap between theory and practice.

Research study limitations

To ensure the transparency and trustworthiness of the research, it is crucial to acknowledge the study's limitations. One such limitation is the potential for bias, given the primary researcher's experience and knowledge of the phenomenon under investigation (Malterud et al., 2016). Reflexivity was incorporated throughout the study to mitigate this bias. Moreover, social desirability bias could have influenced the participants' responses due to the researcher-participant relationship (Krumpal, 2013). Nevertheless, the participants' critical thinking and sincerity were evidenced by the provision of both positive and negative feedback.

The study's findings cannot be generalised to other contexts as it focused exclusively on registered nurses in neurological practice. However, the transferability of the study's insights to other contexts may illuminate the broader value of simulation in healthcare education. Future research could usefully explore the implementation of simulation in interprofessional education and its subsequent impact on patient outcomes.

Ethical considerations were integral to the study. The research adhered to the ethical guidelines for educational research (British Educational Research Association, 2018), and informed consent was obtained from all participants. Measures were taken to ensure confidentiality and anonymity, with participant names replaced with codes. The data collected was securely stored, and only the research team had access to it. Identifying information was expunged from the transcripts prior to analysis.

Despite these limitations, the study offered valuable insights into the use of simulation in neurological practice, affirming the importance of simulation as a pedagogical approach for registered nurses (Cant & Cooper, 2014).

Conclusion

In conclusion, this study provides significant insights into the experiences of postgraduate students and registered nurses regarding the integration of clinical simulation into a post-registration neurological course, with a specific focus on a blended approach to debriefing. The emergent themes of self-evaluation, collective learning, confidence building, and the theory-practice interface shed light on the essential components of effective neurological nursing education. The findings highlight the transformative role of simulation in enhancing students' self-confidence, knowledge, and clinical skills in a safe and supportive learning environment.

However, the challenge of simulation realism and the need to bridge the gap between theory and practice are areas that require further attention. Future research and development should explore innovative ways to enhance the authenticity of simulations, such as incorporating realistic patient scenarios and utilising advanced technology. Additionally, ongoing efforts should be made to strengthen the integration of theoretical knowledge with practical application, ensuring that students can effectively transfer their learning to real-world clinical settings.

Based on the findings of this study, several recommendations can be made for nursing practice. First, educators should prioritise the implementation of simulation-based training and flexible debriefing techniques in post-registration neurological courses to enhance the learning experiences of students. The use of simulation provides a safe and controlled environment for students to practise and refine their skills, while flexible debriefing allows for reflective discussions and deeper understanding of their experiences.

Furthermore, collaboration between educational institutions and healthcare settings is crucial to create opportunities for students to engage in authentic clinical experiences alongside simulation-based training. This integration can provide a seamless transition from the educational environment to the clinical practice, ensuring that students are well-prepared and confident in their abilities to deliver high-quality neurological care. By implementing these recommendations, nursing education can harness the full potential of simulation-based training and flexible debriefing techniques, ultimately enhancing the competence and confidence of registered nurses in the field of neurological care.

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The Street: Enhancing self-confidence and activities of daily living assessment experience in nursing students through drama-based learning

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Keywords

Drama-based teaching;
narrative nurse education;
self-confidence;
storytelling.

Abstract

This study investigated the impact of a drama-based patient pathway, 'The Street', on pre-registration nursing students' perceived self-confidence and experience in assessing activities of daily living (ADL). Utilising an interpretative constructivist approach and narrative inquiry, the study involved 80 students specialising in various nursing fields, with focus groups held after the sessions. Key themes emerged, including authenticity, the story, practice learning, and practice application. The findings suggest that 'The Street' can enhance students' self-confidence and holistic assessment experience, thus contributing to the development of teaching and learning resources in nursing education.

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Introduction

In today's dynamic healthcare environment, innovative teaching methodologies are essential to prepare nursing students for the complexities of patient care. One such method gaining prominence in nursing education is simulation, which provides a safe and controlled environment for students to practice and hone their skills. This article explores a unique approach to simulation called 'The Street', which utilises drama-based patient pathways to enhance the learning experience of student nurses, particularly when assessing activities of daily living (ADLs). Our study aims to assess the impact of an immersive, interactive, and engaging teaching approach, 'The Street,' on nursing students' perceived self-confidence and overall experience in competently and confidently performing ADL assessments. By evaluating the influence of this modality, we seek to explore the potential benefits and challenges of incorporating 'The Street' into nursing curricula, furthering the ongoing discourse on best practices in nursing education.

Activities of daily living

Activities of daily living (ADLs) encompass the fundamental tasks essential for an individual's ability to function independently, including eating, bathing, dressing, and mobilising (Roper et al., 2000). Assessing ADLs is a crucial aspect of nursing care, as it serves to evaluate a patient's functional status, detect potential changes in their condition, and inform appropriate interventions (Roper et al., 2000). Nurses often act as the primary observers of variations in a patient's functionality and independence, making their role in ADL assessment indispensable (Mooney and O'Brien, 2006). Therefore, it is imperative for nursing students to not only grasp the theoretical foundations of ADL assessment but also to develop proficiency in its practical execution, ensuring their ability to provide comprehensive, patient-centred care.

The Street simulation

'The Street' is an innovative drama-based simulated learning experience employed within nursing, midwifery, and health programmes at a UK university. The simulation features a complex network of interconnected characters, similar to a television drama, with relationships established through family ties, friendships, or work affiliations. This study aimed to integrate the character of Brenda Brown into the simulation scenario for enhanced learning outcomes.

Brenda Brown

Brenda Brown (Figures 1 and 2) is a 70-year-old woman who resides alone in her house on 'The Street'. She is a widow with chronic obstructive pulmonary disease (COPD) and has a pet budgie named Reggie. Despite her medical condition, Brenda maintains mobility and independence. A specialised COPD nurse visits her periodically for consultations. Brenda is a smoker, drinks brandy to help her sleep at night, and leads a sedentary lifestyle with no regular exercise. Brenda presents herself as well-groomed and in good health. She is retired and enjoys spending time with her grandson Jaden, who occasionally visits her. Her daughter, however, lives at a considerable distance. In her retirement, Brenda finds pleasure in playing the piano and likes an occasional Gin and Tonic, and sometimes a brandy, with her grandson.

Figure 1: Brenda Brown.

Self-confidence and drama-based patient pathways

Self-confidence in nursing students is a critical attribute, as it reflects their belief in their ability to competently perform tasks and effectively manage situations associated with nursing care (Bandura, 1997). This is especially crucial when assessing activities of daily living (ADLs), which include essential self-care tasks such as personal hygiene, mobility, and nutrition (World Health Organization, 2001). A strong sense of self-confidence allows nursing students to make informed decisions, communicate assertively with patients and colleagues, and adapt to the ever-changing healthcare environment (Levett-Jones et al., 2010). Furthermore, self-confident nursing students are more likely to exhibit resilience when facing challenges, ultimately improving the quality of care they provide to patients (Mackintosh-Franklin, 2020).

As in other clinical and theoretical domains, self-confidence, encompassing knowledge and skills, is vital for students to ensure they can provide safe and effective care (McCabe et al., 2015). Students develop self-confidence by building their

Figure 2: Brenda Brown at home.

knowledge and competence in both theoretical and clinical learning environments (Herron et al., 2019). Conversely, a lack of self-confidence in specific skills can impede a student's ability to manage stress and tackle challenging or difficult situations, not only as learners but also once professionally qualified (Lundberg, 2008).

Various pedagogical approaches have been employed to support students' self-confidence, such as role-play and sharing stories in the development of clinical and assessment skills (Lundberg, 2008). Narrative pedagogy involves the use of narrative storytelling, a well-suited philosophical approach to nursing education (Bruner, 1991), and is widely acknowledged as a powerful educational strategy in higher education for active learning through practice (Yocom, 2020; Myonghwa & Jeong, 2020). Within the narrative framework, storytelling promotes deep learning by encouraging learners to think creatively, challenge assumptions, and question behavioural norms (Santos et al., 2011). Often used in controlled classroom environments with 'real-life' clinical scenarios, nursing students are exposed to moral dilemmas and problem-solving exercises that facilitate the exploration of personal and professional roles and identity (Gazarian et al., 2014), ultimately fostering confidence in practice (McCabe et al., 2015).

Narrative and storytelling methods for educational purposes have been highly valued by nursing students for building self-confidence (Urstad, 2018; Waugh & Donaldson, 2016; Petty, 2017). However, challenges in implementing storytelling in nursing education exist, such as maintaining narrative authenticity and student engagement (Urstad et al., 2018). Moreover, most research to date focuses on student-made digital stories (Park & Jeong, 2020; Urstad et al., 2018).

Drama-based Patient Pathways (DBPP) can be effectively integrated into simulated learning environments to create a realistic depiction of a patient's healthcare journey. This innovative method employs drama and professional actors to translate theoretical concepts into practical experiences. A "patient pathway" is a healthcare term that delineates the trajectory a patient follows from initial referral through to ongoing care. This path provides a strategic structure and process for managing a patient's treatment plan (NHS, 2014). The DBPP approach is designed to close the gap between the textbook representation of a patient and the actual patient experience. It allows for a more engaging presentation of the patient by creating an interactive format that puts the patient's journey into context.

There is a need for more in-depth knowledge on the effective use of DBPP in nursing education, the experiences of student nurses using tools similar to DBPP, and the impact of this pedagogical approach on students' perceived self-confidence in holistic assessment skills. Consequently, this study had two primary aims: 1) to explore the influence of DBPPs on first-year undergraduate nursing students' perceived self-confidence in performing ADL assessments and 2) to investigate the students' experiences using DBPP in their learning.

A participant information sheet was provided, along with written information about the study, supported by an animated video. This covered topics such as anonymity, confidentiality, publication, recording of focus groups, and the participant's right to withdraw from the study at any time without consequences. Participants were informed that their participation or lack thereof would not impact their academic results. All participants provided written consent before participating in the study.

Study methods

Study design

The study was grounded in a constructivist and sociocultural learning theoretical approach, which posits that individuals actively construct their own knowledge and that reality is shaped by learners' experiences (Piaget & Inhelder, 1972; Vygotsky, 1978). This theoretical framework aligns well with the use of DBPP. It supports the notion that reflective practice enables learning to occur through direct engagement in authentic situations and via interactions among participants within a social context (Vygotsky & Kozulin, 1986). A qualitative method and post-intervention design were employed to gain insights and foster a deeper understanding of the phenomenon under investigation (Tariq & Woodman, 2013).

Setting and participants

The study was conducted at a large college of nursing (1,600 students) within a university in London, England. An opportunistic sample of ten class groups, comprising first-year adult, child, and mental health nursing students, was selected. To be eligible for inclusion in the study, students had to attend the same session on the same day. Following the presentation of audio-visual study information, researchers invited a total of 278 students to participate. Ultimately, 80 students agreed to partake in the focus groups, determining the final sample size.

Demographic overview

The participant population in this study exhibited a diverse demographic composition. Female students constituted 80% of the sample, while male students represented the remaining 20%. A significant proportion, 70%, were aged 24 years or older. Notably, 56% of participants had more than a year's prior experience in the healthcare sector, enriching the collective perspectives and insights drawn from the study.

Ethical considerations

Ethical approval for this study was obtained from the University Research Ethics Committee prior to the commencement of data collection. The research team adhered to ethical guidelines outlined by the British Educational Research Association (BERA, 2018) to ensure the protection of participants, their confidentiality, and the integrity of the research process.

Participants were provided with a detailed information sheet outlining the study's aims, objectives, and their rights as participants. Written informed consent was obtained from all participants before their inclusion in the study, ensuring they had a clear understanding of the study's purpose and the potential benefits and risks associated with participation.

All data collected during the study were anonymised to protect the identity of the participants. No identifiable information was included in the research findings or published materials, ensuring the confidentiality of individual participants. Additionally, any information shared during the focus group discussions was treated as confidential by the research team.

Participation in the study was entirely voluntary, and students were informed that their decision to participate or not would not impact their academic results. Participants were also informed that they had the right to withdraw from the study at any time without consequence.

The research team carefully considered the potential risks and benefits associated with participation in the study. The primary benefit of the study was the potential for the research findings to inform future nursing curricula and improve the learning experience for nursing students, especially in ADL assessments. Potential risks were minimal, with the most significant risk being the potential for participants to feel uncomfortable or stressed during the focus group discussions. To mitigate this risk, the facilitators were trained to create a supportive environment and to address any concerns raised by the participants during the discussions.

The intervention

The intervention arm comprised three phases: pre-instructional, instructional, and post-instructional activities:

The pre-instructional phase

During the pre-instructional phase, the university's established pedagogical framework (Figure 3) was utilised, and researchers developed materials for students to access during the 'Investigate' stage of their learning. This phase included the 'flipped classroom' as a pre-session activity. The flipped classroom is an innovative teaching approach that inverts the traditional educational model by providing direct instruction outside the classroom and promoting active learning, problem-solving, and collaboration within the class (Bergmann & Sams, 2012). Students engage with pre-recorded lectures, readings, or other instructional resources before attending class, which allows for more in-class time dedicated to interactive activities such as discussions, group work, and practical exercises (Bishop & Verleger, 2013).

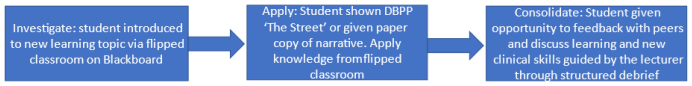

Figure 3: Pedagogy for session.

As a result, the flipped classroom model seeks to enhance understanding, critical thinking, and knowledge application by enabling more personalised guidance and support from the teacher during class time (Fulton, 2012). This approach also encourages students to assume greater responsibility for their learning and promotes peer collaboration, both of which contribute to improved learning outcomes (Abeysekera & Dawson, 2015).

After receiving study information and providing consent, ten teaching sessions were conducted simultaneously, with seven delivered face-to-face and three via a virtual learning platform. Five of these classes (out of the ten teaching sessions) viewed the DBPP in class, irrespective of the delivery method (face-to-face or virtual), while the other five received a narrative transcript (paper copy) of the case study depicted in Figure 4.

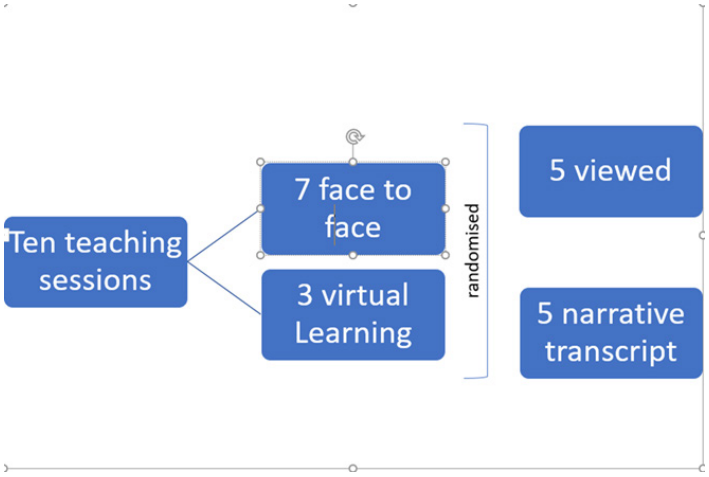

Figure 4: Intervention.

The instructional or teaching phase

During the instructional or teaching phase, students were randomly assigned using a random number generator to one of ten evenly distributed groups. In these groups, they would either engage with the DBPP of Brenda in class or be provided with a paper-based case study transcript of the Brenda scenario to interact with in class. The DBPP or paper case study was presented in class, either through a face-to-face session or virtually via a virtual learning environment (VLE). Both the paper case study group and the DBPP group received the same pedagogical approach and instructional elements during the session, as illustrated in Figure 1.

The post-instructional phase

In the post-instructional phase, data were collected and analysed using narratives that described the student experiences of the simulated activities. This phase involved collecting data to evaluate learning outcomes and analysing it to develop themes and discussions. The post-instructional phase was a critical step in assessing the impact of the educational intervention and programmes learning outcomes.

Data collection

Data were collected immediately following the intervention. Ten focus groups, each consisting of eight students and lasting 45 minutes, were conducted to gather student experiences and perspectives. All participants had received the intervention. The groups were facilitated either in person or online by a researcher or the group's lecturer, who had been prepared by the research team prior to the focus group sessions. To encourage reflections and discussions about the learning experience, the focus groups employed eight structured prompts based on the Plus-Delta model (Cheng et al., 2021) (Figure 5). Participants' views and opinions were recorded and transcribed verbatim.

Figure 5: Focus group prompts using the Plus-Delta model.

Data analysis and trustworthiness

Focus group data were analysed using Braun & Clarke's (2006) six-step approach (familiarisation with the data, coding, generating themes, reviewing themes, defining and naming themes, and writing up) to identify key themes that shape the phenomenon of interest. The researchers individually familiarised themselves with the data and utilised the prompts from the focus groups to provide a broad framework for coding the transcripts. Subsequently, the data were analysed line-by-line by the researchers to uncover themes and connections between them. An illustration of the process, from quotes to subthemes and then key themes, can be found in Figure 6 and Table 1. The analysis was conducted through a recursive and iterative process, comparing, and connecting the coding, subthemes, and key themes.

Figure 6: Overarching themes and subthemes.

Table 1: An example of the process from quotes to nodes and then themes.

Quotes	Subthemes	Key Themes
'Thinking outside of the box, the video helped me pick up on the not-so-obvious things that she did not say i.e., environment'	Emotional response fostered by detailed design and presentation of the scenario	Authenticity
'Makes the class interact – really good'	Learner preferences and engagement fostered by implementation of the scenario	Practice learning
'The video is very useful to help you on placement to assess and communicate with a patient'.	Curiosity fostered by enquiry -based approach and presentation of the scenario	Practice application
'The scenario was difficult to assess and there was not enough information'.	Cognitive response fostered by curiosity and presentation of scenario	Story

To ensure the trustworthiness of the analysis, the research team followed multiple steps, as suggested by Nowell et al. (2017). The team held regular meetings to discuss and refine the themes, thereby ensuring the reliability of the analysis. The robustness of the findings was also guaranteed as all researchers engaged with the raw data and discussed all ideas and hypotheses about the themes until a consensus was reached. Credibility and dependability were enhanced through prolonged engagement with the data and researcher triangulation. Transferability is facilitated by the detailed description of the experiences analysed.

In terms of reflexivity, the research team acknowledged their own experiences, values, and interests as educators in higher education, clinicians, and arts practitioners. The research team collectively agreed upon the upper-level themes presented in the paper.

Findings

A total of 80 students participated in the focus groups. Their experiences with the DBPP were characterised by four primary themes: authenticity, the narrative, practice-based learning, and practical application.

Description of themes

'Authenticity' was identified as the impact of learning experiences (DBPP) on students' sense of identity and engagement in their studies. Both internal and external authenticity contributed to meaningful learning, enabling students to make sense of past experiences and gain a deeper understanding of nursing practice. The 'narrative' theme highlighted the empowering role of storytelling and engagement with a story, allowing students to think in diverse ways, challenge assumptions, and question behavioural norms (Yocom, 2020). The 'practice-based learning' theme encapsulated the scenario's purpose and how the story's authenticity encouraged learners to envision themselves in potential real-world situations and contemplate their responses to such circumstances. Nursing education should reflect clinical practice, offering students opportunities to experience highly complex, dynamic situations in a safe, facilitated environment. Lastly, 'practical application' bridged the 'theory-practice gap' by facilitating knowledge transfer and the sharing of previous lived experiences from situations that could be recalled, blurring the boundaries between classroom and clinical practice.

Authenticity

The DBPP generated strong emotional engagement due to the scenario's authenticity. The DBPP not only depicted reality but added an extra dimension of realism and relevance, making the story feel closer to a real-life situation: "Thinking outside the box, the video helped me pick up on the not-so-obvious things that she didn't say, such as the environment".

While the DBPP enhanced the student experience, the paper copy was, conversely, found to lack additional details that would have facilitated a more comprehensive holistic assessment. As a result, it provided a suboptimal learning experience, with less enthusiasm and more subdued discussion afterwards. Moreover, the paper scenario was comparatively more challenging to engage with and required more effort from the participants, who would have preferred to visually examine the patient for greater context: "I would have preferred to see the video to observe her behaviour and pick up on any additional information".

The visual and audio content of the video appeared to increase participants' internal authenticity (internal values), enhancing their emotions and fostering empathy towards 'Brenda' and her health and wellbeing: "I liked the way she was open about the death of her husband". Some participants recognised Brenda's vulnerability from the video: "I felt sorry for her" and commented on her loneliness. They seemed able to apply this to the then-COVID-19 pandemic climate and identified loneliness as a key factor: "Brenda could feel extra lonely because of the Covid pandemic; it's very concerning, she is alone".

Furthermore, the participants praised the external authenticity of the video, which led to a more meaningful learning experience: "It's good that she doesn't give all the information. If you are sitting with a patient, you need to ask questions and discuss important points; this always happens in my experience"; "this was a realistic representation and something we are likely to experience when qualified." On the other hand, some participants in the paper scenario group acknowledged that a visual stimulus would have been helpful for easier interpretation and assessment; "the scenario would have been improved with more detail to look at, this would help me with my assessment".

The story

Although the students valued the DBPP, the video appeared to foster a heightened emotional response and compassion from the students. They expressed feelings of concern, anxiety, and worry for Brenda, particularly those who had viewed the video. However, this level of compassion and empathy did not translate from the paper version of the

scenario: "A video would have led to a better understanding of what the patient meant"; "I would have preferred to see the video to observe her behaviour and pick up on any additional information"; "the scenario was difficult to assess, and there was not enough information available".

For students who had watched the video, the narrative enabled them to explore personal and professional roles in their lives, constructing their own understanding and professional identity: "Improved confidence to complete ADLs. Not just what we see and hear"; "I was able to relate to the actual person, her mannerisms, what she looked like, and what her living room looked like".

The use of video seemed to change the role of the storyteller: "I enjoyed Brenda's flowing conversation; she was natural and personable". With the paper version, some students appeared more focused on the text and theoretical perspectives, obscuring the personal message. In contrast, the students with the video were urged to take more responsibility for Brenda's care. For these students, Brenda was a real patient, and they treated her accordingly: "The scenario helped me to be more patient-centred. I thought she was real".

However, the video was not only beneficial in fostering empathy but also as a pedagogical and didactic tool: "You remember more if you watch something, but videos can be over-complicated if English is not your first language. A video and written scenario would be much easier". Some students suggested that both a script and video would have been helpful to assist with learning convenience, contextualisation, and interpretation of different types of speech: "A script and video would have been the gold standard". This idea was also mentioned by students in relation to accommodating different learning styles: "The descriptions were easier to pick up on because they were written down".

Practice learning

The lifelike nature of the scenario allowed students to immerse themselves in a real-world situation. The learner-centred approach transformed learning, making it interactive while remaining anchored in a clinical context. This facilitated a form of collective learning in which students became co-constructors of knowledge, encouraging and motivating one another: "Feel more prepared for a real situation". Through the pre-session work, students felt able to apply some of their prior knowledge to Brenda's video in class and the task at hand. This demonstrated a transmission, mobilisation, and acquisition of knowledge for the students.

The students found the narrative around different aspects of Brenda's care beneficial in highlighting the integration of multi-professional roles: "The complexities of managing a patient like that". They commented on how the DBPP provided them with insights into multidisciplinary care, some aspects of which surprised them: "Gave perspective on different parts of the nurse's role".

Peer-to-peer learning was emphasised by the students exposed to the DBPP video. They felt that this approach helped them communicate as a group and generate ideas from one another. The DBPP also highlighted areas for development and gaps in current knowledge, both individually and collectively. Some students felt that they initially "missed certain aspects of the video" and benefited from viewing the video twice. This was less apparent in the paper scenario. Several students explained that "Brenda made the assessment easier", but some of the ADL parameters were implied and not explicit: "I didn't know what information was relevant".

They felt that there were still many unanswered questions, particularly around activities related to sexual health and washing and dressing. Although Brenda appeared well-kept, these gaps forced the students to make assumptions. However, they reported that: "these assumptions fuelled in-class discussions, allowing for the sharing of views and sense-making".

Practice application

Some students described how theoretical perspectives were integrated into the investigative activity prior to the session, thereby combining theory and practical application: "The assessment of Brenda could start even before she spoke in terms of washing and dressing and how she looked"; "understanding the whole patient and what help they need".

Additionally, some students expressed aspects of knowledge transfer from practice learning to practice application. Their deeper understanding of the topic from the DBPP provided new insights that could potentially be applied in similar situations within clinical practice: "I feel I am able to make judgments and assessments".

Several students commented on their own gaps in knowledge and understanding: "Helped to build my confidence"; "practical and confidence-building". Some students with previous healthcare experience noted that they had: "No prior knowledge of the ADL assessment and enjoyed learning a new skill in a practical way"; improved my confidence and highlighted areas I need to work on".

Some students reported that the DBPP video would enable stronger recall of the scenario and learning, which could be applied to future practice: "I will be able to recall the visual images and the key information". They felt that the name Brenda would resonate with them, and her specific health and long-term conditions would serve as a reference point when encountering similar patients in practice: "Helpful to visualise this when assisting an actual patient".

Several students who had viewed the DBPP video expressed a desire for more sessions like this and a longer video in the future. Others highlighted the potential benefits of having a 'real' patient in the room to ask questions for clarity on some of the ADL parameters.

Discussion

This study aimed to explore the influence of DBPP on the reported perceived self-confidence of student nurses in assessing activities of daily living. Our findings suggest that students exposed to The Street DBPP reported an increase in perceived self-confidence and a decrease in anxiety when the DBPP was embedded in a learning session. Participants in the DBPP arm reported experiencing a richer learning environment where authenticity and realism fostered engagement, promoted ownership, and encouraged a deeper understanding of the experienced situation. Students enjoyed the lesson and engaged with the topic through peer discussion and group work in class. When students provided feedback regarding the 'patient', those exposed to the DBPP displayed higher instances of positive feedback and emotional response. Arguably, better learning takes place when linked to an emotional response (Tyng et al., 2017).

The Street focuses on individual patients and their healthcare journey. The quality of the script, acting, and authenticity of the video provides an essential bridge between theory and practice. The topics are highly relevant to nursing students, and the videos are situated in environments much like those the students will experience in practice. Today's students are considered 'digital scholars' (Weller, 2011) who use technology in all academic studies, and higher education institutes strive to implement digital and immersive learning tools into pedagogical programmes (HEE, 2020). This study strengthens the knowledge about the benefit of drama and patient-focused storytelling in higher education as a pedagogical strategy to enhance the practical application of clinical skills. DBPP can better prepare students for specific clinical situations, challenging and consolidating ideas on their support for individuals (patients) with varying needs.

As reported previously, the power of drama and film depicting patient stories seems to be in the way that it contributes to lifelong learning and prepares students for the professional role, enabling the practice of skills in a safe environment (Oh et al., 2012; Raga-Chardi et al., 2016). In the UK, first-year student nurses are likely inexperienced in real-life nursing situations and do not attend clinical placements until later on in the curriculum. Anxiety is often high, particularly before the first clinical placement, and driven by lack of experience, compounded by fear of making mistakes and the first-time application of skills (Sun et al., 2016). Some studies have explored if intervention strategies decreased anxiety and helped students to foster self-awareness to deal with these feelings when in clinical practice (Moscartolo, 2009; Ganzer & Zaudered, 2013). The DBPP triggered emotional engagement due to the resemblance to everyday situations encountered in nursing. Other studies have found that cognitive processes might be positively affected by emotions, including an impact on emotional memory, increased attention, memory, and motivation for learning (Um et al., 2012; Seli, 2016) – an essential element within the sociocultural learning context (Vygotsky, 1978). However, the extent of application to practice depends on the participants' level of engagement and contribution to the social context (Um et al., 2012; Seli, 2016).

Confidence is one of the most vital factors for being able to apply knowledge and competence (Back et al., 2016). Self-confidence gives the feeling of self-assurance arising from the appreciation of a person's own ability. Confidence at the novice level can improve curiosity, exploration, and proficiency to see patients as 'wholes' rather than parts (Benner, 1984). The comments in the ten focus groups showed that the students with the video demonstrated increased engagement in learning through visualising the patient and their environment. Addressing different learning styles can improve engagement, understanding of the content, and practical application of skills transferable to the clinical setting (Herron et al., 2019). In this study, students who had the video specifically commented that the DBPP was engaging and particularly helpful for visual learners.

In a similar study by Herron et al. (2019), comparing the use of video case study scenarios and paper scenarios, it was also found that there was no statistically significant difference in self-confidence between the two approaches. However, the use of video case studies improved student satisfaction with the sessions when compared with paper scenarios. Furthermore, students exposed to the video case study rather than the paper case study had higher levels of knowledge after the session, which may likely lead to a deeper understanding of the taught topic. As identified in our paper, student feedback singled out the visualisation aspect of the video case study as a learning aid.

The theory-practice gap remains a challenge in nurse education (Gallagher, 2004; Urstad et al., 2018). Innovative pedagogies and teaching strategies that facilitate active learning could encourage students' ability to apply theoretical and practical knowledge to increase perceived self-confidence and clinical reasoning (Gibson et al., 2015; Kavanagh & Szweda, 2017; Kim & Kim, 2015). This study did not set out to assess learning, focusing on the reported self-confidence of students and efficacy. However, DBPP seemed to impact engagement and might enhance the learning process. The effect of DBPP on learning should be further explored when implemented in nurse education settings. In addition, more evidence is needed for the link between self-confidence and learning outcomes/skills in practice. Further research should include a design aimed at capturing the effect of DBPPs and self-confidence on student nurse learning outcomes.

The feedback from students regarding the use of DBPPs shows that the use of The Street in nursing education can improve the quality and enrichment of taught sessions. Furthermore, it highlighted high levels of student satisfaction, which were linked to student levels of enjoyment and engagement with the session. However, there is a need to have more evidence about the sustainability of the effect. Overall, the evidence for the use of DBPPs in nursing education sessions is promising due to their effect on increasing students' perceived self-confidence, reducing anxiety surrounding the topic, increasing student satisfaction, increasing engagement, and increasing knowledge.

Limitations

This study has some limitations. Pedagogic research is perceived as a complex issue due to the blurred boundaries between researchers and participants (Regan et al., 2012). As researchers in the study work in an educational institute and given that some staff who taught the sessions also facilitated focus groups, participants may have offered socially conformant answers (Green & Thorogood, 2018). Online focus groups, while supporting students' response confidence, may have reduced response depth compared to in-person interactions. The convenience sampling method could potentially restrict the findings' generalisability. The study's reliance on self-reported confidence levels might not reflect actual clinical performance and could result in response bias. There was no assessment of the long-term effects of DBPP on students' self-confidence or the influence of variables such as experience, culture, or language proficiency. Lastly, the study failed to evaluate the real-world application of acquired knowledge and learning outcomes, necessitating future research in this area.

Conclusions and recommendations

The use of DBPPs could serve as a valuable pedagogical tool for nurse education. Employing authentic learning content with a strong emphasis on patient stories seems to engage students, providing opportunities for learning and application of skills. Integrating DBPPs as a standard learning activity across the curriculum could become an essential component of nurse education. Further work should evaluate the impact of DBPPs on student performance and other healthcare professionals in assessing activities of daily living.

To gain deeper insights into the application of DBPPs in higher education, future implementation and research should encompass various aspects of healthcare programmes. These include modules that assist with the development of clinical skills and self-confidence, focusing on the application of theory and ethics, interprofessional learning events, and simulations. Additionally, it is worth exploring the incorporation of DBPPs in other higher education programmes where the 'rehearsal' of core skills is a crucial learning activity. Further research on the effectiveness and combination of DBPPs in nurse education is necessary to solidify the role of this pedagogy in nursing curriculums for the future workforce. This research should also explore the long-term effects of DBPPs on students' self-confidence, learning outcomes, and the transfer of knowledge and skills to real-world clinical settings.

Based on this research's findings, several recommendations are made to enhance teaching and learning in higher education using simulation approaches. By integrating multimedia elements, accommodating diverse learning styles, promoting peer-to-peer learning, and embedding real-world context, a more engaging and authentic learning experience can be created. Encouraging self-reflection, bridging theory and practice, and exposing students to multi-professional perspectives will aid in knowledge transfer and enhance comprehension of patient management complexities. Additionally, enabling multiple exposures to materials, facilitating interaction with real patients, and continually refining simulation scenarios based on student feedback will optimise the use of simulation approaches. These recommendations aim to equip students with valuable experience, empathy, and confidence in applying their knowledge to real-world situations.

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Exploring the lived experiences of mental health professionals: A phenomenological study on ligature training in a simulated environment

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Abstract

This phenomenological study investigates the first-hand experiences of mental health practitioners engaged in an intensive two-day workshop on managing ligature-related situations. This workshop was implemented within a realistic simulated environment at a renowned higher education institution, offering participants a chance to experience scenarios that closely mirror real-world conditions.

In this study, a rigorous thematic analysis was applied to participants' feedback, which yielded three dominant themes: (1) transformative experience, (2) transformed views about ligature training, and (3) patient-centred risk management and empowerment. The first theme encapsulates the idea of a 'transformative learning journey.' Participants experienced a marked expansion in their knowledge base, practical skills, and overall understanding of ligature management following their participation. The training, facilitated by realistic simulations, demonstrated the efficacy of such an immersive approach in enhancing healthcare professionals' competency in handling ligature-related situations. The second theme, 'transformed views about ligature training,' alludes to the substantial shift in the participants' pre-existing attitudes towards such training workshops. Post-participation, their views were radically altered as they acknowledged the profound value and potential life-saving benefits such immersive training can impart, particularly in the critical sphere of ligature management. The third theme emphasises 'patient-centred risk management and empowerment.' This underlines the central role that patients play in the approach towards managing ligature-related situations. An essential takeaway from the training was the need for healthcare professionals to manage risks effectively and instil a sense of empowerment within their patients, thereby promoting them as active participants in their care journey.

This research provides a comprehensive exploration of the lived experiences of mental health professionals within a simulated learning environment. Rather than solely recounting the training process and participants' immediate reactions, it probes the training's more profound, lasting impact on the attendees' professional lives and perspectives. Consequently, the study significantly contributes to the existing knowledge in ligature training and care for people at risk or post-ligature, accentuating the effectiveness of simulation-based educational methodologies. It offers invaluable guidance for healthcare institutions and educators looking to design or improve their training strategies, thus equipping professionals to tackle ligature-related situations effectively and compassionately.

Introduction

Ligatures encompass objects capable of fastening or connecting, such as chains, linen, clothing, cords, and tubing. A ligature anchor point can be defined as any object that could serve as an attachment for a cord or similar material for hanging or strangulation. In contrast, a ligature represents any object that can be fastened to a ligature anchor point or be wrapped around the neck without an anchor point, leading to self-strangulation (Care Quality Commission (CQC), 2022). In mental health in-patient facilities, where patients may exhibit self-harming or suicidal behaviour, staff must manage the environment and support patients to reduce potential harm.

The management and safety planning to prevent ligatures within clinical practice is critical to mental healthcare. It directly influences the safety and well-being of patients. Mental health staff are responsible for ensuring support and care for people at risk of self-harm or suicide. In recent times, simulation-based education programmes have emerged as promising tools for enhancing staff skills and competence across various healthcare domains (Gharibi & Arulappan, 2020). This study investigated the effectiveness of a simulation-based training programme for healthcare professionals to support and care for people at risk of death by hanging.

Background

The study examined the first-hand experiences of healthcare workers who underwent a simulation exercise. This training enhanced their abilities and confidence when assisting patients involved in ligature incidents. The National Institute for Health and Care Excellence (NICE) clinical guidelines on self-harm emphasise training for all personnel, both within and outside the healthcare domain, who engage with individuals of any age prone to self-harm (NICE, 2022). This training should be multifaceted, encompassing interactive role play, online modules, direct face-to-face sessions, and the provision of relevant resources.

A critical aspect of the training should be reflecting on staff attitudes, considering their values, beliefs, and any inherent biases. It is also essential that the training's depth be tailored to match the staff member's level of responsibility. Additionally, rather than being a one-time event, such training needs to be offered regularly, ensuring that all professionals remain updated and well-prepared.

Recent statistics from the Office for National Statistics (2021) and the University of Manchester (2022) emphasise that ligature usage is the predominant method of suicide within both the general population and in-patient mental health care settings in the UK. Moreover, there is a rising trend in the usage of ligatures year on year. For instance, there has been a 29% surge in self-inflicted deaths among the detained population in the UK over the past year. The UK government report maintains that hanging was the most frequently employed method of self-inflicted death in 2021, constituting 83% of successful suicide attempts (UK Gov, 2023). They also note that out of the 76 self-inflicted deaths via hanging or self-strangulation in 2021, bedding remained the most frequently utilised ligature type, accounting for 82% of incidents (UK Gov, 2023). These developing patterns underline the pressing need to broaden research efforts and expedite the enhancement of education and training for healthcare professionals providing education and support (Public Health England, 2020; National Institute of Health and Care Excellence, 2018).

Mental health staff often face significant challenges in supporting people who use ligature as a method of self-harm, which can evoke strong emotional reactions and adversely impact their physical and mental well-being (Patterson et al., 2007; Babic et al., 2020). Witnessing self-harm through ligature can be more traumatic than other forms of self-harm due to its high risk of death, with anxiety levels in staff escalating when multiple incidents or attempts occur (Rouski et al., 2017; Karman et al., 2015).

Several qualitative studies have explored the experiences of healthcare staff members involved in caring for people following ligature-related harm or death. These studies have revealed that staff members often feel vulnerable and burnt out and perceive themselves as unable to manage potentially challenging situations effectively (Anderson et al., 2003, McGlinchery et al., 2021). Concerns about using sharp objects, such as ligature cutters near patients' necks, could result in life-threatening injuries, further exacerbating staff members' sense of unpreparedness and safety (Razak, 2022). Staff reported feelings of powerlessness and frustration when managing patients who engaged in self-harm and ligature behaviour (Dixon-Woods et al., 2018).
A systematic literature review on self-harm and suicide within in-patient psychiatric units revealed a troubling pattern: staff frequently felt overwhelmed and inadequately equipped to handle patients displaying self-harm or ligature behaviours (Gibson et al., 2018). Similarly, within the confines of the UK prison system, personnel expressed considerable emotional and psychological strain when confronted with inmates engaging in such behaviours (Newman et al., 2018). It is essential to dispel the misconception that only individuals with diagnosed mental health conditions contemplate or resort to ligature as a method of self-harm. Modern healthcare paradigms emphasise the intrinsic linkage between physical and mental well-being. This integrated perspective highlights that ligature-associated risks are not confined merely to those with evident mental health symptoms (Bolton & Gillett, 2019). Consequently, the responsibility does not rest solely with mental health professionals; all healthcare professionals need to be vigilant to these risks.

Patients, irrespective of their mental health history, can undergo episodes of acute distress, potentially culminating in self-harm or suicidal behaviours (Harmer et al., 2023; Samaritans, 2023). This reality mandates a proactive approach from healthcare practitioners: the capacity to discern early warning signs, intervene with alacrity, and provide appropriate support. Training emerges as a pivotal element in supporting people. By equipping healthcare professionals with the necessary skills, they can identify individuals at heightened risk and deploy rapid and efficacious interventions. Additionally, this training

can facilitate effective communication strategies to liaise with and support affected families and friends. Gorman et al. (2023) highlight that family involvement has been identified as a critical aspect of clinical practice that may help to prevent suicide. Therefore, creating a therapeutic environment wherein patients perceive their feelings and concerns as valid is also paramount. Such an atmosphere can attenuate feelings of isolation, a potent precursor to detrimental actions. Lastly, the merit of multidisciplinary collaboration cannot be overstated (NICE, 2022). Pooling expertise across healthcare disciplines guarantees a holistic care trajectory for patients, ensuring their needs are met regardless of the specific care setting.

Overall, the studies highlight the significant emotional and psychological impact that supporting people who have used ligature as a method of self-harm can have on healthcare staff members. They emphasise the need for improved training and support for staff members managing these complex and challenging situations to ensure the ongoing safety of both patients and healthcare staff. Mental health staff recognise the need to decrease distress, increase understanding, and explore concepts related to self-harm and ligatures to improve their professional practice by engaging in further education and training (Rouski et al., 2017). Research has demonstrated that staff who undertake evidence-based education are more likely to have positive attitudes when supporting people with complex needs due to increased knowledge and feelings of competence (Dickinson et al., 2009; Saunders et al., 2012; Timson et al., 2012; Department of Education, 2017). The importance of investing in training and education to influence staff attitudes toward clients who self-harm is well-established in the literature (Cleaver et al., 2014; Dickinson & Hurley, 2012; Saunders et al., 2012).

Narrative review

Ligature, death by hanging, and injuries causing long-term harm to physical and psychological well-being are critical issues in nursing practice that necessitate meticulous consideration to prevent further morbidity and mortality. Educating healthcare professionals on caring for and supporting individuals who might resort to ligature as a method of strangulation or suicide is vital in nursing. It equips professionals with the skills to identify, manage, and deter ligature-related incidents (Wand, 2016). According to the World Health Organisation (WHO), suicide represents a substantial public health issue, with hanging being one of the most common means people use to end their lives (World Health Organisation, 2019). Thus, healthcare professionals must have a sound understanding of factors that contribute to preventing ligature and death by hanging, as well as the skills and competencies to manage critical situations where patients have attempted to end their lives.

Several factors could augment the risk of ligature and death by hanging. Mental health disorders such as depression, anxiety, bipolar disorder, and substance misuse are significant risk factors for suicide, with hanging being the prevalent method (Brådvik, 2018). The risk factors for hanging include a history of previous suicide attempts, accessibility to ligatures, and the absence of social support (Chammas et al., 2022). Addressing the prevention of ligature-related incidents and hanging deaths requires a comprehensive strategy that includes risk assessment, environmental adjustments, and educational initiatives. Healthcare professionals should conduct regular safety checks to identify potential ligature risks and ensure that patients are never left unattended in areas where ligatures are present (WHO, 2021).

In addition to risk assessments, environmental modifications can mitigate the risk of ligature and death by hanging. For instance, healthcare facilities can install ligature-resistant fixtures, such as showerheads and door handles, to prevent patients from using them to self-harm (Mills et al., 2013). Facilities can also alter the layout of patient rooms and communal areas to eliminate potential ligature points (Bowers et al., 2010). Ongoing education on the identification of ligature risks and the implementation of environmental modifications to avert patient harm should be provided to healthcare professionals (Gaskin et al., 2016).

Swift interventions are necessary if a patient is at immediate risk of ligature or death by hanging (Appleby et al., 2019). Healthcare professionals should remove potential ligatures and stay with the patient to provide continuous supervision (Hawton et al., 2014). Restrictive measures sometimes prevent self-harm (Kontio et al., 2012). Safety planning is essential as part of overall care, crisis, and contingency planning. Healthcare providers should involve the patient in developing a safety plan to address suicidal thoughts or behaviours (Stanley & Brown, 2012).

A qualitative study by Bowers et al. (2016) explored staff members' experiences in a UK psychiatric hospital who supported patients who engaged in self-harm and suicidal behaviour. Participants in that study emphasised the importance of building positive relationships with patients, communicating effectively, and involving patients in their care. This approach reflected a patient-centred approach to care that prioritises patient safety and empowerment. Furthermore, a study by Gibson et al. (2018) reviewed the existing literature on self-harm and suicide in in-patient psychiatric units. The study found that staff members often felt overwhelmed and unprepared to manage patients with self-harm or ligature behaviour. However, the study also emphasised the importance of a patient-centred approach to care, which involves understanding and addressing the underlying issues behind the behaviour and involving patients in their care.

The Wellness Recovery Action Plan (WRAP) embodies a robust and accessible approach, empowering individuals to realise their life and wellness aspirations. As an inclusive methodology, WRAP equips individuals to unearth user-friendly, secure, and effective wellness tools, establish a daily blueprint for unwavering commitment to life and wellness objectives, and identify potential obstacles and strategies to persist resiliently (WRAP, 2023). It also provides an invaluable support structure that upholds one's autonomy, even in crises (MIND, 2023). WRAP invites individuals to acknowledge the resources that enhance their well-being and draft proactive strategies for seamless integration into daily life. Anchored by five fundamental principles, these form the heartbeat of

the WRAP ethos (WRAP, 2023). The cornerstone of WRAP is hope, reinforcing our belief in recovery, sustained wellness, and fulfilling dreams. Reflecting on the importance of hope facilitates the development of methods to nurture it within ourselves. Following this, personal responsibility emphasises the individual's role in initiating action towards maintaining wellness. This principle is tailored to individual interpretation and implementation (WRAP, 2023). Education, the third principle, encourages the pursuit of comprehensive knowledge about one's experiences, thus enabling informed decision-making. The learning journey can be customised according to individual requirements. The concept of self-advocacy underscores the necessity of articulating one's needs to others to guarantee the support required for wellness and recovery. This empowers individuals to assert their needs and preferences in a manner best suited to them (MIND, 2023). Lastly, the principle of support emphasises the mutual process of giving and receiving assistance, enriching one's life quality. The individual determines the characterisation of support, the traits sought in supporters, and the preferred methods of giving and receiving support. Collectively, these guiding principles breathe life into WRAP, fostering a holistic, personalised path towards wellness and recovery (WRAP, 2023).

Ligature and death by hanging are critical nursing practice issues requiring ongoing attention and assessment (Wand et al., 2015). Healthcare professionals must comprehensively understand the risk factors for suicide and prevention techniques to feel prepared, maintain psychological resilience, and cope with the potential psychological trauma associated with these events to safeguard their well-being (Wand et al., 2015).

Suicide and death by hanging are significant global concerns, necessitating effective management from healthcare providers, including professionals (World Health Organisation, 2014). As frontline healthcare providers, these professionals play a critical role in preventing, assessing, and managing suicide and death by hanging (Wand et al., 2015; Hawton et al., 2014).

Despite the importance of learning how to manage incidents of suicide and death by hanging, healthcare professionals encounter many challenges. One significant challenge is the emotional impact of caring for patients at risk of suicide or who have attempted suicide. Healthcare professionals may experience fear, anxiety, and helplessness, negatively impacting their ability to provide quality care (Kang et al., 2020). Moreover, supporting people at risk of suicide and death by hanging requires specific knowledge and skills that healthcare professionals may not have gained during their education.

To address these challenges, education and training programmes should incorporate best practices promoting effective learning and skill development. Simulation-based training effectively teaches suicide prevention and management skills to healthcare providers (Kang et al., 2020). Training allows healthcare professionals to practice assessing the risk of self-harm and suicide, supporting people with suicidal behaviours, and responding to death by hanging in a safe and controlled environment. Simulation-based training has gained popularity in healthcare education as an effective means to enhance healthcare providers' competence, confidence, and performance in various clinical scenarios, including managing suicide and death by hanging (Bingham et al., 2019; Pascucci et al., 2019; Okuda et al., 2009; Al-Elq, 2010).

The use of simulation-based education in catastrophic event training is widely researched not just in nursing but in other areas of industry, for example, aviation. Standardised patient scenarios are an effective method for educating healthcare professionals on suicide and death by hanging. These scenarios offer a realistic setting for professionals to practice assessing suicide risk and responding to suicidal behaviours. Standardised patient scenarios have improved healthcare professionals' knowledge of suicide risk assessment and management (Hunt et al., 2019).

Consequently, educational institutions and healthcare organisations must prioritise developing comprehensive training programmes that give healthcare professionals the skills and knowledge to manage suicide and death by hanging. These programmes should also address the emotional and psychological impact of caring for patients at risk of suicide or those who have died by hanging.

Instructional design of the simulation

The instructional design of the two-day workshop was informed by a pre-workshop questionnaire that asked participants to explain their feelings towards ligaturing and how they manage this in practice. The aim was to provide a safe learning space for healthcare professionals, with the primary learning outcomes focused on critical thinking, clinical judgment, self-confidence, teamwork, care, and safety. These attributes reinforce the importance of simulation pedagogy to develop skills and build knowledge in cognitive, procedural, and attitudinal domains and support the application of these skills into clinical practice in a psychologically safe environment.

Participants were briefed at the beginning of the first day concerning the learning objectives and logistics of the two days, including time frames, expectations, and support. Participants' previous experiences of ligaturing were explored at the beginning of the first day. These were shared in a facilitated discussion with a senior mental health practitioner. Over the two days, the participants took part in four simulated scenarios, all acted by a simulated patient.

Participants were debriefed after each simulation by a senior mental health practitioner using the Plus-delta model (Figure 1) (Kainth, 2021). The debriefing framework was used to structure the conversation, allowing participants to share visceral emotions and initial reactions to the simulated experience, reflect and engage in discussions, identify performance gaps and highlight key learning points. The consistent use of a debriefing model throughout the workshops helped the learners buy into the framework and anticipate the flow and nature of the post-simulation conversations. Learner reflection and feedback enabled self-assessment and group reflection to identify areas

of team strengths and weaknesses. The use of circular questions from the facilitator enabled participants to reflect on an interaction between two other participants, thus encouraging a third-person perspective. Sharing insights from this vantage point helped trigger discussions around behavioural rationale and drivers.

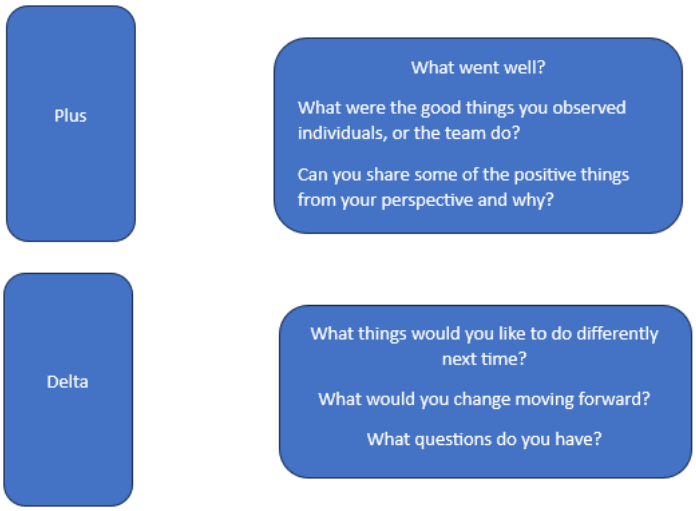

Figure 1: Plus-delta model (adapted from Kainth, 2021).

Methods

Their managers invited healthcare professionals working within in-patient settings to participate in our two-day simulation-based ligature management workshop. A purposive sample of ten healthcare professionals was enrolled in this study. The participants were all members of the clinical mental health care team. Participants were 18 years old or older and could provide written informed consent. Participants needed to be proficient in English to read and make an informed decision. Individuals were excluded from the study if they did not have access to email or the internet to receive the Participant Information Sheet or consent form before the training. Qualitative data was collected following a two-day simulation workshop via audio recording and verbatim transcriptions that were thematically analysed and interpreted by the research team.

Ethics

In compliance with the University's Research Ethics Code of Practice, all ethical guidelines were strictly followed during the study. Participants were protected from physical harm, and safety rules were emphasised during a pre-brief session. The actor portraying the patient was instructed not to use force or throw objects in the direction of participants. Although sharp objects, such as ligature cutters, were utilised during the simulation, participants received a thorough pre-briefing on their safe usage.

Throughout the study, participants were encouraged to express any discomfort or distress they experienced and could opt out of the training sessions. While ligatures, self-harm, and suicide may be mentally distressing, healthcare staff regularly encounter such distressing situations in their clinical practice. Individual data was kept anonymous and was not disclosed to any other individual or organisation. The data collected was used solely for this study and was accessible only to researchers at the University. Following the General Data Protection Regulation (GDPR) outlined by the Data Protection Act (2018), participant data was securely stored.

The participant information sheet and consent form indicated that audio recordings were necessary for data analysis. For participants who did not wish to be audio-recorded, the option to stop recording during their participation was provided, and the option to edit out their voice input was offered; however, no one chose these options.

Data analysis

Data were analysed using verbatim transcriptions of the participants' voice and narrative feedback. Thematic analysis is a widely used qualitative data analysis method that involves identifying patterns, themes, and meanings within data (Braun & Clarke, 2006). The process of thematic analysis typically involves six steps: familiarising oneself with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing a report (Braun & Clarke, 2006; Nowell et al., 2017).

In the first step, the researchers became familiar with the data by reading and rereading it. In the second step, the initial subthemes were generated by highlighting prominent features of the data. In the third step, key themes were established. In the fourth step, the key themes were reviewed by checking if they accurately represent the data. In the fifth step, key themes and sub-themes were defined and named by creating a coherent description. Finally, in the sixth step, a report presents the themes and their analysis clearly and concisely (Nowell et al., 2017). Following these six steps, the researchers could analyse qualitative data and identify important themes and patterns effectively and systematically.

Additionally, the researchers considered and utilised the hermeneutic circle, which helped to continuously review the identified themes emerging from data (Gadamer, 1960). This process enables researchers to immerse themselves in the data, iteratively reading and identifying patterns and themes while transitioning between individual data and broader context. This cyclical process enables refinement and adjustment of their understanding (Gadamer, 1960).

Findings

Theme 1: Transformative experience

Primarily, the participants described transformed experiences following their simulated ligature training and management workshop:

> I have gained knowledge of how to manage patients with a risk of ligature.
>
> Made me reflect on myself; I will spend more time listening than talking.

> It's given me more confidence to adapt my approach based on the patient/incident. It's made me more aware that we shouldn't make assumptions.
>
> I have learnt to always take everyone as an individual and explore their feelings and experiences.

The participants describe gaining knowledge, increased confidence, improved listening skills, and the importance of treating patients as individuals to better support and approach patients in distress, particularly those at risk of ligature.

Theme 2: Transformed views about ligature training

Secondly, the participants also described transformed views about ligature training:

> You don't always have to physically intervene to cut ligature unless there's an urgent need for that. Instead, talk to them.
>
> I feel more confident in dealing with ligature attempts.
>
> I still feel very sad and traumatised by the use of ligatures, but I feel I'm better equipped to manage myself and patients during these incidents.
>
> Try not to panic; the situation is still in the patient's control, and we just need to engage with the patient positively to help them make healthy choices.

The participants' narratives describe a shift in perspective, highlighting the importance of communication over physical intervention, increased confidence in handling ligature situations, recognition of the emotional impact and improved preparedness, and advocating for a patient-centred approach in dealing with ligature incidents.

Theme 3: Patient-centred risk management and empowerment

The final key theme was Patient Cantered Risk Management and Empowerment. The participants also described transformed views about ligature training:

> Always let the patient own the risk management plan by involving them all the way.
>
> Exploring the best possible ways to help the patient stay safe in the ward. Being patient-centred.
>
> To listen more and be less reactive.
>
> Individualised care is everything. There needs to be less focus on restrictive practices across the board in mental health services.

The participants' narratives emphasise the importance of involving the patient in developing a risk management plan to ensure they have ownership of their care and feel empowered. Participants' narratives describe prioritising patient safety and ensuring that care is patient-centred, which involves exploring the best ways to keep patients safe. This narrative emphasises the need for healthcare professionals to actively listen to their patients and avoid being reactive in their responses. The narrative also highlights the importance of providing individualised care to patients rather than relying on restrictive practices applied universally across mental health services.

Discussion

The participants described transformed experiences following their training and workshop. They reported gaining knowledge on managing patients with a ligature risk, reflecting a newfound confidence in handling such situations. One of the key findings identified by the participants highlighted the importance of listening more and talking less, which helped them better understand their patients' needs and perspectives. By treating patients individually and exploring their feelings and experiences, participants learned to adapt their approach based on the patient and the incident. This theme within our findings is consistent with previous research highlighting the importance of staff training in managing patients at risk of ligature.

Additionally, a qualitative study by Anderson et al. (2003) explored staff experiences and perceptions of self-harm and ligature. Participants in that study reported feeling unprepared and vulnerable when managing patients who engaged in self-harm and ligature behaviour. However, the study also found that training and education on risk assessment and management effectively reduced staff anxiety and improved preparedness. Similarly, a study by Fidalgo and colleagues (2017) explored the impact of training on staff confidence in managing ligature incidents. The study found that training improved staff confidence in handling such incidents and reduced the need for physical intervention.

Participants also reported transformed views about ligature training. They recognised that physical intervention such as restraint, holding, and touching is not always necessary and that communication is a more effective means of intervention. This approach maintains patient autonomy and control over their care, reflecting a patient-centred approach to care. Participants also described increased confidence in handling ligature attempts, indicating improved preparedness to deal with such incidents' emotional impact. Overall, participants learned to engage with patients positively to help them make safer choices, even in challenging situations. This theme within our findings is consistent with previous research highlighting the importance of a patient-centred approach to care when managing patients at risk of ligature. A systematic review by NICE (2011) recommended a patient-centred approach focusing on understanding and addressing the underlying issues behind self-harm and suicidal behaviour rather than solely focusing on the behaviour itself. This approach prioritises communication and collaboration with patients to ensure they feel supported and empowered throughout their care. Additionally, a study by Newman et al. (2018)

explored staff members' experiences in a UK prison setting who managed prisoners who engaged in self-harm and ligature behaviour. Participants in that study recognised the importance of maintaining patient autonomy and control over their care, even in challenging situations.

The final key theme was patient-centred risk management and empowerment. Participants recognised the importance of involving simulated patients in developing their risk management plan, giving them ownership of their care, and empowering them. This approach prioritises patient safety and explores ways to keep patients safe, reflecting a patient-centred approach to care. Participants also learned to listen actively to their patients so they could be proactive and prevent potential incidences of self-harm. By providing individualised care, healthcare professionals can better support and engage patients who are in distress, leading to improved patient outcomes and reduced staff burnout. This theme within our findings is consistent with previous research highlighting the importance of a patient-centred approach to care in mental health services. A systematic review by Roseet et al. (2017) emphasised the importance of involving patients in their care and decision-making processes to meet their preferences and needs.

Enhancing mental health care through simulation-based education

Simulation-based pedagogical education is vital in preparing healthcare professionals in the context of mental healthcare because it offers a safe and controlled environment for learners to develop their knowledge, skills, and confidence. Simulation-based education allows learners to practice managing complex and challenging situations in a controlled and supportive environment, such as managing patients at risk of ligature. This approach enables healthcare professionals to gain experience in managing real-life scenarios in a safe and controlled environment without putting patients at risk (Husebø et al., 2015). Simulation-based education also allows learners to understand and empathise with the phenomenology and lived experience of patients who engage in self-harm and suicidal behaviour. By simulating scenarios that patients may face, healthcare professionals can better understand the underlying factors contributing to such behaviours and develop a deeper understanding of the patient's experiences (Anderson et al., 2015). This approach helps foster a more empathetic and compassionate approach to care, which is critical in mental healthcare. In addition, simulation-based education provides a platform for healthcare professionals to learn and practice patient-centred care. By involving patients in developing their risk management plans and exploring the best possible ways to keep them safe, healthcare professionals can ensure that their care is tailored to the patient's needs and preferences. This approach helps to empower patients and prioritise their safety, which is critical in mental healthcare (Skelton et al., 2015).

Consequently, simulation-based pedagogical education is essential for preparing healthcare professionals in mental healthcare. It provides a safe and controlled environment for learners to develop their knowledge, skills, and confidence while fostering a deeper understanding of the phenomenology and lived experience of patients who engage in self-harm and suicidal behaviour. This approach helps to promote a more empathetic and compassionate approach to care, which is critical in mental healthcare.

Implication for practice

The implications of using simulation to educate healthcare professionals to deal with ligature hanging and patient suicide are significant for nursing practice and patient care. Firstly, simulation education can provide healthcare professionals with a safe and controlled environment to learn and practice critical skills needed to identify and intervene in situations involving patient suicide. This can include recognising warning signs, assessing the risk of suicide, and developing an appropriate intervention plan. Simulation education can also allow healthcare professionals to practice their communication skills with patients and families, particularly concerning having difficult conversations.

Secondly, simulation education can help healthcare professionals develop the confidence and competence needed to manage situations involving patient suicide. This can lead to better patient outcomes, as healthcare professionals can intervene early and effectively to prevent suicide attempts. Additionally, healthcare professionals educated in suicide prevention and intervention are better equipped to provide emotional support to patients and their families, which can be critical to patient care.

Finally, preparing healthcare professionals' using simulation education pedagogy can contribute to an overall improvement in the quality of patient care. Healthcare professionals skilled in suicide prevention and intervention are more likely to provide appropriate care and support for patients, which may lead to better patient outcomes, reduced readmissions to acute care services, and improved collaborative and multidisciplinary working. This is key to providing the patient with high-quality care.

Conclusion

In conclusion, this phenomenological study sheds light on the transformative experiences of mental health professionals who participated in a two-day simulated ligature training and management workshop. The study identified three key themes: transformative experience, transformed views about ligature training, and patient-centred risk management and empowerment. The findings suggest that simulation-based training can enhance mental health professionals' competence, resilience, and preparedness in managing ligature-related situations. Using simulation as a learning pedagogy allowed learning to occur in a psychologically safe space, helping develop competence and confidence, which is transferable back into clinical practice. Furthermore, involving patients in developing their own risk management plans and providing individualised care can improve patient outcomes and reduce staff burnout. Additionally, exploring the lived experiences of those who participated in this study enabled them to reflect and appreciate the complexities

of ligature. Overall, this study provided valuable insight into effective simulated training strategies for mental health professionals in managing complex and challenging situations in mental healthcare.

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The utilisation of a standardised educational framework to develop and deliver impactful programmes of simulation-based learning

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Abstract

Simulation has become a well-integrated modality of learning in pre- and postgraduate healthcare education programmes. The use of advanced technologies and the delivery of complex simulation-based learning opportunities require adequate preparation of healthcare educators. This paper details a European collaborative development and utilisation of an educational framework designed to prepare educators for the delivery of simulation-based learning strategies. The framework was subsequently adapted by a commercial partner and an evaluative study identified the impact of this programme of education on United Kingdom Faculty and within the National Health Service utilising qualitative methods of enquiry.

The evaluation study demonstrated that the use of the educational framework effectively educates faculty to construct and deliver simulation-based learning. Furthermore, the valuation demonstrated positive impacts on patient safety by increasing the confidence and skills of frontline staff and by improving the 'preparedness' of systems. It has also contributed to significant economic benefits within healthcare organisations.

Introduction

This paper describes the development and validation of an educational framework that prepared nurse educators who teach in pre- and post-registration settings to utilise simulation-based learning (SBL). The framework was developed through a European collaboration between educational institutions and an industry partner.

SBL has become central in nurse education and is integrated throughout curricula worldwide to ensure that students develop clinical skills and clinical reasoning, to become competent caregivers (Aebersold, 2018). SBL is an effective, complex education strategy that can be used to replicate clinical practices in a safe learning environment and is ubiquitous within university and clinical settings (Johnston et al., 2018; Shin et al., 2015). Educators and facilitators are key to any successful learning approach and as such must possess adequate skills in developing and delivering SBL (Persico et al., 2021). As SBL became more prevalent within healthcare education, it became increasingly apparent that educators utilising this teaching and learning strategy would require suitable preparation and education to facilitate its potential (Morse et al., 2019). The last decade has witnessed a significant increase in the innovative technological advances in SBL with associated practices, and it has now become a modality of learning that spans the entire career of many healthcare professionals, including nurses, across their under- and postgraduate programmes of education and clinical practice (Morse et al., 2019). In the UK and USA, SBL has been used to replace significant elements of students' learning in clinical settings (Waxman et al., 2019). The associated investment in technology and infrastructure, which is often required, and the increasingly complex SBL opportunities provided have not always been matched with associated investment in the education and preparation of educators who have become immersed in this approach to teaching and learning (Topping et al., 2015).

Recognising such disparity with regard to their own experiences, educators and researchers from a range of academic institutions and industry shared their concerns and formed a collaborative research team.

The research team undertook a systematic rapid review and synthesis of the literature (Topping et al., 2015), investigating the competencies required to utilise SBL effectively. Delivery of SBL appeared to demand competencies associated with planning and designing simulations, facilitating learning in "safe" environments, expert knowledge based on credible clinical realism, with reference to evidence-based knowledge, and demonstration of professional values and identity. In 2013, the research team expanded to include an industrial partner that is a global company and significantly influential in the development and distribution of manikins and task trainers used for simulation (Laerdal Medical, 2023).

The research team successfully bid for European Union Transfer of Innovation funding (20013- 1-DK1-LEO05-07053: €250,000) to develop and test a framework to prepare educators to utilise SBL. The outcomes of the systematic review directly influenced the design of the framework now named NESTLED (Bøje et al., 2017). The initial framework consisted of eight elements (Table 1). The testing of the NESTLED competency framework demonstrated a significant increase in participant confidence in preparing and running SBL events. This prototype was then refined and further tested in Finland and Estonia (Koivisto et al., 2018).

Table 1: The NESTLED Framework.

Phase	Session	Content	Suggested Teaching and Learning strategy
Preparation for SBL event	1. Background to simulation-based learning	Theories of learning through simulation and facilitation and definitions. Simulation-based learning cycle (SLC) and evidence-based competencies.	Pre-reading (directed reading) and didactic.
	2. Pre-planning	Curriculum, design and operationalisation (positioning SBL). Devising SBL (level, baseline, and contributory learning, audience [uni- or multi-professional], assessment [formative/summative]).	Group work activity including curriculum analysis. Lecture/discussion.
	3. Hypothetical case development	Devising and planning delivery. Case design. Operational planning (equipment, setting, staffing, instructions, guidance development, handouts, etc.).	Mini lecture. Discussion. Group work activity. Design and planning of delivery of a hypothetical case.
Delivering SBL event	4. Briefing	Creating the learning climate. Preparing the student: ground rules, engagement, and professional identity. Students as formative assessors and responsibilities/peer reviewers.	Simulation, video recording, and facilitated discussion.
	5. Delivery "running the sim"	Different roles of facilitator. Managing groups (large and small) Managing individuals, and trouble-shooting equipment. Time management including deviations from planning and disruptions. Improvisation. Acting.	Simulation (recorded). Discussion (face to face). Structured online discussion (recording available to participants online).
	6. Debriefing	Different forms of debriefing including theory, techniques, timing, familiarity with video, debriefing in groups and with individuals. Ethical issues to do with confidentiality	Mini lecture. Discussion. Role-play. Simulation (recorded).
Feedback and Evaluation of the SBL Event	7. Evaluation of student learning	Theory of assessment. Assessment strategies including formative and summative and competency assessment. Assessment schemas. Rater reliability and validity of assessment. Rater negotiation and consensus.	Pre-reading. Discussion. Interactive appraisal of an example of (recorded) assessment. Reflective writing.
	8. Evaluation of the SBL (the "learning experience")	Modes of evaluation. Theoretical input on different ways of evaluating.	Discussion. Workshop activity.

In 2016, the Laerdal Medical® Educational Services team adopted The NESTLED Framework and adapted this into a four-step programme, the NESTLED Faculty Development Program in Simulation (NESTLED FDP). The rationale was to increase the reach of this evidence-based programme, to better prepare educators in healthcare organisations and academic institutions across Europe to maximise the potential benefits of SBL. Since 2016, the NESTLED FDP has been delivered across healthcare and education sectors in seven European countries.

As the reach of the NESTLED FDP extended, the project team further investigated and evaluated the impact of completing the programme for both the individual and their organisation. The aim of this paper is to evaluate the

perceived impact of the NESTLED FDP.

Adapting the NESTLED framework into a faculty development programme.

A requirement of the European Union Transfer of Innovation Fund was that a commercial partner was part of the core membership. Laerdal Medical® (Stavanger, Norway) was identified as a suitable commercial partner to support the stages of refining and validating the NESTLED framework. Once the framework was validated, discussions were held with the Educational Services (ES) team at Laerdal Medical® regarding the operationalisation of the framework.

A team of three educators from the ES team (1 UK, 1 Norway, and 1 Denmark) reviewed the components of the NESTLED framework to distil the eight sessions into the NESTLED FDP which met the following development goals:

1. The programme had to be agile in its construction. It had to be deliverable within any clinical environment and it had to have relevance for new and experienced educators.

2. It had to address current challenges in healthcare delivery or education. Multi-professional teams must be supported to identify and then develop a simulation activity that addressed current challenges faced in practice.

3. The programme must be hybrid in nature. A combination of face-to-face and online resources would support the translation of new learning into practice.

4. The simulation activities developed must be able to evidence impact.

Table 2 describes the integration of sessions from the NESTLED framework into the NESTLED FDP.

Table 2: The four steps of the NESTLED faculty development programme.

NESTLED Faculty Development Programme Module		Content	NESTLED Framework sessions
1	Overview of Simulation Education (eLearning)	Conduct a workplace analysis to identify areas of practice that require improvement. Engage with literature relating to the use of simulation-based education.	1 and 2.
2	Simulation in Education in Practice (face to face)	Discuss and receive feedback on workplace analysis. Work in small teams to develop a simulation scenario based on the workplace analysis.	3 and 4.
3	Delivery of a High-Quality Simulation (face to face)	Deliver, test, and refine your simulation activity. Identify data capture points to show the impact of this solution.	5, 6 and 7.
4	Approaches to Change Practice (face to face)	Develop an implementation timeline for the validated solution. Consider how to report the impact of this intervention within your organisation.	7 and 8.

The NESTLED FDP was delivered across Europe by the ES team. All members of the ES team undertook a training the trainer's course before delivering the NESTLED FDP for the first time. One educator would facilitate the delivery of a NESTLED FDP and they frequently ran multiple programmes at the same time. Each programme could accommodate a maximum of 12 attendees. The face-to-face modules were delivered at four-week intervals. This break in between modules was designed to allow attendees to test and refine their simulation activity within their area of practice.

It was essential that there was a logical process to support educators in identifying current challenges, develop and test appropriate solutions, and then implement their simulation activities within clinical or educational settings. The Circle of Learning (Figure 1) was developed by Laerdal Medical and comprises five stages which support individuals or healthcare teams to enact impactful change in a logical manner (Sautter & Eikeland, 2008).

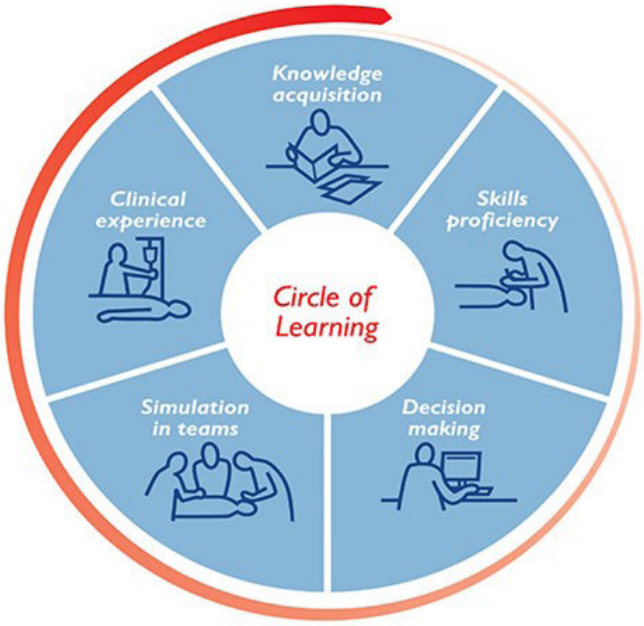

Figure 1: The Circle of Learning (Sautter & Eikeland, 2008).

The Circle of Learning is similarly constructed to Quality Improvement methodologies, such as the Model for Improvement (Langley et al., 2009). It supports a stepwise approach to the development and rapid testing of solutions at incremental stages. The Circle of Learning was utilised to support the core framework of the NESTLED FDP as it provided a clear road map for attendees to follow from the initial conceptualisation of a simulation activity to its implementation within clinical or educational settings. Table 3 demonstrates how the five stages of the Circle of Learning were used to underpin core work activity during the NESTLED FDP.

The Circle of Learning served as a bridge between the NESTLED FDP and real-life experiences within clinical or educational settings. This approach facilitated attendees in ensuring simulation activities they developed had direct relevance to their area of practice and developed momentum within their workplace in supporting colleagues engaged with this change process. The staggered delivery of modules ensured that support was provided by the ES team over 8 – 12 weeks, thus ensuring that the attendee felt prepared to deliver their simulation activity and thereafter report the

Table 3: How the Circle of Learning underpinned the NESTLED Faculty Development Programme.

	Stages in the Circle of Learning	Activity during the NESTLED FDP
1	Knowledge acquisition	Identifying relevant data that creates the basis for change.
2	Skills Proficiency	Forming a development team; define the challenge that the simulation activity will address.
3	Decision Making	How will the simulation activity enhance current practice; what are the impact measures that will be captured before, during, and after the implementation of the solution.
4	Simulation in Teams	Small-scale testing, refining, and validation of the solution.
5	Clinical Experience	Translation and integration of the simulation activity within clinical or educational settings.

impact of this intervention within their organisation.

Methodology

The purpose of this evaluative study was to investigate the impact of the NESTLED FDP on UK Faculty and within the National Health Service (NHS) utilising qualitative methods of inquiry. Specifically, through interviews with Faculty and other NHS staff, the evaluation sought to investigate:

1. How Faculty evaluated the programme.
2. To what degree Faculty has acquired confidence to use SBL in their practice.
3. How Faculty applied what they had learnt when they were back in their own work settings.
4. What impacts occurred in the NHS because of Faculty completing NESTLED FDP.

A formal evaluation of the NESTLED FDP was undertaken by the University of Huddersfield in partnership with Laerdal Medical® and the international NESTLED project team, to investigate the impact of the programme on the participants' practice and their organisation.

Study design

This evaluation used an overarching qualitative descriptive approach (Bradshaw et al., 2017). This approach, used widely in nursing research, focuses on the 'who? what? where? why?' of the phenomenon under investigation and can incorporate multiple approaches to analysis.

Ethical approval

Ethical approval for this evaluation was obtained from the School of Human and Health Sciences Research Ethics Panel at the University of Huddersfield. Permission from each National Health Service (NHS) organisation was also obtained as the participants were predominantly NHS staff.

Participants

Participants were identified and approached by the Laerdal ES team and invited for an interview. In total, 14 individuals volunteered and were subsequently interviewed. Nine attended the NESTLED FDP and will be referred to as 'Faculty'. These participants represented seven NHS Trusts in five counties in England and one NHS Trust in Scotland. The remaining five participants were individuals identified by the Faculty or the Laerdal ES Team, who could provide further evidence of the impacts of the NESTLED FDP in practice. Throughout the report, these are referred to as 'Snowball'.

Data collection

The interviews were conducted in person, face-to-face, via Skype, or via the telephone. All interviews were audio recorded, transcribed verbatim for manifest content, and anonymised.

The Kirkpatrick Model for evaluating training programmes (Kirkpatrick & Kirkpatrick, 2006) was used to structure interviews to determine how effective the NESTLED FDP was in association with four different levels of complexity:

1. To what degree participants reacted favourably to the programme.
2. To what degree the participants acquired confidence to use SBL in their practice.
3. How participants applied what they had learnt when they were back in their work settings.
4. What impacts occurred because of the training programme and use in practice. An adapted VICTOR (Visible ImpaCT of Research) (Jones et al., 2021) was used to identify the impact of the NESTLED FDP in practice.

Analysis

Qualitative Content Analysis (Elo & Kyngäs, 2008) is a method developed for the thematic analysis of qualitative research data. It utilises both deductive and inductive processes and has three stages: preparation, organising, and reporting.

The study investigators independently coded the analysis of interview transcripts. This coding used the Kirkpatrick Model (based on the interview schedule and VICTOR) as a deductive framework, but content themes with this framework were inductively derived. The Lead Investigator coded all the interviews, and the other co-investigators coded four each. The Lead Investigator and two UK-based co-investigators agreed on a final coding framework. The Lead Investigator recoded all the interviews and produced analysis matrices.

Impact

Programmes delivered and healthcare teams impacted

NESTLED Faculty have utilised their training to deliver SBL across a wide range of clinical specialties and professional groups within their organisations. Table 4 reports the numbers of programmes delivered across Europe by country from 2017 – 2020; Table 5 identifies healthcare teams impacted by NESTLED FDP.

Table 4: Programmes delivered across Europe.

Year	Number of NESTLED FDP programmes delivered by country				
	UK	Norway	Denmark	Germany	Spain
2017	3		3		
2018	10	1	2	4	2
2019	17		2	3	1
2020	4				
Total	34	1	7	7	3

Table 5: Healthcare teams impacted by NESTLED FDP.

Clinical Specialties and Teams	**Professional Groups**
Emergency Departments	Overseas nurses
Trauma	Foundation medical trainees
Theatre	Cardiology trainees
Dementia teams	Physiotherapists
ITU	Consultants
Transfusion teams	Optometrists
Maternity teams	Anaesthetic nurses
Cardiology	Registered nurses
Paediatrics	Nursing assistants
Renal	Midwives
Medicine	**Other Groups**
Surgery	Medical students
Ophthalmology	Ward Clerks
Obstetrics and gynaecology	Schools
Palliative Care	

NESTLED Faculty (n=9) were predominantly Simulation Leads or Clinical Skills Facilitators, representing seven NHS Trusts in the UK and one Hospital board in Germany. Six out of nine were classified as 'experienced' SBL educators, with over two years of experience, versus three who were 'novices'. Faculty reported a range in the proportion of their role spent using SBL (see Table 6).

Five out of nine Faculty had received no previous training on how to effectively deliver simulation-based learning. Two reported previous one-day 'theoretical' courses and one a three-hour course about the Diamond Debrief Model (Jaye et al., 2015). Only one Faculty reported formal training from a Simulation Centre, some 15 years previously.

Snowball participants

Five 'snowball' interviews were undertaken. These individuals included members of clinical skills teams who held an overview of the wider impact of the NESTLED FDP within their organisation. In addition, there were foundation medical staff, who had attended an in-house training session hosted by one of the faculty. Finally, a Specialist Nurse working alongside a colleague who had attended the NESTLED FDP

Table 6: Description of participants.

Domain	**Details**	**N**
Faculty		
Role	Simulation Lead	4
	Clinical Skill facilitator	3
	Medical staff	2
Background	Nursing	6
	Paramedical	1
	Medical	2
Years of experience using SBL	0 – 1.9 years (novice)	3
	2+ years (experienced)	6
Proportion of role spent using SBL	0 – 25%	2
	26 – 50%	3
	51%+	2
	Missing data	2
Previous SBL training	None	5
	1-day or less	3
	Formal training	1
Snowball		
Role	Clinical skills Lead (retired) Clinical skills technician 2x Foundation Year 1 doctor Diabetes Surgical Specialist Nurse	

devised an SBL event that resulted in significant impact on clinical practice.

Experience of NESTLED FDP (Kirkpatrick Level 1)

Training style

The practical, 'hands-on workshop' nature of the NESTLED FDP was appreciated by the faculty, together with the capacity to make the training 'bespoke' for each participant. Undertaking the training with a mixed group facilitated peer-to-peer learning and support.

> There was a lot of opportunity to look at what I needed as a facilitator and what would benefit my project, which I really appreciated. NESTLED had those moments where I could focus on specific things, like how do you do a proper debrief, rather than just give an overview of 'this is roughly how a debrief should run' and that was really useful (Faculty 1026 [novice]).

Several Faculty found the blended teaching of theory and practice particularly useful.

> It gave you the background, and it also broke down the way to develop simulation and the questioning behind what you're trying to get across. So, it was a nice sort of process over the course, how to get there at the end, if you know what I mean. So, we, we built up to doing a scenario, and then at the end, obviously, we ran that with the colleagues that were on the course in groups and stuff, and then the idea was then to take it back into your own environment to run (Faculty 1024 [novice]).

Specific topics within the NESTLED FDP, such as learning outcomes, audit, evaluation, and debrief, were considered particularly useful. Eight out of nine Faculty highlighted the

debrief as an area where they had benefited (see Debrief for more details).

Impact of NESTLED FDP on Faculty (Kirkpatrick level 2)

Increased confidence

Following the NESTLED FDP, 8/9 Faculty (1 missing data) reported an increase in their confidence to deliver SBL. This was evident in both novice and more experienced Faculty.

> The biggest thing that I got was a sense of confidence from NESTLED (Faculty 1026 [novice]).

> So, I was able to utilise some of the skills that I did learn there and be more confident in making things and also more confident in giving advice to other people when it came to them doing simulation (Faculty 1007 [experienced]).

> When we are almost winging it, but it's not very nice, you know, when you have done a job, but you don't always get that job satisfaction from it. But following NESTLED, I'm more confident in designing, delivering, and debriefing… it has definitely changed my feeling toward simulation (Faculty 1006 [experienced]).

> I think it definitely gave me the confidence to be able to plan the sessions better and then hopefully get the result I wanted (Faculty 1024 [novice]).

Thinking differently

Before their NESTLED FDP training, experienced Faculty had been delivering SBL with no (or minimal) formal training. They reported a shift in their thinking following NESTLED FDP. This shift in thinking led to the realisation that SBL is not just limited to teaching new clinical skills but can be used effectively to implement existing clinical knowledge e.g., to facilitate adherence to protocols and best practice and to promote communication and teamwork.

> NESTLED made me think about how [SBL] is used as an educational tool. So rather than it's about teaching how to manage a particular condition, it's about how you implement skills you already have... NESTLED changed my view from that point of view, that you know, it's not about individual skill, but more about what people, the more human factor stuff, what makes people do what they do and yeah, that was an eye opener (Faculty 1002 [experienced]).

Improved communication within faculty and a change in how debriefing was delivered were also noted.

> We all understand, we've all been trained the same, so we understand and work with each other better for having NESTLED training… I think [communication] is more professional, simulation language… we communicate differently…We communicate better why we are doing certain things ... So, we are more efficient, effective and yeah, I think it's better, a better working atmosphere (Faculty 1006 [experienced]).

As well as an increased understanding of the role of the debrief, there was a shift in thinking about the role of the pre-brief.

> Just completely re-arranging how we're going to run our PROMPT training now and the amount of time we're going to allocate to each simulation within the day and how we're going to brief people on what we're expecting from them (Faculty 1015 [experienced]).

Faculty use of NESTLED FDP in practice (Kirkpatrick level 3)

Responsive SBL

SBL was utilised in healthcare organisations in response to Serious Incidents (SI) and triggers such as complaints, incident reports, or audits, and was seen as part of action planning.

> We had what's called NaDIA, which is the National Diabetes Audit… at this Trust we noticed that there were quite a lot of people experiencing hypoglycaemia… We did have an incident related to someone experiencing hypoglycaemia… when there wasn't a lot of staff around, and it was brought to my attention that perhaps we needed to look at the education of the staff around that (Snowball 1008).

> So, you see it a lot as a solution, you have an incident, and we get a lot of people putting sim down as an action following an SI (Faculty 1002 [experienced]).

Incorporating knowledge and skills learnt from completing the NESTLED FDP, SBL has been used to 'springboard off' serious incidents and to practice 'never and rare´ events. This approach has resulted in improved preparation in clinical areas to avoid potential patient harm.

> This was off the back of one SI. So, they had a patient who deteriorated and became quite unwell, and when it was investigated, they'd stuck on the action plan as they sometimes do, simulation, the action plan. But when I met their manager, they didn't need simulation for that SI; that was all about process. They'd had a patient who they shouldn't have had. So, I kind of agreed with her that we do some sim about those patients they're not meant to get (Faculty 1002 [experienced]).

Proactive SBL

Several participants reported that they used SBL proactively as part of generic and explicit quality improvement approaches, noting the opportunities to encourage learning on broader, underlying issues and change attitudes within their organisations.

> I very much try to push it as identifying risks before they happen, rather than, once they've happened, there's no point in me going and re-running some traumatic event because people have already spoken about it and debriefed it without our input… We look at the kind of core issues that led to that. So often,

> when you have an SI, there… might be… a breakdown of communication. So, we'll do other simulations that look at communication skills but don't re-run that SI (Faculty 1002 [experienced]).

> So recently, we've just had an overhaul of our triage process within the [Emergency] Department… we had to develop a whole new educational package around that and looking at [Standard Operating Procedures] and pathways for how we triage patients… we use the Royal College of Medicine Guidelines…But we've also run quite a lot of simulation around the new process. So, it's not just an education, they're learning how to use the new process (Faculty 1024 [novice]).

Doing things differently

A key challenge noted by Faculty was releasing staff from front-line care to attend training. Completing the NESTLED FDP resulted in a shift in the thought process amongst Faculty in how SBL sessions could be delivered. For example, reducing the duration of an SBL event increased the uptake for many clinical frontline staff to attend. The concept of 'coffee break simulation' was used as part of the NESTLED FDP to describe how participants might deliver simulation within a shorter period compared to what might be delivered within a simulation centre. The principle of coffee break simulation was to deliver a simulation activity within a maximum of ten minutes and thereafter conduct a debrief which meant that participants were returned to their clinical area within the time normally allocated to a coffee break.

> I think our biggest challenge… was, you know, we want to do it, but people don't come for, you know, they can't be released and they'll tell you, 'we don't have an hour, two hours to come over,' and he [Instructor on Faculty Development Programme] was like, 'have you ever thought about [a shorter session] and having a ten minute debrief afterwards?' It was very, very useful because now we have people coming in their lunch hour for a scenario, we'll usually just have them for an hour, give a session, debrief and they're gone. So that has made a massive impact concerning our scenarios that way (Faculty 1006 [experienced]).

> It's a massive task. So, as you can imagine, we don't necessarily have the time… we thought we didn't have the time to debrief, pre-brief, all of that. We did, however, figure out in NESTLED that it's completely doable and because of that, we are re-arranging our programme (Faculty 1015 [experienced]).

More experienced Faculty have incorporated knowledge and skills learnt from the NESTLED FDP into reviews and redesign of existing training e.g., more formal planning and communication of scenarios, noting the effect this has on participants' wellbeing and training uptake.

> So, what we used to find before was that we didn't used to brief anyone, we just used to walk into a clinical setting, find a room, pretend to be a patient, call the emergency buzzer and expect people to act and people would run away and hide and think that we were testing them and feel very intimidated. But now we tell people what we're going to do, what we're expecting them to do and that there will be a debrief at the end and a time for discussion and we're finding that the uptake rate is much higher… It's been really positive actually (Faculty 1015 [experienced]).

In addition to developing and delivering SBL in practice, novice Faculty used transferable skills learnt during the NESTLED FDP within other contexts such as supporting medical students and mentoring junior colleagues, sharing scenario templates with Trust staff so that scenarios could be codesigned, and improving aspects of external formal training.

> The [NESTLED FDP] has led to me developing an additional section for stroke thrombectomy assessment and transfer to the thrombectomy centre in another health board (Faculty 1037 [novice]).

Debrief

The debriefing aspect was highlighted by all Faculty as being a particularly useful aspect of the NESTLED FDP.

> I think the most benefit for me was the debriefing and having an example of how to debrief using factual stuff where it happened in the scenario was very useful (Faculty 1006 [experienced]).

> NESTLED just sort of honed our skills in simulation and taking into consideration factors that we'd never considered before. So how people are affected by simulation in their clinical settings and how you almost take simulation with you unless you're debriefed out of it. I think we didn't really consider people in it at all, we kind of saw it as a task and had outcomes to meet that task without considering really the implications it had on people (Faculty 1015 [experienced]).

The NESTLED FDP educated Faculty about increasing the focus on the debrief which changed their existing approaches to this important step in the SBL process.

> The biggest challenge for me was conducting the debrief… So being able to sit down and you know, deliver our scenario, I mean actually sit down with [Instructor on NESTLED FDP] and do a structured debrief, I found that very useful… I have a structured approach that I follow, and I think it has definitely helped vastly in the way I debrief (Faculty 1006 [experienced]).

> What we didn't focus on [prior to attending the NESTLED FDP] at all was debriefing and I think what I took away most from NESTLED was how to debrief appropriately and how to get people out of the simulation mind frame, which I knew nothing about before (Faculty 1015 [experienced]).

Faculty used their developed debriefing skills in other teaching contexts, such as when training medical students.

> Skills of debrief has actually come in handy for when I do teaching in the clinical environment with patients because sometimes I have students and I say 'oh go and take a history from this patient and come back and let me know' and that's actually debriefing skills, it's not simulation, but talking to them afterwards, I need to be able to debrief them (Faculty 1026 [novice]).

Impact of the NESTLED FDP in practice (Kirkpatrick Level 4)

The NESTLED FDP made a difference in the NHS in several ways, identified through four main impacts derived from the analysis of the data: increasing patient safety by improving the preparedness of staff and systems, increasing staff clinical communication skills and confidence, and economic impact through cost saving.

Impact of the NESTLED FDP on patient safety

SBL delivered by Faculty resulted in improved skills, better adherence to existing protocols, and the adaptation of systems and provision of appropriate equipment/supplies. It also influenced associated education and training, and the introduction of new safety-focussed protocols. Faculty contributed to these impacts by using SBL to highlight evidence of skills and knowledge gaps and by providing skills training in a 'real' clinical context to fulfil education and training needs. Examples of these impacts are illustrated in the following case studies.

Case study 1. SBL improves preparedness for hypoglycaemic incidents

> I have been amazed at the results we've had… It is a brilliant and realistic method for learning for hospital staff (Snowball 1008).

In 2017, the National Diabetes Inpatient Audit (NaDIA) identified that one NHS Trust recorded higher than average rates of hypoglycaemia (23.6% vs. a national average of 16.7%). This led the Diabetes team to re-evaluate the hypoglycaemia education provided for staff. At the time, the approach to hypoglycaemia education and training was solely classroom-based teaching led by the Diabetes Specialist Nurses. The lead nurse approached their simulation lead, who had completed the NESTLED FDP about delivering hypoglycaemia-specific simulation-based training that aligned with local and national guidelines. A simulation-based training session was piloted with a multidisciplinary healthcare team, including clerical assistants and students.

Pre and post hypoglycaemia simulation-based training confidence scores were measured by the local team, of which 93% of staff felt more confident in recognising and treating hypoglycaemia following the simulation-based training. Confidence scores increased from 2.8 to 7.7 out of 10. Following the simulation-based training, staff evaluated that they felt more knowledgeable and confident in recognising and treating hypoglycaemia (Beecroft et al., 2018).

Since the pilot, hypoglycaemia simulation training has been implemented across the wider surgical and medical teams. Simulation is now included in regular study days for registered nurses and nursing assistants, and there are other general Development Days facilitated by Matrons within the organisation that incorporate hypoglycaemia simulation. Simulation-based training is also delivered in ward areas, so staff receive the same education, but delivered in their own ward context, with the systems they use day to day.

A subsequent NaDIA audit was undertaken in 2019. The average rates of both mild hypoglycaemia and severe hypoglycaemia had significantly reduced (Table 7).

Table 7: Change in Hypoglycaemia rates between 2017 and 2019 in one NHS Trust.

NaDIA Audit Year	Hypoglycaemia rates, compared to England					
	Mild			Severe		
	Trust		England	Trust		England
	%	Quartile	%	%	Quartile	%
2017	23.6	4	16.7	7.3	3	7.1
2019	13.9	2	16.5	5.6	2	6.8

> The simulation training has made a large contribution to our improved inpatient care when experiencing hypoglycaemia (Snowball 1008).

Case study 2. Impact of using authentic equipment during SBL sessions to improve patient safety

SBL has been used by Faculty to improve patient safety in one Emergency Department, as evidenced by a reduction in the number of Datix (a risk management information system used to collect and manage data on adverse events) complaints.

> "We've had a huge number of complaints, 'wrongly labelled', 'not using the system properly', 'equipment' and that's dramatically dropped off" (Faculty 1024 [novice]).

Faculty observed that the issues recorded in Datix indicated a lack of practical skills with equipment, particularly in acute situations.

> It seems to revolve a lot of the time around a practical skill with equipment, I think. So when you've got that really acutely ill unwell patient, you then have to use pieces of equipment that you haven't… used for a long time, or you've never used, or you think you know but you're not really sure, and you're suddenly the person that has to put it together, you know, run it and I think that's incredibly difficult (Faculty 1024 [novice]).

In response to this issue, Faculty focussed their scenarios on the use of equipment in the emergency setting.

> The more you do something, from a practical, it's not necessarily difficult; it's just that you need to be confident and know how you're doing it because you don't want to have to learn when you're under pressure (Faculty 1024 [novice]).

Similar issues with equipment and the knowledge and skills needed to use it were highlighted by other Faculty, emphasising the changes that occurred in Trusts because of the approach taken and the added value of SBL in Quality Improvement.

> There was one piece of equipment that they were supposed to be… universal fittings, but they weren't when it came together. If that had been a real situation, the patient would have died. So immediately, that stock was looked at. So, it… brings to light these real near misses (Faculty 1004 [experienced]).

> "We did an in-situ simulation on ICU, and we discovered that not all the staff knew how to deflate the mattress… that resulted in staff getting training, being rolled out to all the staff so they knew to do that" (Faculty 1006 [experienced]).

Impact of NESTLED-based training on front-line staff

Increased confidence and skills

A common use of SBL was to create a learning space where staff could consolidate clinical skills and practice the use of those skills. This consolidation and practice of skills increased front-line staff confidence, leaving them feeling better prepared for their role.

> I think obviously because, as a student, I think it would be just that increased confidence going to the first shift. I think that would be the biggest impact it had. Just kind of almost within that little safety net of 'well no I've done this before, even as a simulation, I know I do have the skills', so it just gives you that little bit of a safety blanket really (Snowball 1032).

Case study 3. SHOC (Simulated Hospital Out of Hours on-Call)

Faculty 1026 [novice] created SHOC (Simulated Hospital Out of hours on-Call) for final-year medical students in their NHS Trust following their NESTLED FDP. SHOC was designed to give final-year medical students an opportunity to experience an on-call shift in a simulated environment. The training was based on challenges Foundation Year 1 doctors frequently encounter during an on-call shift. Tasks that provoke the most stress, such as handovers, cannulation, prescribing fluids or medication, and analysing blood results were included.

The SHOC course received positive feedback. An evaluation (Hodgson et al., 2019) demonstrated a 40% overall increase in confidence in preparation for on-call shifts, a 30% increase in confidence in prescribing, and a 46% increase in confidence in managing an acutely unwell patient. Feedback from SHOC trainees was very positive.

> You don't tend to get actual experience of being on call as a medical student…the training was brilliant, I was less apprehensive about the little things, like how to bleep someone… how to find my way around the hospital. It definitely helped increase my confidence… going into the first shift… in prioritising jobs, prescribing, communication skills, how to be on call (Snowball 1032).

> It prepared me and made me create a document, which was essentially a mini handover to myself, which I could regularly refer back to over the shift and see what I had done, who needed follow-up and what jobs were outstanding… It has provided me with a foundation of how to properly assess an unwell patient as well as interact with different departments and keep myself organised… it applied very much over my surgical rotation. The SBAR was solidified with the help of SHOC, which helped me a great deal… It helped make the dreaded surgical rotation a walk in the park (Snowball 1028).

These trainees went on to deliver SHOC in Phase Two of its development within the healthcare organisation. SHOC is now delivered by junior doctors independently.

Faculty 1026 [novice] was awarded a Clinical Teaching Excellence Award and has subsequently worked on Phase 3 of SHOC, disseminating SHOC into other Trusts within the region, as well as expanding it to include other professions, such as nursing within the scenarios.

Communication

Improved communication was a common consequence of training noted by Faculty, impacting in a range of clinical areas such as emergency care, theatres, and intensive care units.

> You can see people's practice change when they are doing when we do our in-situ simulation in ITU; their ability to lead teams and communicate things changes and the impact they have on the nursing staff, the cross-multidisciplinary communication changes (Faculty 1007 [experienced]).

Economic impact

Case study 4. NESTLED FDP helps save £1m per year in a single healthcare organisation

One NHS Trust saved £1m per year on the Clinical Negligence Scheme for Trusts (CNST) Maternity Incentive Scheme (NHS Resolution, 2023) as a result of trainers who completed the NESTLED FDP delivering the Maternity Acute Illness Management (M-AIM) course and the PROMPT training (Practical Obstetric Multi-Professional Training).

Safety Action 8 states that 90% of each maternity unit staff group must have attended an 'in-house' multi-professional maternity emergencies training session within the last training year. In 2018/19, following its accreditation with M-AIM, the Trust achieved a 97% compliance rate across its two Birthing Centres, one of which is midwife-led. This was achieved due to NESTLED Faculty being considered eligible to attend M-AIM training and then offer M-AIM both within the Trust and across the wider region.

Another benefit for the Trust is that it can now draw down payment for each regional candidate on this course. A second Trust also reported saving £400,000 per year on their CNST premiums, because of changes made by colleagues who had completed the NESTLED FDP.

> Our maternity component of our bill is four million, so that's four hundred thousand pounds we've saved by delivering that training. So… it's a big economic impact (Faculty 1002 [experienced]).

Conclusion and recommendations

The NESTLED FDP is an effective way to educate and train faculty to facilitate and deliver programmes of education which utilise simulation-based teaching methods. It changes the way that faculty think about simulation-based teaching and learning and how it should be constructed and delivered. SBL facilitates learning in 'human factors' such as communication and teamwork, in addition to being a way to consolidate and implement clinical knowledge into practice.

This evaluation has demonstrated positive impacts on patient safety by increasing the confidence and skills of frontline NHS staff and by improving the 'preparedness' of systems. It has also contributed to significant economic benefits within healthcare organisations.

The COVID-19 pandemic accelerated the acceptance and use of the already prevalent and developing online strategies for delivering education and virtual education products. With the significant investments being made in developing further virtual and online resources (including Augmented Reality and Virtual Reality), we must learn from mistakes in the past where educators were expected to 'run with' developing SBL strategies and products without always receiving the necessary education and support to maximise their potential. We would recommend that the healthcare education academies invest in developing an understanding of these new ways of teaching and learning. This would enable educators to keep pace, feel supported and prepared in maximising the potential of SBL strategies.

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Does simulation in medical education enhance or inhibit the development of self-knowledge?

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Abstract

Simulation has been widely adopted in medical education. Traditionally, the design of simulation activities was through a hierarchical approach where experts within a speciality contributed to the development of content and assessment processes. Whilst this has proved to be a somewhat reliable method, the effectiveness from the perspective of medical students has rarely been examined.

The Ward Simulation Exercise was delivered in the final year of the undergraduate medical curriculum at the University of Dundee. It was designed to assess the capabilities of medical students to prioritise competing demands and work collaboratively within a simulated environment. Medical students were observed by two assessors (normally consultants), who determined whether the student had met the required standard to pass this assessment.

This study examined whether the Ward Simulation Exercise enhanced or inhibited the development of medical students' self-knowledge. This study presented a longitudinal analysis over five years which examined the effect that the Ward Simulation Exercise had on the development of students' self-knowledge. Medical professionals arguably need to be more inclusive of students in designing simulation activities and the associated assessment process. This could allow students to develop self-knowledge appropriate to their stage of professional development.

Introduction

Within medical education, there is a requirement for universities to deliver curricula which ensure that medical students can demonstrate competency in all learning outcomes at the point of graduation (General Medical Council (GMC), 2015; GMC, 2018). In the United Kingdom (UK), the academic journey to graduating as a newly qualified doctor normally takes five years. The construct of medical undergraduate curricula in the UK historically adhered to a positivist paradigm, which facilitates objective measurements of performance and the integration of a spiral curriculum, affording students the opportunity to revisit core concepts and theories and to apply this learning within different clinical specialities (Acton, 1951; Bruner, 1960).

The most obvious evidence of continued adherence to a positivist paradigm within medical education is observed in the way competency is assessed. The assessment of competency in medical education is designed to determine whether a junior trainee or medical student has attained the objectives of a course or a programme of study and whether they have met the required standard to be deemed safe to practise within clinical environments (Tejinder, 2022). The recurring elements of this assessment process are noted to be a need for a junior trainee or medical student to be examined by a person (normally of a superior status) to determine their competency in a skill or a task (Epstein, 2007). Owens (2012) identified that in the year 1027, the imperial physician Wang Wei-Yi had two bronze statues made to assess the competency of his trainees in correctly inserting acupuncture needles. Harden and Gleeson (1975) developed the Observed Structured Clinical Examination (OSCE) framework. The OSCE examination, where senior medical professionals assess the competence of students to complete set tasks specific within a number of stations, has been widely adopted within undergraduate curricula globally. Within clinical practice, the Mini-Clinical Evaluation Exercise (Mini-CEX) and the Direct Observation of Procedural Skills (DOPS) have become popular in assessing the competency of junior trainees or medical students (Alves de Lima et al., 2007; Tsui et al., 2013; Watson et al., 2014; Eggleton et al., 2016). The determination of competency has changed very little over time which has led to medical education being grounded in the 19th Century rather than the 21st Century (McGaghie, 2015). A scoping review undertaken by Long et al. (2022) analysed literature, published between 2000 and 2020, related to the assessment of competency in medical education. An initial return of 4870 articles was reduced to 80 pieces of literature after applying the inclusion criteria. The authors identified that the relevance of the assessment process to the student, the assessor's perceived competence and the context of the assessment influenced how students perceive the credibility of an assessment and its associated feedback. These findings related to assessments conducted within simulated environments (such as the OSCE) or clinical environments (using Mini-CEX or DOPS).

At the University of Dundee, the undergraduate medical curriculum had two elements: a theory-based curriculum in years one to three and an experienced-based curriculum in years four and five. The OSCE was used to assess competency in both elements of the programme across all five years. Mini-CEX and DOPS were used in the experience-based curriculum in years four and five to determine competency in clinical environments. Although a progressive programme of simulation and assessment was integrated into all five years of the undergraduate medical curriculum, the Ward Simulation Exercise (WSE) was one of the only instances where students practised solely within a simulated environment and self-assessment formed part of the assessment process.

The WSE was designed to assess the preparedness of medical students to progress to graduation and was delivered in the final year of the undergraduate programme (Stirling et al., 2012; Till et al., 2015). The WSE was designed to recreate instances from clinical practice within an authentic simulated environment and lasted for 20 minutes (Ker et al., 2006; McIlwaine et al., 2007). Six exercises were developed for the WSE; three were used for the initial run and three for the second run. Students were randomly assigned to an exercise to minimise contamination. Each exercise was developed and validated through a process of shadowing doctors within clinical areas, focus group sessions with healthcare teams, and testing of the simulation before deployment. This ensured that the WSE was delivered in a standardised manner which was representative of clinical practice.

During the WSE, medical students were expected to prioritise the care that three simulated patients (who were admitted to the simulated ward) would receive whilst dealing with timed interruptions and working collaboratively with a qualified nurse. Simulated patients used a script to portray a new admission, a communication scenario or a patient who became acutely unwell. Protocols and guidelines related to characters, which simulated patients would portray, were updated on an annual basis to ensure the WSE was concurrent with changes in clinical practice.

The competencies of students were assessed by a minimum of two senior doctors (most normally consultants or general practitioners). Assessors used a standardised assessment tool to make judgements about students' capabilities. Following the WSE, students conducted a self-assessment whilst watching a video recording of their WSE. This process then informed a feedback session. In this way, the WSE adhered to a positivist paradigm of assessment as medical students were observed by a person of superior status who determined their competency to undertake a skill or task to the required standard.

There was no one way to pass the WSE. The benchmark for a successful performance was how safe the student's response was to the timed interruptions and the patient presentations. The assessment process relied on the professional expertise of the assessor to determine a student's readiness for clinical practice. Although this process might introduce a degree of subjectivity into the assessment process, the WSE was shown to have a good degree of reliability (α=0.89) (Till et al., 2015).

Literature review

Cassam (2014) defines two forms of self-knowledge being trivial and substantial. Trivial self-knowledge is an in-the-moment appraisal that informs judgements relating to one's motivation, capabilities, and ability to perform to an acceptable standard. The concepts of self-efficacy, self-awareness and self-perception arguably describe the basis for the development of trivial self-knowledge (Govern & Marsch, 2001; Aguirre-Raya et al., 2016; Williams et al., 2017). The term 'trivial' self-knowledge might debase what might have been multiple points of significant learning for a student. Therefore, in the context of this study, the term 'trivial' will be replaced with the term 'momentary' self-knowledge which is still distinguishable from 'substantial' self-knowledge. In relation to the WSE, momentary self-knowledge was observed during this assessment when students were motivated to perform well (self-efficacy), they were able to regulate their performance in the moment (self-awareness) and they were able to react to and deal with competing demands (self-perception). Substantial self-knowledge can be considered to be the aggregation of the insights derived from exposure to internal and external stimuli (momentary assessments of self and the subsequent decisions made).

There is limited published literature which reports how the concept of self-knowledge has been utilised within medical education. Dias Pereira et al. (2015) published one of the few articles that addressed the concept of self-knowledge within medical education. This research study evaluated student learning at the end of an elective module that taught stress management strategies. The authors described the impact that stress had on medical students' psychological resilience (the authors stated that burnout, depression and anxiety are highly prevalent in medicine). The authors examined the development of resilience by analysing how students perceived their reactions to stress before and after a standardised intervention and which coping strategies they incorporated into their practice to improve their stress management skills. Questionnaire data (n=76) was reported under three themes (stress symptoms perceived before and after the intervention, use of stress coping strategies by students after the course and students' perceptions of the course). The data reported was surprisingly one-dimensional; 67% reported fewer symptoms of stress, 76% adopted new coping strategies and 90% recognised that stress management strategies would benefit their colleagues. No clear definition of self-knowledge was described or applied in this study, which was a significant limiting factor. Gardiner (2016) commented on the centrality of self-knowledge as part of a patient consultation. Gardiner stated that self-knowledge is critical in informing clinical reasoning to minimise bias and the comparative classification of patient symptoms. The author suggested that self-knowledge facilitates patient-centred consultations that mitigate the tendency to lapse into unconscious mental processing where diagnoses are made that may be erroneous due to an incomplete investigative approach. The author argued that self-knowledge facilitates a creative space where clinicians can reflect and explore multiple possibilities in relation to making a differential diagnosis (challenging perceived assumptions, feelings, thoughts, and beliefs).

The student voice in medical education is not commonly heard in the design of simulation activities or the associated assessment process (Elliot et al., 2019). This research study utilised the standpoint theory which attests that within any social encounter, there are submissive and dominant parties; these roles are interchangeable and are either consciously or unconsciously engaged with (Kokushkin, 2014; Schumann, 2016). Standpoint theory is grounded in feminism and legitimises the opinion and agency of the submissive (whether that is by gender, role or circumstance) and contrasts this with the opinion of those deemed to be in a dominant position (Jovic et al., 2006; Bleakley, 2013). There is limited published literature about the utilisation of standpoint theory within medical education (Bynum and Artio, 2018; Sharma, 2019). The Standpoint theory was used to analyse the opinion of the student (being in a submissive role) with that of the assessors (perceived as being in a dominant role) and the effect that the construct of the WSE and the associated assessment process had on the ability of students to access stores of self-knowledge.

Healthcare is a highly unpredictable and stressful working environment. The impact that extrinsic and intrinsic stressors have on the performance of individuals and teams and their subsequent ability to function safely within unpredictable and stressful environments has been the subject of significant debate and research within medical education (Reason, 2000). The increased adoption of simulation within healthcare education has been catalysed by the mandate to improve patient outcomes and minimise incidences of avoidable harm. The continued adherence to a positivist paradigm negates an understanding of the lived experience of the learner (Rees, 2013). Cronbach's Alpha is a standardised method of reporting the internal consistency of assessment instruments in medicine such as DOPS, Mini-CEX, the OSCE and the WSE. Both Mini-CEX and DOPS can be completed in a relatively short period of time (10 - 15 minutes) and are designed to assess a student's ability to undertake a singular task (either an examination or a procedural skill). Within controlled environments (such as a simulation centre or having dedicated time for assessments), both Mini-CEX and DOPS achieve acceptable levels of reliability (α=0.85) (Watson et al., 2014; Eggleton et al., 2016). The OSCE is structured using multiple stations that students rotate around, completing tasks specific to each station (Harden & Gleeson, 1975). As with Mini-CEX and DOPS, each station assesses competency in a specific skill or procedure. Brannick et al. (2011) conducted a meta-analysis to determine the reliability of the OSCE in medical education. The authors analysed data across assessment criteria and stations. The authors' meta-analysis reported α=0.78 across assessment criteria and α=0.66 stations (the mean α for OSCEs with less than 10 stations was α=0.56 and α=0.74 with greater than 10 stations).

Self-assessment is a subject that generates a significant amount of debate within medicine. The landmark publication by Linn et al. (1975) advocated that medical students should be encouraged to develop skills with peer- and self-assessment to facilitate more diverse evaluation methods (beyond annual examinations) that incorporate an examination of behaviours and motivations that might reveal personal insecurities or overconfidence. Almost 40

years later, Eva and Regehr (2011) were critical of how the medical profession had failed to integrate self-assessment effectively into the practices of the profession, thereby limiting the utility of this technique to inform ongoing professional development. Davis et al. (2006) noted that the current application of self-assessment within medical education predominantly formed part of formal revalidation processes or high-stakes examinations. The authors identified that there was minimal training and preparation within the profession to support doctors to engage effectively with this process. The authors concluded that there was an inadequate evidence base to determine the ability of doctors to undertake self-assessment effectively.

Within medical education, Kruger and Dunning (1999) identified that students in the top percentile of their cohort succumbed to a false consensus where they decreased their self-assessment scores to be more in keeping with their peers. The reverse was shown in those in the lower percentile who lacked insight into their poor performance and rated themselves higher. Therefore, highly reflective and introspective students will embrace negative self-concepts regarding their practice, whilst those with low reflective abilities will endorse a more favourable evaluation of their abilities (Cooney et al., 2021).

Within medical education, the accuracy of a student's self-assessment to describe their lived experience within an assessment is sometimes based on how accurately this perception correlates with the judgements made by assessors (Domician and Éva, 2017; Kukulski et al., 2021). Although self-assessment is endorsed as part of the process of revalidation in medicine, the further application and adoption of this technique within medical education is lacking.

Methodology

The WSE utilised a standardised approach to the delivery of this assessment, which was as follows:

- Assessors observed a student undertake the WSE and rated their performance independently.
- At the end of the WSE, assessors would make a consensus judgement of the student's performance.
- The student would review a video recording of their WSE and conduct a self-assessment.

After completing their self-assessment, students would receive feedback from the assessors who described whether they had met the required standard or not. Those students who had not met the required standard on their first attempt were invited to undertake a second WSE. This transactional approach to feedback, where the onus is placed on the student to enact change following an assessment process, is commonplace in medical education. A scoping review conducted by Cordovani et al. (2023) identified that the process of providing student feedback was a relatively new development in medical education (it has increased in popularity since 2010). The authors identified a variety of approaches to delivering feedback which varied in methodological rigour. The authors concluded that the ability of students to interpret the feedback provided and the credibility of the person delivering that feedback were core determinants of whether students could integrate this information into their practice. As the WSE was an uncommon assessment, being one of the few times that a medical student practised alone in a simulated environment, this did pose ontological challenges for students regarding how they might assimilate this feedback, which might vary in the overall level of quality and relevance from the student standpoint, successfully into their practice.

The assessment instrument used by students (to conduct a self-assessment) and assessors (to conduct an independent and consensus judgement) during the WSE had a mix of open questions and closed domains. Open questions were descriptive in nature and evaluated:

- the strengths in their practice,
- areas for improvement, and
- how this will affect their clinical practice.

Closed domains rated performance using a 1–- 5 Likert scale (1) Very poor, 2) Poor, 3) Good, 4) Very good and 5) Outstanding) and were aligned with the domains in Good Medical Practice, which was the national guidance framework by which a student's performance would be assessed when they graduated (GMC, 2019). The assessors' independent and consensus forms mirrored the student domains in 2010, except that the global score was replaced with a pass/fail domain. As part of their evaluation of the reliability of the WSE (using data from 2010), Till et al. (2015) identified that two domains, Communication and Health and Safety, were the easiest to score highly in. In 2012, the Communication domain was expanded to include ratings for i) Communication with Patients and ii) Communication with Relatives. The Health and Safety domain was expanded to include ratings for i) Safe Medical Practice and ii) Preventing Cross Infection. A global score was inserted to allow direct comparison with the student's self-assessment. The process of making a consensus judgement was amended in 2014. The Global Score and consensus pass/fail judgement were removed at the request of the deanery, and students were only provided with open text feedback following the WSE. This change was intended to make the consensus feedback more relatable to the student's ongoing professional development. Therefore, the process by which assessors used closed domains to make judgements pertaining to students' performance differed for every year of data collection (the open questions remained the same). This was not ideal for the process of data analysis and reporting. Most domains remained consistent in 2010, 2012, and 2014, but the impact of any amendments will be acknowledged as part of the data analysis process.

The domains from Good Medical Practice which underpinned the closed domains in the assessment instrument were as follows:

- Prioritisation (of essential tasks and procedures)
- Clinical skills (effective technical skills)
- Acutely unwell patient (recognition and systematic assessment)
- Prescribing and written documentation (completion of written tasks and safe prescribing) ^
- Response to interruptions.
- Communication (good interpersonal skills).
  - o With patients/relatives *
  - o With colleagues *
- Health and safety (demonstrating safe practice)
  - o Safe medical practice *
  - o Preventing cross-infection *
- Professionalism *
- Global score (overall rating of the student's performance) *

* These domains were added to the assessment process in 2012.

^ This domain was separated into two separate domains ('Prescribing technique' and 'Written documentation') in 2012.

In relation to the WSE, only data from assessors has been reported in previous publications. This research study distanced itself from the positivist standpoint which had underpinned previous research activity surrounding the WSE and engaged with a post-positivist standpoint to generate new knowledge regarding how simulation enhances or inhibits the development of student self-knowledge.

Assessment data from three years were analysed using a mixed methods approach. Quantitatively, Cronbach's Alpha was used as a measure of the reliability of the assessment tools used as part of the WSE. Qualitatively, K-means Cluster Analysis and Inductive Thematic Analysis were used to better understand the lived experience of students and determine the reliability of the assessment from the student perspective.

Cronbach's alpha

The closed domains from students' self-assessments and assessors' independent and consensus judgement forms for the first and second run of the WSE in 2010, 2012 and 2014 were analysed using Microsoft Excel. The reliability of each assessment instrument was reported for each year and run. An overall statement regarding the reliability of the instrument over multiple years was also made. Cells that had no data recorded had a zero inserted. The total number of empty cells for each year and run was reported as part of this stage of analysis.

K-means cluster analysis

K-means Cluster Analysis categorised data beyond statements and judgments that were directly linked to whether a student met the required standard. The closed domains from students' self-assessments and assessors' independent assessment forms were used to define the number of clusters to be generated as part of the data analysis. Students' self-assessment data from 2010, 2012 and 2014 were assigned to seven clusters. Assessors' independent assessment forms were assigned to eight clusters in 2010 and 2012 and 12 clusters in 2014. K-means Cluster Analysis assigned assessment domains (in the case of the WSE, all scores submitted by students and assessors) into pre-determined groups (clusters) that explained the structure of the data. Clusters are ranked in order of significance and the volume of objects assigned to each group. This allowed a determination of convergence or non-convergence in relation to what both groups determined to be the most important components of a satisfactory performance during the WSE.

Data were analysed using SPSS version 22. K-means Cluster Analysis created a bridge between the quantitative and qualitative methods which informed the stages of Inductive Thematic Analysis.

Inductive thematic analysis

Inductive Thematic Analysis advocates a constant comparative approach when analysing data (Thomas, 2006; Braun & Clarke, 2006). The constant comparative approach appraises data holistically and builds concepts based on what the data say most frequently and with the greatest clarity. This approach requires an exhaustive knowledge of the data and rejects any urge to superficially code data.

Qualitative data was reviewed from the standpoint of a student's self-assessment of their performance during the WSE as follows:

- Open text statements were coded to generate categories.
- Categories were refined through multiple readings.
- Prominent categories were contrasted with open-text data from assessors.
- Convergence or non-convergence (between students and assessors) was then determined, describing instances where the WSE enhanced or inhibited the development of self-knowledge.

Data were generated from responses to the open questions in students' self-assessment forms and assessors' independent and consensus judgement forms from the first and second runs of the WSE in 2014. This systematic approach allowed for multiple categories, properties and hypotheses to be generated that proposed and validated a formal theory that will be discussed further in the results. To ensure that the process of theory generation was robust, data were

reported using the cluster rankings generated by K-means Cluster Analysis. A process of selective secondary review of qualitative data was undertaken by a colleague from the University of Dundee. This colleague has experience in the delivery of the undergraduate medical curriculum including the annual diet of examinations. This colleague was selected as they were aware of the construct of the WSE (including its assessment process) but they had no active role in the delivery of this assessment.

Ethical considerations

Ethical approval for this research study was granted by the University of Dundee Research and Ethics Committee (ref no: UREC15047). Prior to undertaking the WSE, students gave their informed consent to allow the materials relating to their performance to be used for research purposes. This request for consent occurred prior to the preparatory briefing that was delivered just before a student undertook the WSE. Students completed the consent form independently and on a voluntary basis without coercion.

In all instances, any identifiable data relating to the first or second run of the WSE in 2010, 2012 and 2014 were anonymised prior to analysis.

Analysis

The total volume of data sets from the first and second run of the WSE in 2010, 2012 and 2014 is presented in Table 1.

Table 1: Data sets of students and assessors for the first and second run of the WSE.

	1st run of the WSE				2nd run of the WSE			
Year	Data set 1		Data set 2		Data set 3		Data set 4	
2010	Students	158	Assessors	32	Students	29	Assessors	14
	Data set 5		Data set 6		Data set 7		Data set 8	
2012	Students	153	Assessors	33	Students	228	Assessors	19
	Data set 9		Data set 10		Data set 11		Data set 12	
2014	Students	165	Assessors	41	Students	47	Assessors	17

The total amount of data collected from the first and second run of the WSE in 2010, 2012 and 2014 is presented in Table 2.

Table 2: The total amount of data generated in 2010, 2012 and 2014 from the first and second run of the WSE.

Year	Assessors				Students		Total
	Independent		Consensus		Self-assessment		
	1st run	2nd run	1st run	2nd run	1st run	2nd run	
2010	155	45	155	45	155	45	600
2012	154	45	154	45	154	45	597
2014	163	52	-	-	163	52	430
Total	472	142	309	90	472	142	1627

Data were excluded if it failed to meet the following criteria (listed in order of priority):

- The name of the student or assessor must be identifiable.
- An assessment form must have a minimum of 50% of the domain fields completed.
- Assessors and students must complete the global rating score (excluding 2010 data).
- A pass or fail judgement must be made by assessors when completing the independent and consensus assessment forms (excluding 2014).

The inclusion criteria were applied to the assessors' independent and consensus forms, and if no exclusions were identified, then they were applied to the students' self-assessment. In total, 1552/1627 (95%) data sets from the first and second runs of the WSE in 2010, 2012 and 2014 met the inclusion criteria. The process of data reconciliation resulted in 412/472 data sets (87%) for the first run of the WSE and 127/142 data sets (89%) for the second run of the WSE being included in the subsequent data analysis.

Demographics

Demographic data relating to the gender of the student participants were collected as part of this study (Table 3). Demographic data relating to the professional role (Consultant, General Practitioner (GP), Specialty Trainee (ST)) and the gender of the assessors is presented in Table 4. No further demographic data were collected.

Table 3: Demographic data for students categorised by WSE run and gender.

Year	Run	Male	Female
2010	1st	60	81
	2nd	24	18
2012	1st	51	86
	2nd	16	24
2014	1st	57	77
	2nd	23	22

Table 4: Demographic data for assessors categorised by professional role and gender.

Professional role	Gender	Number of Assessors
Consultant	Male	30
	Female	15
GP	Male	4
	Female	4
ST	Male	7
	Female	9

Quantitative analysis

Quantitative analysis determines the reliability of the assessment instrument used during the Ward Simulation Exercise.

Cronbach's alpha

Till et al. (2015) reported a Cronbach's Alpha of 0.89 for the assessment instrument used during the WSE. This statement of reliability is related to the independent judgements made by assessors during the first run of the WSE in 2010. Cronbach's Alpha was performed to determine the reliability of the assessment instrument used to conduct student self-assessments and the independent and consensus judgements made by assessors as part of the first and

second run of the WSE in 2010, 2012 and 2014. A value of 0.7 and higher was adopted to state whether Cronbach's alpha measures were sufficiently consistent to indicate the measure is reliable. The results for the first and second run of the WSE are presented in Tables 5 and 6.

Table 5: Cronbach's Alpha data for all assessment domains for the first run of the WSE.

Year	Number of students	Independent	Consensus	Self-assessment
2010 [1]	141	**0.89**	**0.80**	**0.83**
2012 [2]	137	**0.95**	**0.90**	**0.78**
2014 [3]	134	**0.91**	-	**0.78**
a ([1,2,3])	-	**0.92**	**0.87**	**0.80**

Emboldened = significant

Table 6: Cronbach's Alpha data for all assessment domains for the first run of the WSE.

Year	Number of students	Independent	Consensus	Self-assessment
2010 [1]	42	**0.80**	0.60	**0.80**
2012 [2]	40	**0.91**	**0.85**	**0.81**
2014 [3]	45	**0.93**	-	**0.76**
a ([1,2,3])	-	**0.92**	**0.87**	**0.78**

Emboldened = significant

Tables 5 and 6 demonstrate that the assessment instrument used by students and assessors showed high levels of internal consistency except for the second run of the WSE in 2010. The α reported in Table 5 for the first run of the WSE in 2010 was similar to what was reported by Till et al. (2015). The number of items with no data recorded totalled 2% for assessors' independent forms (239/12184), 1% for assessors' consensus forms (45/3765) and 1% for student self-assessments (34/4312) which was acceptable.

K-means cluster analysis

The gender of the student or assessor was included in the K-means Cluster Analysis. The gender of the student was analysed along with the assessors' independent data to see if the gender of the person being observed affected the assessment outcome. The gender of both assessors was analysed along with students' self-assessment data to see if an awareness of who was observing their practice affected students' rating of their performance (students were informed who their assessors were as part of the preparatory briefing).

A one-way ANOVA was conducted as part of the analysis. The null hypothesis for a one-way ANOVA is that all means are equal (or exhibit minimal variance). A null hypothesis is stated for each stage of analysis and is reported as part of the results for every year and run. Degrees of freedom (df) are calculated in two ways: df1 assumes that if n equals the number of clusters, the degrees of freedom is n – 1, df2 is calculated by subtracting the total amount of clusters from the total population. Means are derived from the degrees of freedom between clusters (df1) and the total variance within clusters (df2). SPSS version 22 reported df2 as an 'error'. This term was changed to 'variance within clusters' to avoid confusion.

The Qualitative aspects of this study analysed open text data from the first and second runs of the WSE in 2014. Therefore, only the results from the K-means Cluster Analysis for the first and second run of the WSE in 2014 are reported in this section. Tables 7 – 10 report the number of cases allocated to each cluster for students and assessors for the first and second runs of the WSE in 2014. Each table reports the results of the one-way ANOVA for each cluster. A statistically significant difference was stated if the significance value was below 0.05. The total number of assessments reported in Tables 8 and 10 is double the number of students who undertook this assessment. This figure is correct as two independent assessments were conducted for each student in the first and second run of the WSE.

First run of the WSE: 2014

Students.

Table 7: Probabilities of difference based on a student's perception of their performance and the number of cases assigned to each cluster following analysis of students' self-assessment during the first run of the WSE in 2014.

Number of students 134	Variance between clusters		Variance within clusters		F	Anova	No. of cases	%
Cluster	Mean Square	df (1)	Mean Square	df (2)				
Prioritisation	4.4	8	.37	125	12	**.00**	9	7
Clinical Skills	4.2	8	.30	125	14	**.00**	3	2
Acutely Unwell Patient	5.4	8	.35	125	15	**.00**	1	1
Prescribing and Written Documentation	7.6	8	.28	125	27	**.00**	**31**	**23**
Response to Interruptions	6.6	8	.33	125	20	**.00**	**20**	**15**
Communication	3.3	8	.33	125	9.9	**.00**	17	13
Health and Safety	8.9	8	.40	125	22	**.00**	15	11
Assessor 1 Gender	.62	8	.23	125	2.7	**.01**	**26**	**19**
Assessor 2 Gender	.61	8	.23	125	2.7	**.01**	12	9
					Total		134	100

Emboldened = significant/ highest number of cases assigned

The clusters (assessment domains) with the most cases allocated to them were Prescribing and Written Documentation (F(1.1,.18) = 6.2 p= <.00), Acutely Unwell Patient (F(3.0,.18) = 17 p= <.00) and Communication (F(1.1,.21) = 4.9 p = <.00).

Assessors.

Table 8: Probabilities of difference based on an assessor's perception of students' performance and the number of cases assigned to each cluster following K-means Cluster Analysis during the first run of the WSE in 2014.

Number of students 134	Variance between clusters		Variance within clusters		F	Anova	No. of cases	%
Cluster	Mean Square	df (1)	Mean Square	df (2)				
Prioritisation	16	12	.32	255	48	**.00**	8	3
Clinical Skills	9.4	12	.43	255	22	**.00**	4	1
Acutely Unwell Patient	16	12	.35	255	46	**.00**	28	10
Prescribing Technique	31	12	.44	255	72	**.00**	8	3
Written Documentation	17	12	.58	255	30	**.00**	**30**	**11**
Response to Interruptions	6.3	12	.32	255	20	**.00**	4	1
Communication: With Patients	7.0	12	.34	255	21	**.00**	26	10
Communication: With Team	7.7	12	.40	255	19	**.00**	29	11
Health and Safety: Safe Practice	31	12	.45	255	68	**.00**	10	4

Health and Safety: Cross Infection	6.7	12	.81	255	8.3	**.00**	1	0
Professionalism	13	12	.33	255	39	**.00**	**47**	**18**
Pass / Fail	3.1	12	.08	255	37	**.00**	**47**	**18**
Student Gender	.71	12	.22	255	3.2	**.00**	26	10
					Total		268	100

Emboldened = significant/ highest number of cases assigned

The clusters (assessment domains) with the most cases allocated to them were Professionalism (F(13,.33) = 39 p= <.00), Pass/ Fail Judgement (F(3.1,.08) = 37 p= <.00) and written documentation (F(17,.58) = 30 p= <.00).

Second run of the WSE: 2014

Students.

Table 9: Probabilities of difference based on a student's perception of their performance and the number of cases assigned to each cluster following analysis of students' self-assessment during the second run of the WSE in 2014.

Number of students 45	Variance between clusters		Variance within clusters		F	Anova.	No. of cases	%
Cluster	Mean Square	df (1)	Mean Square	df (2)				
Prioritisation	1.5	8	.24	36	6.5	**.00**	3	7
Clinical Skills	1.2	8	.22	36	5.7	**.00**	**11**	**24**
Acutely Unwell Patient	1.7	8	.26	36	6.7	**.00**	1	2
Prescribing and Written Documentation	2.0	8	.31	36	6.3	**.00**	1	2
Response to Interruptions	1.0	8	.23	36	4.4	**.00**	**9**	**20**
Communication	3.1	8	.24	36	13	**.00**	**8**	**18**
Health and Safety	2.9	8	.18	36	16	**.00**	1	2
Assessor 1 Gender	.32	8	.19	36	1.7	.14	7	16
Assessor 2 Gender	.51	8	.10	36	4.9	**.00**	4	9
					Total		45	100

Emboldened = significant/ highest number of cases assigned

The clusters (assessment domains) with the most cases allocated to them were Clinical Skills (F(1.2,.22) = 5.7 p= <.00), Response to Interruptions (F(1.0,.23) = 4.4 p= <.00) and Communication (F(3.1,.24) = 13 p = <.00).

Assessors.

Table 10: Probabilities of difference based on an assessor's perception of students' performance and the number of cases assigned to each cluster following K-means Cluster Analysis during the second run of the WSE in 2014.

Number of students 45	Variance between clusters		Variance within clusters		F	Anova	No. of cases	%
Cluster	Mean Square	df (1)	Mean Square	df (2)				
Prioritisation	5.8	12	.27	77	22	**.00**	3	3%
Clinical Skills	5.6	12	.21	77	27	**.00**	3	3%
Acutely Unwell Patient	5.5	12	.23	77	24	**.00**	**18**	**20%**
Prescribing Technique	8.6	12	.31	77	28	**.00**	5	6%
Written Documentation	8.1	12	.28	77	29	**.00**	**9**	**10%**
Response to Interruptions	2.4	12	.35	77	7	**.00**	**14**	**16%**
Communication: With Patients	3.9	12	.33	77	12	**.00**	8	9%
Communication: With Team	2.5	12	.22	77	12	**.00**	2	2%
Health and Safety: Safe Practice	11	12	.52	77	22	**.00**	3	3%
Health and Safety: Cross Infection	5.4	12	.46	77	12	**.00**	5	6%
Professionalism	3.0	12	.26	77	12	**.00**	5	6%
Pass / Fail	1.2	12	.06	77	19	**.00**	8	9%
Student Gender	0.6	12	.20	77	3	**.00**	7	8%
					Total		90	100

Emboldened = significant/ highest number of cases assigned

The clusters (assessment domains) with most cases allocated to them were Acutely Unwell Patient (F(5.5,.23) = 24 p= <.00), Response to Interruptions (F(2.4,.35) = 7 p= <.00) and Written Documentation (F(8.1,.28) = 29 p= <.00).

Summary of the quantitative analysis

In relation to students who undertook the first and second runs of the WSE in 2010, 2012 and 2014, the null hypothesis was that the gender of assessors would have an influence on the manner in which students undertook their self-assessment. In all instances, except the first run of the WSE in 2012, the gender of assessors did not have a strong effect.

In the first run of the WSE, the assessment domains (clusters) which had cases allocated to them most frequently as part of the K-means Cluster Analysis were as follows (the years(s) in which cases were highest for a cluster is shown in parenthesis): Acutely Unwell Patient (2010, 2014), Prescribing and Written Documentation (2010, 2014), Communication (2012, 2014), Clinical Skills (2012), Assessor 1 gender (2012) and Health and Safety (2010). This was similar to the results reported from the ANOVA in each year. In the second run of the WSE Clinical Skills, the clusters (assessment domains) which had cases allocated to them most frequently as part of the K-means Cluster Analysis were as follows: Acutely Unwell Patient (2010, 2012), Prescribing and Written Documentation (2010, 2012), Communication (2012, 2014), Health and Safety (2010)), Clinical Skills (2014) and Response to Interruptions (2014). This was similar to the results reported from the ANOVA in each year.

Overall, the following clusters had cases assigned most frequently - Acutely Unwell Patient (4/6 runs), Communication (4/6 runs) and Prescribing and Written Documentation (4/6 runs).

In relation to assessors, the null hypothesis was that the gender of students would have an influence on the manner in which assessors undertook their independent assessment. The one-way ANOVA reported statistically significant results for all clusters in all years, but student gender, apart from the second run of the WSE in 2010, did not have a strong effect.

In the first run of the WSE in 2010, assessment data demonstrated convergence with students in three domains (Health and Safety, Acutely Unwell Patient and Prescribing and Written Documentation) and non-convergence in one (Clinical Skills). In the second run of the WSE in 2010, assessment data demonstrated convergence with students in all domains (Health and Safety, Acutely Unwell Patient and Prescribing and Written Documentation).

In the first run of the WSE in 2012, assessment data demonstrated convergence with students in one domain (Communication) and non-convergence in two domains (Prioritisation and Prescribing Technique). In the second run of the WSE in 2012, assessment data demonstrated convergence with students in one domain (Written Documentation) and non-convergence in two domains (Pass/ Fail Judgement and Professionalism) which did not

form part of the self-assessment form.

In the first run of the WSE in 2014, assessment data demonstrated convergence with students in one domain (Written Documentation) and non-convergence in two domains (Pass/ Fail Judgement and Professionalism) which did not form part of the self-assessment form. In the second run of the WSE in 2014, assessment data demonstrated convergence with students in one domain (Response to Interruptions) and non-convergence in two domains (Acutely Unwell Patient and Written Documentation).

Overall, the following clusters had cases assigned most frequently - Prescribing and Written Documentation (and its variants) (6/6 runs), Acutely Unwell Patient (2/6 runs), Pass/ Fail Judgement (2/6 runs), Professionalism (2/6 runs) and Response to Interruptions (2/6 runs).

Qualitative analysis

Based on the outputs from the K-means Cluster Analysis, Tables 19 and 20 describe the assessment domain (cluster) rankings which were applied to the process of structuring and analysing the qualitative data:

Table 11: Total number of cases by domain for students and assessors during the first run of the WSE.

First run of the WSE in 2010, 2012 and 2014			
Students		Assessors	
Domain	Total number of cases	Domain	Total number of cases
Gender	98	Communication	84
Communication	65	Prescribing and Written Documentation	64
Prescribing and Written Documentation	65	Prioritisation	47
Clinical Skills	56	-	-

Table 12: Total number of cases by domain for students and assessors during the second run of the WSE.

Second run of the WSE in 2010, 2012 and 2014			
Students		Assessors	
Domain	Total number of cases	Domain	Total number of cases
Prescribing and Written Documentation	27	Prescribing and Written Documentation	22
Clinical Skills	24	Acutely Unwell Patient	17
Gender	21	Response to Interruptions	16
Communication	16	Communication	14
		Gender	14

Clusters were used to categorise and describe personas, activities, interactions and standpoints that related directly to the design and delivery of the WSE. Inductive Thematic Analysis facilitated a more in-depth understanding of why students and assessors were allocated to specific clusters. Analysis of open text data from the first and second runs of the WSE in 2014 described instances of convergence and non-convergence between students and assessors beyond merely contrasting what each professional group deemed acceptable performance components. The framework that sequenced the qualitative analysis was based on the total number of cases assigned to clusters as part of the analysis of student self-assessment data from the first and second run of the WSE in 2014, and were as follows:

1) Gender
2) Communication skills
3) Prescribing and written documentation
4) Clinical skills
5) Prioritisation
6) Acutely unwell patient
7) Response to interruptions

This research study investigated the components (in the design or delivery) of the WSE that enhanced or inhibited the development of self-knowledge. As described in the methodology, this data underwent a process of selective secondary review to ensure that inter-rater reliability was 100%. Codes, concepts and themes from either students or assessors within the text are emboldened.

Students were allocated a unique identifier that was generated by their designation (student (ST)), their gender (male or female (M or F)) and a random allocation of a number to differentiate each data set, for example, STM123. Assessors were allocated a unique identifier that was generated by their designation (Assessor (A)), their status (Consultant (CO), General Practitioner (GP), Speciality Trainee (ST)), their gender (male or female (M or F)), the total number of times they assessed the WSE (01 - 74), for example, ACOM12-01.

Gender

Students

This cluster reported the characteristics of male and female students from the standpoint of the student and thereafter, the assessors. In total, 38 students (13(m), 25(f)) were allocated to this cluster in the first run of the WSE and 11 students (6(m), 5(f)) from the second run.

Male and female students seemed to aspire to inhabit different personas. Overall, the characteristics displayed by male students were more confident and they were focussed on accomplishing tasks, whilst female students were less confident in their abilities and were more collaborative in their approach to teamworking and patient care.

In the first run of the WSE, the persona described by all male students in their self-assessment was one of inspiring confidence, being proactive, knowledgeable and in control. These included undertaking interventions such as **patient consultations** (STM56, STM97), **managing the acutely unwell patient** (STM08, STM126, STM79) and appropriate **patient-centred** and **professional communication** (STM113, STM116, STM43) and **seeking advice from their senior colleague** or to **delegate tasks to the nurse** (STM08, STM43).

The persona described by all female students was predominantly focussed on being person-centred. The characteristics included having a **systematic approach** to care delivery (STF161, STF141, STF110), a **calm demeanour** (STF106, STF98, STF18), **good prioritisation skills** (STF110, STF83, STF77, STF18), a recognition of one's personal limitations (STF158, STF54, STF53), a **reassuring manner towards patients** (STF57, STF09), **collaborative teamworking** (STF137, STF92, STF83, STF53) and **strong patient-centred** and **professional communication** (STF154, STF136, STF129, STF127, STF125, STF83).

In the second run of the WSE, male students were more focussed on being **systematic** and **proactive** (STM145, STM43), ensuring **collaborative teamworking** (STM145, STM105, STM62) and **being patient-centred in practice** (STM105, STM62, STM43). Students described **pausing**, **taking a step back** and **being more organised** as approaches that underpinned the prioritisation of their workload and managing the associated **internal and environmental stressors** (ST14M167, ST14M139, ST14M62).

Similar to the first run of the WSE, female students were focussed on **good communication skills and teamworking** (STF109, STF27, STF25). Students were critical of their ability to **remain calm** and manage internal and external stressors (STF63, STF27), ensure a **systematic approach when assessing patients** (STF109, STF63, STF40, STF25) and **that information was properly communicated and documented** (STF109, STF25).

Assessors

The statements made by assessors (both independently and in consensus) resonated with the personas described by male and female students.

Those male students who passed the WSE attained a standard of practice that was described as consistent, responsive and efficient (ACOF74-01, ACOF46-02, ACOM41-01). These students were observed to be **safe** (ACOM25-01, ASTM37-01), systematic (ACOF74-01), **calm** (ASTM37-01, AGPM46-01) and **organised** (ACOM25-01).

Assessors recognised female students' **communication skills** (ACOM35-01, ACOM25-01, ACOF08-01, ACOM04-01, AGPM07-03, ASTF72-01), **collaborative practice** (ACOM12-03, AGPM04-08), explanation of **management plans** (ASTF60-01, ASTF39-01, ACOM35-01,) and the **delegation of tasks** (ACOM36-01, ACOF08-01, ASTM07-01) as strengths although there was a recognised need to **increase personal confidences** to lead the team more effectively (ACOM25-01, ASTM37-01).

Communication

In total, 17 students (35% (m) and 65% (f)) were allocated to this cluster in the first run of the WSE and 8 students (62% (m) and 38% (f)) from the second run. Due to the volume of data returned, only the first run of the WSE is reported.

In the first run of the WSE, students described limitations in how they **requested investigations** (STM145, STM147, STM82) and **how they conveyed this information to their senior colleagues** (STM145, STM82). When communicating with simulated patients, students recognised that **introducing themselves to the patient** (STM147), **being empathetic** (STM35) and **conducting a structured consultation** (STM35, STM69) as areas of practice which required improvement.

All female students rated their communication skills as a strength. Person-centred communication was described as being **empathetic** (STF74, STF33), **explaining treatment plans** (STF25, STF74) and **conducting an appropriate consultation** (STF90). Areas for improvement were identified as **speaking clearly and concisely to patients** (STF74, STF140), working effectively with the **nurse to deliver interventions** (STF90) and **conducting an effective handover at the end of the WSE** (STF33, STF29, STF146).

Assessors

The management of the acutely unwell patient was a key determinant of whether a male student passed or failed the WSE. Male students who passed the WSE (n=4) **recognised and assessed the acutely unwell patient quickly** (ACOM30-01, ACOF22-01, ASTF72-01, ASTF39-01). They **communicated the results of this assessment** to the nurse or their senior colleague and **worked collaboratively to implement an appropriate treatment plan** (ACOM04-09, ACOF22-01) and to reassess the patient (ACOM30-01).

The language used by assessors to describe female students who passed the WSE (n=7) demonstrated an ability to **remain focused** throughout the WSE. These students **clarified tasks** at the end of the initial handover (AGPM07-03, ASTF39-01), engaged with the **patient's agenda** (AGPM07-03), **conducted a structured consultation** (AGPM07-03, ASTF39-01, ACOM41-01, ACOM04-09) and delivered a **good handover at the end of the WSE** (AGPM46-01).

Prescribing and written documentation

In total, 31 students (52% (m) and 48% (f)) were allocated to this cluster in the first run of the WSE and only one student from the second run. Due to the volume of data returned, only the first run of the WSE is reported. An average score of 2 (poor) was calculated from all self-assessment scores submitted by male and female students.

Students

Of the 16 male students, only one student (STM32) recognised their prescribing technique as a strength. No male students commented positively regarding their documentation skills. All students described instances during the WSE where they felt disorganised and **struggled to manage their workload** (STM10, STM32, STM121, STM135). The underlying cause was described as **not being familiar with the environment or the paperwork** (STM42, STM108), **poor documentation of interventions** (STM68, STM42, STM32) and **an absence of**

a safe prescribing technique (STM132, STM111). The effect of stress on performance was described frequently as a key limiting factor (STM132, STM135).

Like their male counterparts, the 15 female students did not identify any positive aspects of their practice with this domain. The open-text comments of female students described a need to be more **systematic and structured in their prescribing technique** and the **documentation of patient information** (STF01, STF89, STF114). This resulted in data from **patient consultations not being written down** and subsequently forgotten (STF13, STF133) and **medications not being prescribed,** which meant they were not administered (STF01, STF89).

Assessors

The average score that assessors awarded students for this assessment domain was a 3 (good). The language used by assessors in relation to male students who failed their first attempt (n=6) described students' inability to access stores of self-knowledge. Students were described as having a **haphazard and indecisive approach to patient management** (ACOM36-01, ACOF10-01). Assessors suggested that these students **were lacking in core knowledge** (ASTF39-01, ASTM37-01, ASTF12-01) but did not acknowledge that these limitations could be related to environmental or internal stressors.

Female students who failed their first attempt at the WSE (n=3) were described as **hesitant and lacking in confidence by assessors** (ASTM37-01, ACOM09-02). Female students were observed to **not be systematic in their practice** when they **prescribed medications without examining patients** (ASTF72-01, ACOM08-04) and **did not know the doses of medications** that are prescribed regularly in clinical practice (ACOF22-01, ACOM09-02), which resulted in an **unstructured approach to patient care** (ACOF22-01, ACOM05-01).

Clinical skills

Clinical skills are defined as technical skills (practical procedures), non-technical skills (leadership, teamworking), and cognitive ability (decision-making). (Health Education England (HEE), 2015). In total, three students were assigned to this cluster (2 (m), 1(f)) in the first run of the WSE and 11 students (3 (m),8 (f)) from the second run. Due to the volume of data returned, only the second run of the WSE is reported.

Students

Following the second run of the WSE, STM84 described a lack of confidence in their abilities. STM84 preface all aspects of their performance with the word *tried*: **tried to be polite** (non-technical skills) and **tried to prioritise a sick patient** (cognitive skills). Conversely, STM111 described a systematic approach in their practice: **communicated well with nurses** (non-technical skills), **followed ABC and instigated management** (technical skills).

Following the second run of the WSE, STF14 described becoming increasingly **worried as they managed two patients** that they described as being acutely unwell (technical and cognitive skills). This student focussed all their activity on **assessing and treating these patients** (technical skills). Her assessors noted an improvement in prioritisation but recommended that this student be more **decisive and systematic in their practice** (ACOM16-02, ACOF08-03). STF93 attempted to be logical in their practice by using a **systematic approach** (technical skills) and good teamworking (non-technical skills). The effectiveness of this approach was not observed by the assessors, who described this student as **lacking in structure and having poor teamworking skills.**

Assessors

In relation to the second WSE, there was a convergence between students and assessors regarding their performance. STM84 was described as **acting on impulse rather than being systematic** which led to him to become **increasingly overwhelmed** (ACOF74-01, ACOF46-02). The assessors recognised that STM111 was **systematic in his assessment of patients**, the commencement of the treatment plan and **his use of patient-centred and professional communication** (AGPM46-01, ASTF72-01).

Assessors ACOM16-02 and ACOF08-03, who assessed STF14, observed that this student knew **when to call for senior help** and that they were **faster to assess patients** during the second run of the WSE. The ability to remain focused and calm alluded to STF93. This student's assessors recognised improvements in their **teamworking** (non-technical skills) and **the assessment of the acutely unwell patient** (technical skills), but they generalised that **by this stage, they [the student] should be slicker/quicker** (ACOM36-01, AGPF15-02).

Prioritisation

No students were assigned to this cluster. In total, seven assessors were assigned to this cluster for the first run of the WSE. All male assessors were practising at consultant level within clinical practice (anaesthetics (1), surgical (2) and medical (2)). The three female assessors were practising at the Specialist Trainee level.

Assessors

Statements made in relation to prioritisation could be summarised as the **rapid, effective response** to an untoward event. Those students who passed the WSE were observed as being polite, efficient, **and confident** (ACOM41-01, ACOM27-01, ACOM16-02). In relation to teamworking, they **worked collaboratively** with the nurse and **sought senior help appropriately** (ACOM41-01, ACOM27-01, ACOM16-02). Their practice was deemed to be **systematic when assessing patients** (ACOM41-01, ACOM16-02, ACOM08-04). They developed evidence-based management plans (ACOM27-01, ACOM12-02), and **interventions were**

implemented swiftly and reviewed regularly (ACOM41-01, ACOM27-01, ACOM16-02). Those students who failed to meet this standard were deemed to be **unfocussed, hesitant, indecisive**, and **lacking in basic clinical knowledge** (ACOM41-01, ACOM27-01, ACOM16-02). These standards were unaffected by student gender.

Acutely unwell patient

The context for this cluster was that the nurse would ask the student to come and review an acutely unwell patient as they had concerns about the patient's wellbeing. This normally occurred six minutes into the WSE, and the student would be expected to systematically assess and manage this patient.

Assessors

This domain was only significant in the second run of the WSE. No students were assigned to this cluster. In total, 12 assessors were assigned to this cluster (4(m), 8(f)). All male assessors were practising at consultant level (medical (3), anaesthetics (1)). Female assessors were practising various professional roles within the clinical practice (Consultant (4)–- medical (3), anaesthetics (1); GP (1); ST (3) - medical (2), surgical (1)).

Those students who passed the WSE were observed by male assessors as displaying a **calm, reassuring manner with patients** and **were not distracted by other interruptions** (ACOM36-01, ACOM09-02). They used a **structured approach to assess and examine patients and commenced appropriate treatment plans** (ACOM36-01, ACOM16-02, ACOM09-02). These students reassessed the patient and **recognised the need to seek advice from their senior colleagues** (ACOM36-01, ACOM16-02, ACOM09-02, ACOM08-02). Those who never met the required standard were observed as becoming flustered and **lacking a safe and systematic approach to patient assessment** (ACOM36-01, ACOM16-02, ACOM09-02, ACOM08-02). In one instance, an assessor observed that this resulted in a circumstance where **the student conceded to the decision-making to the nurse!** (ACOM09-02).

Response to interruptions

Students

This cluster was deemed significant for the second run of the WSE and principally assessed how students reacted to the timed interruptions. In total, nine students were assigned to this cluster (55% (m) and 45% (f)). The average score that both male and female students assigned to this domain was a 3 (good).

Male students described that the WSE had given them a better appreciation of the **impact that frequent interruptions have on clinical practice** (STM155). Students described the utilisation of **a job list to minimise the impact of interruptions** on their practice (STM155, STM94).

Only one female medical student (STF161) described their performance as being satisfactory. All her colleagues described a lack of **confidence in their own abilities**, which led to **disorganisation and poor time management** (STF33, STF102, STF163).

Assessors

Regardless of whether a student reviewed their performance positively or negatively, there was convergence with assessors. In total, nine assessors were assigned to this cluster (6 consultants - 2 (m), 4(f); 1 GP -1(f); ST (3) - medical (2), surgical (1)). Responding appropriately to interruptions was observed as being **systematic in the prioritisation of patient care** (ACOF74-01, ACOF46-02, ACOM36-01), **assessing (and re-assessing) patients in a structured manner** (ACOM36-01, ACOM08-02), **instigating appropriate treatment plans** (ACOM36-01, ACOF15-03), **good teamworking and communication skills** (ACOF74-01, AGPF15-02) and **prescribing medications safely and completing all relevant documentation** (ACOF74-01, ACOF46-02, ACOF15-03). No assessors acknowledged the impact that undertaking a second WSE or the relatively short duration of this assessment might have had in affecting the ability of the student to deliver an acceptable level of performance.

Discussion

The Framingham study is considered to be one of the most influential longitudinal studies ever published in the field of cardiology (Oppenheimer, 2010). The Framingham study commenced in 1948 and was the first longitudinal study to examine the epidemiology of cardiovascular disease on 5,209 subjects over a 20-year period (Mahmood, 2014). The full publication of the Framingham study did not occur until 1980 (Dawber, 1980). Due to the nature of longitudinal studies, they are more resource-intensive than single snapshot studies. The volume of data collated over an extended period of time can cause delays in relation to data analysis and the subsequent publication of results, but this does not necessarily mean that the relevance and applicability of this data are lessened (Thomson & Holland, 2003; White & Arzi, 2005).

This article has demonstrated that the process of assessing competence in medical education has been undertaken in similar conditions for thousands of years. This study reported data over a five-year period in relation to one assessment, the WSE. The WSE is still delivered in a format similar to what is described in this publication, so the data on the lived experience of students within this simulated environment could still be considered relevant and valid. This research study identified the intrinsic and extrinsic factors that affected the development of student self-knowledge and the consequences that adhering to a positivist paradigm had on the outcome of a process of assessment, the WSE. Data were collated from the first and second runs of the WSE in 2010, 2012 and 2014. Data analysis of the closed domains in both the students' self-assessment form and the assessors' independent and consensus forms were deemed to be reliable for both the first and second run of the WSE in

2010, 2012 and 2014. The 2nd run of the WSE in 2010 had a lower reported level of reliability than other years and runs. However, it was still acceptable when compared to other assessments used in medical education, such as mini-CEX, DOPS and the OSCE.

Although the assessment tool reported acceptable levels of reliability, it could be contested that the simulated environment lacked the same degree of validity from the perspective of students. The role that students inhabited during the WSE, and the assessment process had an impact on the resultant performance of the students and the level of insight they had into their performance capabilities (which described processing challenges in relation to self-knowledge). This unfamiliarity with the environment, accompanied by the expectation that students would attain a standard of performance that would allow them to progress to graduation, created significant challenges for some students. Students described instances whereby they perceived being in a disempowered state during the WSE, which inhibited the development of momentary and substantial self-knowledge. Croskerry et al. (2013) used the term 'dysrationalia' to describe an inability to think and behave rationally despite adequate intelligence. This term encapsulated the recurring themes identified in students' reflections, where they recounted instances during the WSE where they failed to meet their own performance expectations or those of the assessors. The resultant effect that dysrationalia had on students' performance capabilities (including the development of self-knowledge) was shown to be different for male and female students.

Standpoint theory attests that within any social encounter, there are submissive and dominant parties. In the context of the WSE, there were two prevalent standpoints: that of students (who were perceived to be in a submissive role) and that of the assessors (perceived as being in a dominant role). Instances of convergence between students and assessors were aligned with the objectives of the WSE (to ensure students met the required standard to deliver safe and effective patient care) and the adherence to a shared mental model of the characteristics of male and female medical practitioners. In the first run of the WSE in 2014, convergence between students and assessors was observed in the total number of cases assigned to the 'Communication' and 'Prescribing and Written Documentation' domains. Non-convergence was observed in relation to 'Gender' (both student and assessors) and the domains 'Clinical Skills' and 'Prioritisation'. In the second run of the WSE in 2014, there was convergence in the domains 'Communication', 'Response to Interruptions' and 'Prescribing and Written Documentation' and non-convergence in relation to gender (both student and assessors) and the domains 'Acutely Unwell Patient' and 'Clinical Skills'. Non-convergence was most frequently observed between students and assessors when there was a requirement to undertake a second WSE. In most instances, if a student identified a component of their practice as a strength, the assessors would hold the opposite opinion. The effect of this hierarchical non-convergence could have profound effects on the development of student self-knowledge.

K-means Cluster Analysis identified that a student's gender had a significant influence on the manner in which interventions were delivered during this assessment. Male and female students conformed to a distinct persona that informed the manner in which they practised during the WSE. Male students focussed on addressing those activities that they deemed to be most urgent (for example, assessing the acutely unwell patient) and delegating non-urgent tasks, whilst female students were more holistic in their practice which was characterised as being patient-centred and working collaboratively with the healthcare team. This persona also informed which aspects of a student's performance were given additional attention during the assessment process. These observations are similar to those of Rudland and Mires (2005), who identified that medical students entered a programme of study with a fixed perception of the role of a doctor, and this became more entrenched over time.

The percentage of students whom assessors deemed to have not met the required standard on their first attempt at the WSE was relatively consistent across the three years (2010: (m) 17%, (f) 13%, 2012: (m) 12%, (f) 17%, 2014: (m) 17%, (f) 16%). In all runs of the WSE (bar the second run of the WSE in 2012), the gender of one or both of the assessors was deemed significant. The data provided no clear explanation for this phenomenon as both male and female assessors of all professional roles and specialties were assigned to this domain.

The professional role of an assessor was identified as a determinant of the confidence of an assessor to either pass or fail a student. Female GPs constituted one of the smallest assessor groups (n=4), but they demonstrated the least amount of variation when passing or failing male and female students. Male consultants were the largest assessor group (n=30), and they showed a similar level of agreement to female GPs in their patterns of passing and failing male and female students. Female consultants were more confident failing female students than male students, whilst male GPs were the opposite (they were more confident failing male students than female students). Both male and female STs had almost double the level of variation of female GPs and male consultants in relation to passing and failing male and female students. The judgements made by assessors during the WSE were demonstrated to be statistically significant. So, although there are instances where assessors demonstrated varying degrees of confidence in the decisions they made, it is reasonable to suggest that both gender, professional role and hierarchical deference had limited impact on the outcome of the assessment process. The judgement of assessors was rarely challenged even though changes in the composition of clinical teams had been shown to reduce the amount of time that assessors worked with newly qualified doctors within clinical practice (House of Commons Health Committee, 2008).

Recommendations

Current assessment practices in medical education are time-consuming, resource-intensive, financially prohibitive, vary in reliability, and arguably counterproductive from the

student standpoint (Sood & Singh, 2012). There is a lack of recognition regarding how internal and external factors can affect the assessment process and student performance. The impact of unconscious mental processes, examiner bias and differing perceptions (of a student's gender, ethnicity or an assessor's previous interaction with this person) has been explored with limited depth and rigour. The nature of a student's level of engagement with a simulation activity has been widely discussed within the literature (Dieckmann et al., 2007). The question of an assessor's engagement with the same simulation activity has not been widely explored. The level of immersion and engagement of assessors with simulation activities and their ability to make distinguishable judgements that relate solely to the simulation itself and not clinical practice needs further research.

The WSE adhered to a positivist paradigm and did not consider the concept of self-knowledge in either its design or delivery or in relation to the associated assessment processes. This practice has been shown to be commonplace within medicine and it can result in a clear dissonance between students' experience of undertaking assessments and the perceived need to provide objective measurements as part of a programme of study. Educators need to be cognisant of the impact (both positive and negative) that educational programmes and assessment processes can have on students' ability to develop stores of self-knowledge and to utilise this information within contextual environments (both simulated and clinical).

Further research is required to consider how students might be actively involved in the design and delivery of educational programmes and their associated assessment processes. Enabling students to become co-creators of educational programmes and their associated assessment processes could challenge hierarchical practices and address an expectation for a more transactional approach to education. The legitimisation of students in curriculum design is a new concept within medical education. It is therefore, counter-cultural and disruptive, but arguably a necessary next step in simulation design and delivery. Co-creation could address issues pertaining to student disempowerment (thus minimising disengagement with formal curricula and assessment anxiety) and potentially enhance how simulation activities are delivered in the wider curriculum. These partnerships could also develop conditions within the wider curriculum whereby students develop substantial self-knowledge over several years, thus promoting greater resilience in the individual which would enhance students' ability to access and utilise stores of self-knowledge during assessments. Ultimately, this could allow students to develop self-knowledge appropriate to their stage of professional development.

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Staff perceptions on implementing interprofessional education for undergraduate students in health, social work and education

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Abstract

Pedagogic approaches which promote collaboration and communication across undergraduate student groups are important for nursing, medical, social care, and education programmes. However, academics' perceptions of developing these events and examples of how to plan and implement learning opportunities of this nature remain infrequent within the existing literature. To address this gap, the current paper provides an analysis of academics' reflections on designing, developing and delivering an innovative simulation-based interprofessional education (IPE) event organised across two universities. Academics involved in either the design and/or facilitation of the interprofessional event were invited to complete a reflective account of their experience. Eight academic members of staff completed a reflective account from which three themes emerged. Themes included communication, valuing others and organisation. These accounts suggest that simulation-based IPE can be a useful teaching and learning strategy. However, resourcing and organisational factors should be carefully considered when planning IPE events.

Introduction

Collaboration across students and academic groups within health, social care and education disciplines is important for professional growth, sharing practice and building confidence (Kitchen et al., 2019). Such learning has been demonstrated in interprofessional workshops involving the use of case studies which resulted in improvements in students' self-rating of their understanding of roles, collaboration and communication (Bridgman et al., 2020). In addition, simulation-based educational events are an effective way to promote interprofessional teamwork opportunities for purposeful and rich learning opportunities for students within a safe environment (INACSL, 2021). Therefore, bringing together interprofessional education (IPE) and simulated learning improves communication and collaboration across professional groups when used both independently and as a joint initiative (Zhang et al., 2011). Further support from a systematic literature review by Granheim et al. (2018) concludes that combining interprofessional learning and simulation "is a sound strategy to improve teamwork and collaboration" (p. 125). Therefore, interprofessional simulation-based education provides opportunities to learn about, with, and from students from other disciplines (CAIPE, 2023; Almendingen et al., 2022).

Research in the fields of social work (Meredith et al., 2021) and health (Platt et al., 2021) suggests that using simulation supports the development of professional and theoretical knowledge. More recently, innovations to include a wider array of professionals, such as teachers and students studying to work in early childhood education, has started to gather impetus (McMillan et al., 2020; McGarr, 2021; Mulholland et al., 2022). This is supported by growing recognition that children who have identified health needs require wider involvement from professionals outside of healthcare including educational providers (Department for Education, 2013). Furthermore, the argument that inter-professional education (IPE) should be extended beyond health education is recommended within the international literature (Garnweidner-Holme & Almendingen, 2022). Therefore, to improve future interprofessional working, students from across a range of disciplines should foster the opportunity to learn together to understand each other's roles, identities, professional terminology and theoretical frameworks. Working together to solve problems enables students to build and develop skills in collaboration and cooperation, to support safe and effective outcomes for the child, through sharing knowledge, experiences, competencies, and an understanding of how looking at problems through different lenses provides more effective care (Garnweidner-Holme & Almendingen, 2022).

Evidence on the design, development and delivery of interprofessional education

There is limited but emerging research on the design and impact of simulation across education, health and social care. The literature discussed below highlights a number of benefits of interprofessional collaborations during simulation-based education on students' attitudes, understanding of roles and confidence in communicating with other professionals. Tuominen et al. (2022) completed a systematic review identifying two studies using online delivery that incorporated all three disciplines. However, the interprofessional education was arranged by health and social care and thus potentially lacked parity across the subject areas, in relation to the teaching aims and organisation of the events. Pirani et al. (2022) reported that interprofessional simulation across health and education improved students' ability with communication, conflict resolution, and collaboration to increase students' confidence to work in partnerships. Almendingen et al. (2022) further support the benefit of IPE across health, social care and education identifying as previously acknowledged that students were able to learn with, from, and about each other. However, the research projects used digital online platforms and, therefore, further research is needed to compare if on-campus delivery impacts the learning achieved.

Evidence on the perspectives of staff involved in the design, development and delivery of interprofessional simulation

Implementing interprofessional simulation is challenging given the timetabling difficulties and human resourcing requirements needed for large numbers of students across different academic schools (Granheim et al., 2018). These challenges can be further exacerbated by difficulties incurred through the need to align curricula, the learning outcomes for part of the course students are undertaking, academic compatibility of the learners, and funding, as well as scheduling learning activities to fall outside of placement hours (Kumar et al., 2018).

To overcome some of these obstacles, it is advisable that the focus for any IPE activity is mutually agreed with all academics involved from the respective professional groups. It is important that the focus is on enhancing interprofessional knowledge of each other's roles, knowledge, and behaviours through clear communication (Boet et al., 2014).

Facilitators of interprofessional learning are fundamental to the success of the learning events (Reeves et al., 2016). Facilitators need to encourage collaboration, as well as share their own experience within the field, to highlight benefits and examples of interprofessional working within the practice environments. However, many academics feel unprepared for facilitating IPE and, so co-facilitation and additional training may be required to support readiness for IPE events (Derbyshire et al., 2015; Milot et al., 2017).

The design and development of the resources used within simulation-based IPE

The simulation-based IPE involved staff and students from children's nursing, medicine, primary education, social work and learning disability nursing. Within the UK, learning disability nurses support and care for people with intellectual or developmental disabilities across their lifespan to optimise their health and well-being. Medical students and social workers also work across the lifespan whilst education providers and children's nurses focus on

the child and family, the professions involved all support people with intellectual disabilities as the need arises. The learning disability nurses, and medical students were in their first year and the remaining professions were all in their second year of study. The students involved had experience of working in practice areas and the medical students had experience of learning using a simulated patient.

Simulations provide students with the opportunity to engage in authentic situations in a safe place for learning while promoting skills for collaboration and problem-solving or shared decision-making. Therefore, they offer students an opportunity to rehearse professional skills and bridge gaps between theoretical knowledge and professional practice in a safe space (Mulholland et al., 2023). Following simulation, learners need to understand how the theoretical knowledge gained can be applied to professional practice. Hence, Almendingen et al. (2022) point out that the success of IPE is dependent on students' perspectives regarding the relevance and realism of the topics. Therefore, it is important for the session to be designed and tailored to support the needs of all the students in attendance at the event, this was completed by the professional disciplines who organised the event by structuring the aims, learning outcomes and designing bespoke resources to meet the students' learning needs. More specifically, to ensure that the learning was authentic and relevant to the different professions the leads who developed the materials for the event also co-designed the scenario together. Furthermore, within the simulation the resources aimed to build authenticity through reflecting documentation within their own professional practice, which they then shared and discussed with peers from other professional programmes. The overall teaching aim was to enhance all students' preparedness, confidence, and competence and therefore, future employability.

The scenario that was developed detailed a fictional family including a mother, her new partner, her three children, and their father. The children were aged 2, 5 and 11 with the oldest child diagnosed with foetal alcohol spectrum disorder (FASD) and the youngest child with cerebral palsy, who had a feeding tube and had recently been admitted to hospital with a chest infection. Safe and effective management of children with FASD and complex health needs require cooperation across healthcare, social services and education (British Medical Association, 2018), therefore, offering an appropriate simulated patient within IPE.

During a home visit, the nurse offers to make the mum a cup of tea and observes that there is minimal food in the cupboards and fridge. The home is noted to be cold, and the washing machine is no longer working. The learning focus within the seminars included:

- record keeping and understanding different types of records held across professions
- the importance of sharing information and escalating concerns
- the importance of multi-agency working
- support for parents and carers in challenging circumstances
- social constructions of particular groups.

The scenario encouraged students to review the documentation used within their field and then feedback on the important points to peers from other disciplines. The students were then able to discuss perceived issues, how they would find out additional information or clarifications, which services to make referrals to and what would be their role supporting the family going forward. Finally, students were given the opportunity to come back to the main group setting, in order to complete a debrief.

Aims

To evaluate staff perceptions of a simulation involving professional programmes including education, social work, medical and nursing students. Including consideration of what is the impact of collaboration on professional learning of staff involved in interprofessional simulation-based education.

Method

Ethical approval

The study has been approved by the Faculty Research Ethics Committee at the University where the interprofessional education was designed and delivered. Reflections were gathered using JISC online survey software, which also included the participant information sheet, information about consent and a debrief. No names or identifiers (including professional discipline) were requested due to the small sample size making it likely that participants could be identified by the research team on the basis of the participants' professional background.

Design

We used a qualitative descriptive study design that made use of an online data collection method that enabled staff to participate at a time and place convenient for them.

Sample

Twenty-three academic members of staff were invited to complete the reflective account. Representing learning disability nursing (n=2), children's nursing (n=5), medical science (n=2), social work (n=2) and education (n=12). All academic staff were based at one university in the north of England or an affiliated university with staff and students currently in the same geographical region.

Data collection

Academic staff involved in the development or facilitation of the interprofessional education seminars were asked to complete a reflective account about their involvement and

their perceptions of the impact of IPE. The reflective accounts were collected after the simulation-based IPE seminar via one open-ended question on an online JISC survey.

Data analysis

Qualitative data analysis was completed using Miles et al.'s (2019) pragmatic approach. Using a realist pragmatic approach supports a wide use of approaches to enable the generation of first and second-cycle codes to identify themes. This condensed data is displayed in the analysis section, which includes written text and supporting visuals to draw and verify conclusions. The data analysis was completed by the lead researcher. Themes from the data analysis were reviewed by the second author, who is from a different professional background, and this was discussed until agreement was reached between the reviewers. The themes were then validated with members of the research team who are from alternate disciplines and were involved in the design, development, and delivery of the IPE simulation to ensure the credibility of the findings.

Results

Eight staff completed a reflective account. A number of codes were identified and related to communication, documentation, teamwork, value, professionalism, learning and teaching, organisation, logistics, workload, timing, and challenges. The codes were then classified into emerging themes and sub-themes, specifically: communication (verbal and written), the value of working together, (learning, and professionalism), and organisational factors (spatial, time and resources). Within each of the themes benefits and challenges of simulation-based IPE are reported and discussed.

Communication

Seven out of eight reflective accounts mentioned verbal and written communication during the organisation or facilitation of the IPE seminar.

Verbal communication

Participants' comments regarding the discussion in the IPE seminar predominantly related to how students engaged with each other. Facilitators reported that they were impressed by the student engagement and detailed how they encouraged students to communicate and learn with each other. It was acknowledged that although some students initially looked uncomfortable due to their limited experience of working with the other disciplines, they were able to learn and share knowledge and support each other through the process. This has been highlighted in the quotes below.

> I was really struck by how engaged the students were – there was a real buzz when they first went into their groups - very different to more typical sessions, even when simulation-style materials are used (P7).

> I encouraged them to engage with it as they would in practice, which meant my role was limited. It was fascinating to see them overcome issues with the data and share their expertise and knowledge with each other (P3).

> I was surprised that although some initially looked uncomfortable in presenting what they knew, they all engaged and added points and were supporting each other... The students then discussed and shared knowledge, and it was nice to see that there was no expectation for me to teach as they wanted to share and teach each other and for others to learn from what they know (P5).

This commentary shows how students engaged in a professional manner with each other and how the pedagogy supported interprofessional interactions found in practice. Further commentary was provided about staff-to-staff engagement, as well as staff-to-student engagement. This highlighted mutual respect across the disciplines involved and supported clarity during the delivery of the IPE seminar. Participants acknowledged that it was important for staff and students to have clear guidance during the initial brief and throughout the day to promote good communication and clear expectations for all involved.

Finally, commentary highlighting student feedback and interactions with staff showed that students considered the importance of clear and accurate communication.

> Debrief at the end was also good to hear some of the challenges and also have students voice how important good communication is and the impact this can have (P2).

Providing students with the time to inform staff about what they had learnt and challenges that they faced was therefore important for the academics to understand if they achieved their learning objectives and how to improve the IPE-sim in the future. The debrief also enabled all students to come back as one group to discuss and embed what they had learnt from the scenario and from the opportunity to work interprofessionally.

Written communication

Participants acknowledged that the documentation used for the simulation-based IPE had both strengths and weaknesses. One of the strengths was the use of documents that mirrored what the students would use in practice to make it more authentic. A second strength was how students only initially had documents that they would complete in practice and therefore, had missing information which other professionals were able to share with them. The students were able to see how the pieces all came together like a jigsaw to support decision-making and how missing or limited information could impact the holistic view of the family and, thus, the outcomes for the family. The benefit of this has been captured within one member of staff's reflective account.

> I really liked the learning outcomes from this session. We wanted the students to really understand the importance of record keeping and information sharing and to recognise that professionals within each individual discipline hold only one small part of the jigsaw when it comes to the information that is held about individuals and families (P8).

Weaknesses within the documentation included some unintended discrepancies between the information about the family presented by individual disciplines. This was seen as a limitation by many academics and has been explained as a result of sickness and workloads meaning some of the documents were prepared late. This meant that the final check of documents could not be completed prior to printing. However, it was acknowledged by academics that this can be corrected in future runs of the simulation-based IPE and that within practice documents errors do occur, and it is therefore important for students to consider how they would clarify inaccuracies. Furthermore, academics reflected on how to improve the simulation-based IPE and wider organisations in the future.

> It was fascinating to see them overcome issues with the data and share their expertise and knowledge with each other. …in the future, I feel it would be helpful to have the paperwork made clearer about which discipline it belonged to and which students belonged to which. That could be just a simple colour coordination of materials and badges (P3).

> I also learned something. For example, how in education they record on a universal system - health could learn from this (P2).

This shows how IPE-sim can benefit future working practices by engaging the future workforce in learning about the working practices of other disciplines. In addition, within the clinical and educational setting there is a benefit to being able to easily identify names and professions, which promotes communication, a sense of belonging and the provision of safe and effective care (Ban et al., 2021; van Dalen et al., 2022).

The value of working together

Six out of eight participants' reflective accounts considered how it was valuable to work with other professions; this could be for the advantage of students, or their own personal benefit. Research on interprofessional education typically assesses how two or more disciplines learning with, from, and about each other impacts students and consequently service user outcomes. The willingness of students to teach others was apparent in the reflections and feedback received, but moreover, reflective accounts also indicated that students across disciplines who did not know each other previously were supportive of one another. Within health, social care and education, professionals need to support colleagues due to high stress, complexities and difficult or unexpected situations that they may face. This is particularly important when working in multi-professional teams who may perceive things according to their own professional lens. In addition to working in a supportive manner, other professional attributes such as inclusion, organisational skills, respect for their own and others' fields of practice and interest in other perspectives were also highlighted as depicted in the quotes below.

> I really enjoyed facilitating this. I was incredibly impressed by the professionalism of the students from across the professions whilst working in the smaller, multi-agency groups. They were insightful and knowledgeable, and seemed really interested to work with and learn from each other! I tried to sit back a little when it came to organising the feedback our group would return to the whole cohort – it was great to see them self-organising and running the feedback, making sure that students from all disciplines were included (P8).

> I felt as though they had a real sense of pride and commitment to their chosen discipline (P7).

> The feedback from students was that they had learned a great deal about each other's perceptions of the family and the multi-faceted elements of the various roles (P3).

This professionalism and value for each other's profession was also mirrored in the commentary about staff who reported personal benefits of working across disciplines, including enjoyment, learning about other fields of practice and sharing responsibility for the development and delivery of the task. Participant Five also details the benefit of role modelling to students.

> For me one of the benefits of the day was that staff felt comfortable to say that they were also learning about other fields of practice. So that students could also acknowledge that they can learn more as well. I think that the staff role modelling that they respect other professionals is one of the most important things, and it was clear that all professionals in the room were given a valued status (P5).

The above quotes highlight the benefits of interprofessional collaboration. However, at times, this can be challenging, particularly when professionals have not worked together previously, causing them to be unaware of how they can best support each other as individuals. Furthermore, this is challenging when students are not clear on each other's roles and scope of practice, leaving academics potentially feeling that they are not valued and supported within conflicts.

The value attributed to the method of teaching or pedagogy used was also prominent within reflective accounts. Academics reported that they perceived simulation-based IPE as an effective teaching and learning strategy to meet the identified aims. This has been summarised in Figure 1 and supported by direct quotes from participants.

> Definitely a good teaching and learning strategy (P2).

> I do feel that we need more interprofessional learning opportunities for students but acknowledge that the logistics can be problematic (P5).

To illustrate the points made on the value of working together, figure one has been included. This shows how academics acknowledged that working collaboratively to design, develop and deliver a simulation to students across different disciplines showed the importance of and enabled academics and students to value their profession and other professions. Furthermore, academics also perceived value in the pedagogy (including the process of teaching others and methods used) and valued the professional groups within the team. Finally, academics reflected on the value of inspiring students to value colleagues from other professions as individuals who need a caring and cooperative culture in which to work and learn. This final quote above also shows a commitment to, and perceived value of, simulation-based IPE and leads to the third theme of organisation.

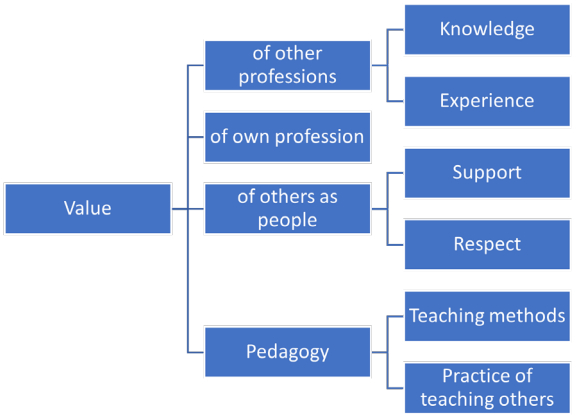

Figure 1: Academic staff perceptions of 'value' in simulation-based IPE.

The direct quotes and the visual representation above show how participants felt that IPE-sim is a more effective strategy than transmissive lectures to enable students to learn skills, values and behaviours needed for practice. However, the organisation of IPE-sim is more complex and labour-intensive.

Organisational factors

Organising interprofessional education can pose many problems for the team to work, such as issues with workload, planning and stress.

Environment

Generally, academics felt that the event was well-organised and that the environment selected for the event was appropriate. The logistics of organising smaller student groups for discussions was problematic due to the unequal numbers across the different professions. However, all groups had a minimum of three different professions in the room, with the facilitator being able to share a summary from any professions that were not present. The importance of considering the space used is highlighted in the quote below and ensured additional space for students to go if they felt upset or overwhelmed by any of the content discussed.

> A really good choice of venue - a lot of opportunity for breakout spaces and it was good for the students to be in an unfamiliar, yet 'official' environment as it added to the authenticity of the simulation (P7).

The advantage of having breakout rooms meant that there were reduced distractions from other groups of students and felt official due to the spaces selected enabling students to consider the confidentiality of the characters. Furthermore, the breakout spaces provided an area that accommodated the number of professionals often found in multi-disciplinary meetings in clinical settings in addition to the authenticity.

Timing

Students across professional courses undertaking placements on different days and in different weeks meant that agreement on the date of the IPE event and rooms were booked early. However, for some students, this meant that the event occurred in their last teaching week prior to their assessment weeks. This was noted by some staff as potentially contributing to student attendance and staff workload.

> This was a carefully planned and well-organised event. Managing the workload can be challenging, and the timing of this event is close to marking deadlines (P1).

> The date was set prior to the exam week/assignment submission week, which may have explained why the student attendance was not as good as I would have liked (P5).

Therefore, the timing of the event needs to consider where students are in their academic journey, including placement, teaching, and assessment requirements, alongside consideration of staff workloads. Consequently, agreeing on a date to run IPE-sim can be problematic given the different curriculum designs used for managing when students are allocated to attend academic and placement settings. However, selecting the most suitable date and negotiating time for staff is important for engagement with IPE-sim and the perceived success of learning events. Therefore, it requires deliberation across the academic teams involved.

Resourcing (workload and materials)

As already suggested, workload was noted as a significant issue within some of the reflective accounts. This had implications for the creation of documentation as well as the number of facilitators that were available in each break-out room. Co-facilitating across professions would have been the ideal option but this was countered by having small groups to enable students to feel comfortable to present their information, discuss the scenario and what their role would be. A lack of agreement is evident within and across participants' accounts, with some feeling that

more facilitators would be helpful and acknowledging the possible benefits of sharing work across a large team, and others seeing this as a potential hindrance.

> The event felt well-organised and appeared to run smoothly… If we had numbers, perhaps the facilitation could have also had a member of staff from each discipline? (P3).

> I found the organisation of this event really stressful!… Finding a time to meet was challenging across so many disciplines and staff members. We didn't know each other well, and that made it more difficult to follow up on documents when things were missing or meetings were missed… [This] meant that we couldn't do the cross-checking of documents that we wanted to (P8).

> One of the benefits of having a larger team to draw upon for this project was also that 'many hands make light work'. One person organised room booking, and another did the Blackboard Organisation and so it was great that I could then concentrate on other aspects of the work (P8).

From the quotes above it can be hypothesised that there is no ideal size of a planning and steering group for IPE-sim events and that the number of staff involved depends on the tasks to be completed, the number of professions and students involved, availability of staff and logistical complexities of the event.

Discussion and conclusion

The teaching innovation allowed academics from learning disability nursing, children's nursing, primary education, social work and medical students who had not previously worked together to create an interprofessional learning opportunity for their respective student groups. This is supported by the university strategy, the Centre for Advancement of Interprofessional Education and the World Health Organisation. The latter states that renewing, revising and updating curricula is part of an effective mechanism for interprofessional education and collaboration (World Health Organisation, 2010). The research aimed to evaluate staff perceptions of a simulation and consider the impact of the collaboration on the professional learning of the staff involved. This used reflective accounts of academic staff engaged in the design, development and delivery of the simulation-based IPE.

Reflective accounts of staff were in agreement with the areas of best practice for simulation-based IPE within the International Nursing Association of Clinical and Simulation Learning standards (INACSL, 2021). More specifically, academics positively appraised the opportunity to design, develop and deliver IPE with representatives from the targeted interprofessional learners. INACSL (2021) go on to point out the importance of authentic scenarios, mutual goals and learning objectives reviewed by experts within the professions and team-based pre-briefing and debriefing, which were also reflected within academic accounts In addition, the wider literature supports the use of authentic simulations which aim to bridge the theory-practice gap to increase student competence (Levin et al., 2023; Weeks et al., 2019) and secondly, a shared depth of knowledge across facilitators regarding the shared learning outcomes (Diggele et al., 2020).

The ascribed value of simulation-based education was evident within the academics' reflective accounts. Academics noted that it was a beneficial learning opportunity for students across health, social care, and education. Simulation-based education provided students with the opportunity to learn about each other and to practice essential professional requirements such as information sharing, working collaboratively and supporting colleagues. From the benefits and challenges discussed within reflective accounts, it is evident that there are a number of important factors to consider when designing simulation-based IPE, which have been illustrated in Figure 2. This shows the importance of ensuring that any documentation and materials used reflect different professions' practices, including through careful review for authenticity as well as cross-referencing to reduce inconsistencies. Attention should also be given to the physical space used, including the importance of having space to enable smaller group discussions as well as to potentially accommodate large numbers of students involved for whole group pre-briefing and debriefing. One influential factor described was the academic staff's commitment to developing materials and facilitating the educational event, which takes time. The increased workload means that staff need to perceive the value of IPE and be able to recruit others within their profession to also support the innovation. This has been reported with previous studies and literature base, which shows the need to ensure simulation space, materials and equipment, support for staff and staffing resources are reviewed to allow sustainability given the resource intensiveness of simulation-based IPE (INACSL, 2021; Abu-Rish et al., 2012).

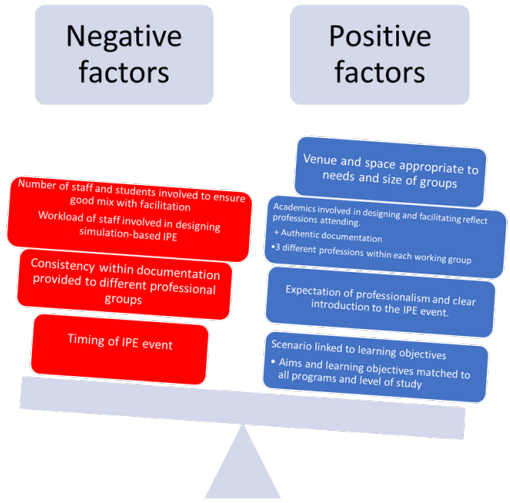

Figure 2: Factors felt to have had an impact on the success of simulation-based IPE.

Following the design, delivery and building of relationships across academic teams, the sustainability of running the event in the future should be considered (Kumar et al., 2018; Lawlis et al., 2014). Participants in the study expressed

that they would like to repeat the learning experience for future cohorts. Furthermore, academics acknowledged that the creation of the resources would make this a less time-consuming task and allow for inaccuracies to be addressed and improvements to be made.

The research completed had both strengths and limitations. The innovative practice of using simulation-based IPE to include health, social care and education has been scarcely researched and this project highlights the benefit of including professional groups outside of health and social care. Furthermore, the majority of research on inter-professional education looks at evaluating the perceived benefit from the stance of attendees at IPE events. However, a wider understanding has been achieved by looking at the perspectives of academics involved in the design and development of the event. Reflective accounts of staff also enable academics to express their thoughts and feelings at a time and place where they feel comfortable without fear of upsetting colleagues. However, this approach may have lacked some of the depth that could have been achieved through face-to-face interviews or focus groups (Guest et al., 2020) and achieved a low response rate.

Although this was a small study, we would recommend that academics embarking on IPE should consider organisational factors, including time and resources that are available to support them with the venture. From a practical perspective, this research and the wider literature point to the benefits of early planning to ensure appropriate staffing, rooms, timing and development of materials on both staff and student satisfaction and learning. Furthermore, we would advocate for the use of IPE-sim that utilises authentic documentation and shared aims that include the goals of increasing collaboration, effective communication across professional groups, and respecting others. Finally, to advance IPE-sim, further research and sharing of innovations to improve teaching practice and pedagogy is needed. More specifically, we encourage longitudinal research on the impacts of IPE-sim and multiple site engagement and collaboration to enhance the development and dissemination of IPE-sim.

In conclusion, simulation-based IPE can be a powerful learning tool for students across a range of professional programmes. These interprofessional educational events can provide students with the opportunity to practice communication and collaboration with other professionals, as well as practice their professional skills relating to providing a supportive culture, teaching others, and valuing and respecting diversity. Furthermore, it allows students the opportunity to learn from peers and understand the different ways of working and alternate lenses through which other professionals perceive the world.

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Stepping into language mastery: Virtual Reality simulations as catalysts for EFL pronunciation enhancement

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Abstract

A virtual reality (VR) simulation-based intervention was compared to conventional pronunciation teaching in an experimental study. The experimental and control groups were assigned at random, with the experimental group using virtual reality to practice pronunciation and the control group using traditional classroom teaching. Pre-post-intervention assessments included pronunciation tests and subjective self-evaluations. T-tests/ANCOVA were used to compare experimental and control group pronunciation test results. The self-evaluation questionnaires' qualitative data were evaluated thematically to determine students' virtual reality simulation experiences. Virtual reality simulation-based education was expected to increase English as a Foreign Language (EFL) pronunciation abilities more than the control group. Students in the experimental group were predicted to be more engaged and satisfied with virtual reality simulations. This research adds to the literature on EFL pronunciation training. It suggests that virtual reality influences Jordanian EFL pedagogy and proposes using virtual reality simulations in pronunciation training to promote language acquisition.

Introduction

EFL training helps non-native English speakers learn the language. In Jordan, where English is frequently taught as a foreign language, good EFL training improves students' language skills and worldwide communication. Traditional classroom-based EFL pronunciation education typically struggles to provide immersive and authentic learning experiences. Virtual reality (VR) simulations, in particular, provide intriguing ways to overcome these problems and improve EFL pronunciation education. Students interact and immerse themselves in virtual reality simulations. VR simulations provide a dynamic and interesting learning environment for students to practice and improve their speaking abilities. This research examines how virtual reality simulations improve EFL pronunciation among Jordanian students. This research compares the results of a virtual reality simulation-based intervention to a control group receiving conventional pronunciation teaching by answering the following questions:

1. What is the effect of virtual reality simulations on EFL pronunciation skills among university students?
2. How do students perceive their engagement and satisfaction with virtual reality simulations in the context of EFL pronunciation instruction?
3. What are the potential implications of integrating virtual reality simulations into EFL pedagogy for improving language learning outcomes?

This study addresses these research questions to add to the literature on successful EFL pronunciation training and investigates the potential of virtual reality simulations to improve language acquisition. This research may help Jordanian EFL teachers enhance pronunciation training by suggesting new methods.

The problem

Traditional pronunciation education typically fails to provide engaging, realistic learning experiences. Traditional methods emphasize exercises and little genuine language usage, which may hamper students' pronunciation abilities (Johnson & Smith, 2017). Jordan's limited exposure to native English speakers and real English language situations hinders EFL learners' pronunciation. Students struggle to achieve target-like pronunciation and communication competence in English due to a lack of real practice. These problems demonstrate the necessity for creative and effective EFL pronunciation teaching. Alternative approaches that provide students with genuine pronunciation practice and rapid feedback are vital to improving speech abilities. Thus, typical pronunciation education approaches fail to teach Jordanian pupils proper and natural EFL pronunciation. These approaches slow students' pronunciation growth and impede their English language learning and communication skills. Thus, this study investigates if virtual reality simulations improve EFL pronunciation training. The study uses virtual reality simulations to provide a more immersive learning environment where students practice and improve their pronunciation in real-world situations.

Significance

This research has major implications for EFL training, particularly in improving pronunciation in Jordanian students. This study is significant for the following reasons.

1. Virtual reality simulations are used to teach EFL pronunciation in the research. The research improves EFL courses in Jordan and maybe elsewhere by studying how this technology affects pronunciation.
2. This research shows that virtual reality simulations improve EFL pronunciation. By understanding the advantages and beneficial effects of this technique, educators build more effective instructional ways to improve language acquisition, particularly pronunciation.
3. Technological integration: EFL virtual reality simulations demonstrate technological integration in language learning. This research shows that virtual reality engages students, improves motivation and encourages active language acquisition.
4. It addresses the challenge of Jordanian EFL learners' lack of exposure to native English speakers and genuine language situations, making learning correct pronunciation difficult. This research explores an alternate pronunciation education method that gives students realistic real-life circumstances and practice, possibly reducing pronunciation improvement hurdles.
5. Practical recommendations: The research offers Jordanian EFL teachers and educational officials practical advice. The study guides curriculum, instructional material, and teacher training choices by recognizing the possible advantages and problems of virtual reality simulations.
6. Student engagement and satisfaction: The research looks at how students feel about virtual reality simulations. Understanding students' experiences and attitudes about this technology helps instructors adjust lessons to suit student preferences and improve learning.
7. Generalizability: Although the research focused on Jordanian students, the results may apply to EFL training in comparable circumstances. This study may be applied to different EFL settings globally, adding to pronunciation training expertise.

Literature review

The acquisition of English as a Foreign Language (EFL) pronunciation skills has posed a persistent difficulty within conventional educational environments. Nevertheless, recent technological advancements have presented opportunities for augmenting language learning experiences. One

example of a technological advancement is the utilization of VR simulations. The objective of this literature review is to offer a thorough examination of current research pertaining to the utilization of VR simulations in English as a Foreign Language (EFL) pronunciation education. The review will particularly concentrate on studies conducted within the context of Jordan. This review aims to illuminate the benefits, obstacles, and consequences associated with the utilization of VR simulations in enhancing English as a Foreign Language (EFL) pronunciation abilities among learners in Jordan, through the synthesis of pertinent research findings. The benefits of integrating VR simulations into language learning settings have been extensively examined in various research studies (Al-Saidat & Al-Omari, 2020; Chapelle, 2018; Merchant, 2017; Lee & Park, 2019). VR simulations generate realistic language learning settings via immersive and engaging interactions. Chapelle (2018) and Al-Saidat & Al-Omari (2020) state that learners may practice pronunciation in genuine circumstances, interact with virtual characters, and get immediate feedback. Immersive experiences help students improve their pronunciation, fluency, and intelligibility.

The utilization of VR simulations in English as a Foreign Language (EFL) pronunciation instruction has been shown by various research studies to lead to enhanced levels of accuracy, fluency, and intelligibility in learners' pronunciation abilities (Al-Saidat & Al-Omari, 2020; Chapelle, 2018; Merchant, 2017; Lee & Park, 2019). In a study conducted by Lee and Park (2019), the researchers investigated the effects of virtual reality (VR)-based instruction on pronunciation education. The findings of the study revealed a substantial improvement in learners' pronunciation accuracy and perceived progress as a result of the VR-based approach. According to Merchant (2017), the utilization of virtual reality (VR) simulations can effectively enhance learner motivation and encourage active engagement in pronunciation practice. In the specific context of Jordan, where English as a Foreign Language (EFL) students encounter challenges in accessing native English speakers or realistic language contexts, the utilization of virtual reality (VR) simulations assumes heightened significance in facilitating the creation of genuine and captivating learning opportunities.

Although VR simulations present promising benefits, their incorporation into English as a Foreign Language (EFL) classrooms is not devoid of obstacles. One of the main challenges lies in the accessibility of suitable equipment and technical assistance. VR simulations need specialized technology and software, which makes them challenging to use in some educational settings. To effectively integrate VR simulations into the curriculum, instructional design and teacher training are crucial (Al-Saidat & Al-Omari, 2020). To overcome these problems, careful planning, budget allocation, and educational institution support are needed.

Several research studies have explored how contextual variables affect EFL pronunciation teaching in Jordan. These studies concentrate on VR simulation effects. Al-Saidat and Al-Omari (2020) investigated whether VR simulations improve pronunciation, perceptions, and motivation among Jordanian university students. Their research found that virtual reality simulations improved students' pronunciation abilities and motivated them to practice. This research shows that virtual reality (VR) simulations may help Jordanian EFL learners with their particular needs. In VR simulations' influence on language learning, Ke (2018) and Lee et al. (2020) have examined how immersive technology may improve language acquisition abilities including pronunciation. Ke examined how VR technology improves student engagement and learning in EFL classes. Lee et al. found that VR improved non-native English learners' motivation and competence.

Studies like those by Wang et al. (2019) and Chen et al. (2021) have shown that VR simulations improve cross-cultural communication abilities, which are essential to language acquisition. These studies underline VR's practicality in preparing language learners for real-world conversation. In addition, Li et al. (2017) and Lotherington and Jenson (2011) examine the pedagogical consequences of VR integration in language instruction. Lotherington and Jenson (2011) highlighted how virtual reality transforms language learning experiences, while Li et al. (2017) examined their efficacy.

Theoretical framework

This section examines numerous theoretical frameworks that support the study of Jordanian students' EFL pronunciation. Language, socio-cultural, technical, experiential, and cognitive load management are illuminated by these ideas. The research uses these theoretical perspectives to investigate the efficacy of virtual reality (VR) simulations in improving EFL pronunciation. The Input-Interaction-Output Model (Gass & Varonis, 1985) and Interactionist Approach (Long, 1983) are popular second language acquisition (SLA) theories. Comprehensible input, active language practice, and meaningful output help language learners, especially with pronunciation. As they learn pronunciation, learners gain from intelligible language input, engaged language usage, and meaningful output.

Socio-cultural theory (Vygotsky, 1978) emphasizes the social and cultural environment of learning. This approach says interaction, collaboration, and scaffolding in a supportive learning environment improve language development. Socio-cultural theory stresses social interaction and collaborative learning to improve pronunciation. Technology-Enhanced Language Acquisition (TELL) studies technology in language acquisition. Immersive virtual reality simulations improve language acquisition (Peng & Liu, 2019). These simulations let students practice pronunciation in realistic settings, addressing the merits and downsides of VR in EFL pronunciation teaching. Kolb (1984) claimed that learning happens via tangible experiences, reflection, conceptualization, and active investigation. This idea stresses experience in pronunciation learning, notably via virtual reality simulations. Students practice pronunciation principles, remark on their performance, and mimic real-life scenarios.

The Cognitive Load method (Sweller, 1988) evaluates cognitive demands on learners during learning. It argues that educational materials and activities control cognitive load to help students concentrate on learning. Virtual reality

simulations are designed to optimize cognitive load and enhance pronunciation using this method. The researcher hopes to use these ideas to determine whether virtual reality simulations might improve Jordanian students' EFL pronunciation. The study examines language acquisition theories, socio-cultural aspects, technology integration, experiential learning, and cognitive load management to improve EFL pronunciation training. These theoretical frameworks, presented by notable academics, give a good foundation for assessing the possible advantages and drawbacks of using virtual reality simulations to enhance EFL pronunciation abilities among Jordanian students. The research builds on these theoretical underpinnings to improve EFL pronunciation instruction.

Related studies

Al-Saidat and Al-Omari (2020) studied Jordanian EFL learners' VR usage to improve English pronunciation. Researchers investigated how virtual reality affects pronunciation accuracy and learners' confidence. In their research, Jordanian EFL learners used a virtual reality English pronunciation application. VR technology created a dynamic learning environment. Virtual reality simulations gave participants real-time pronunciation feedback. The research found that virtual reality increased participants' pronunciation accuracy. Virtual reality simulations helped students improve their pronunciation in a fun and engaging way. Virtual reality immersed learners in realistic events and interactions, improving their pronunciation. Virtual reality also improved learners' pronunciation confidence. Participants felt more comfortable speaking English and expressing themselves. The immersive and participatory virtual reality simulations helped students gain confidence in their pronunciation. Al-Saidat and Al-Omari's study has shown that virtual reality improves pronunciation. Al-Saidat and Al-Omari's (2020) research examines how virtual reality affects English pronunciation accuracy and confidence. The researchers examined the advantages of using virtual reality in EFL pronunciation education by testing its efficacy. This study provides practical advice for educators and researchers using virtual reality to improve EFL learners' pronunciation. Al-Saidat and Al-Omari's study contributes to the use of virtual reality in language acquisition and helps students learn pronunciation in a novel and efficient way. Jordanian EFL teachers improve student pronunciation via virtual reality. Virtual reality lets students improve their pronunciation and get fast feedback. Improved pronunciation improves English language ability. Thus, Al-Saidat and Al-Omari (2020) emphasize the usefulness of virtual reality technology in EFL classrooms, especially for Jordanian learners. Educators and researchers use virtual reality to construct more focused and effective pronunciation treatments for learners.

Ahmed et al. (2020) employed virtual reality to improve EFL learners' pronunciation. Virtual reality simulation was used to improve learners' speech and give interesting and genuine tasks. Virtual reality strategies enhanced pronunciation accuracy and offered essential practice. Virtual reality simulations immersed trainees in real-life communication contexts, improving fluency and pronunciation. Alghamdi and Alzahrani (2018) examined how virtual reality affected Saudi EFL learners' pronunciation. Virtual reality simulations provide learners with an immersive, interactive environment to practice and improve their pronunciation and, thus, their spoken English. Chen and Hsu (2018) investigated how virtual reality affects English language learning. The researchers evaluated how virtual reality affects speech and language acquisition and student motivation by examining several studies. Virtual reality improved voice accuracy, language acquisition, and student motivation, according to the meta-analysis. Virtual reality made language learning more engaging and immersive.

Jin & He (2020) tested virtual reality pronunciation instruction for Chinese EFL learners. Virtual reality training was tested on pronunciation accuracy and speech fluency. Virtual reality training dramatically increased speech accuracy and fluency. Virtual reality simulations allowed students to practice their pronunciation in realistic situations, improving their English fluency and accuracy. The research highlighted virtual reality's advantages for pronunciation training and EFL learners' speech and language learning. Lee and Park (2019) examined how virtual reality pronunciation teaching affected Korean learners' English pronunciation accuracy and perceived progress. The experimental group got virtual reality pronunciation education, whereas the control group received conventional teaching. Virtual reality education enhanced English pronunciation accuracy more than the control group. Virtual reality enables students to practice pronunciation in realistic settings, get quick feedback, and make improvements. The virtual reality lesson also increased participants' confidence and impression of pronunciation progress.

Wang and Chen (2019) examined EFL students' English pronunciation after VR. The experimental group got VR-based pronunciation training, whereas the control group received conventional coaching. The research examined whether VR improved students' pronunciation relative to the control group. VR training improved English pronunciation more than the control group. Students practised pronunciation and received rapid feedback in a realistic VR environment. Students improved their pronunciation by actively participating in VR simulations. Merchant (2017) examines the language-improving potential of serious games, including VR simulations. According to Muñoz et al. (2022), "serious games are interactive games that allow players to carry out activities that enable them to practice skills and achieve aspects beyond simply enjoying a leisure activity" (p. 141). Serious games motivate and engage, improving language learning results. The essay highlights that serious games, especially virtual reality ones, immerse learners in real-life circumstances. Serious games engage learners and help them learn languages. Artificial Intelligence (AI) in serious games improves individualized feedback and adaptive learning, boosting language skills. Kang and Kim (2018) taught English pronunciation via immersive virtual reality. The researchers examined how immersive virtual reality affected learners' pronunciation accuracy and willingness to practice English. Immersive virtual reality enhanced students' pronunciation accuracy more than conventional education approaches. Virtual reality simulations gave students a realistic and engaging environment to improve pronunciation. Learners also

wanted to improve pronunciation, suggesting greater motivation and interest.

The landscape of language learning has been significantly reshaped by the integration of virtual reality (VR) technology. A prime example of this transformation is found in the study by Smith and Johnson (2022), titled "Enhancing English pronunciation skills through Virtual Reality: An experimental study." Through a comprehensive pretest-posttest design, the researchers investigated the profound impact of VR on English pronunciation skills among a diverse group of English as a Foreign Language (EFL) learners. Beyond merely evaluating pronunciation accuracy, this study went further, probing into learners' attitudes, motivation, and perceived progress. The findings of the study unveiled a notable enhancement in pronunciation skills as well as an augmentation in learners' overall engagement and self-assurance, which underscores the potential of VR to foster more confident language learners.

Furthering the exploration into the mechanisms underlying the efficacy of VR in language acquisition, Garcia et al. (2021) presented their study titled "Exploring the cognitive mechanisms of Virtual Reality-enhanced language learning" in the Educational Psychology journal. This study delved deeply into the cognitive processes that are triggered by the immersive nature of VR. Using a blend of advanced neuroimaging techniques and meticulous behavioral analyses, the researchers unveiled a fascinating insight: the immersive experience of VR stimulates neural mechanisms associated with heightened memory retention and active language processing. This discovery not only substantiates the effectiveness of VR in language learning but also underscores its unique cognitive advantages.

Chen and Wang (2020) provided a comprehensive outlook on the broader impacts of VR in language acquisition in their study titled "Beyond pronunciation: Holistic language improvement through Virtual Reality immersion," published in Computer-Assisted Language Learning. Employing a mixed-methods approach that encompassed quantitative assessments and qualitative interviews, the researchers demonstrated that the benefits of VR extend beyond mere pronunciation refinement. Their findings illuminated the potential of VR simulations to foster a more extensive language proficiency, encompassing aspects such as vocabulary acquisition, fluency, and pragmatic competence. The comparative study by Kim and Lee (2019), "Effects of Virtual Reality and conventional instruction on pronunciation and confidence," featured in Applied Linguistics, directly pitted the efficacy of VR-based instruction against traditional teaching methods. Employing a pretest-posttest design along with self-assessment measures, this study showcased that those learners exposed to VR instruction not only exhibited improved pronunciation accuracy but also reported heightened self-assurance in spoken English. The study thus underscores the potential of VR to not only refine pronunciation but also to boost learners' confidence in using the language.

The cognitive dimensions of VR-based instruction took center stage in the study by Brown and Wilson (2018), "Cognitive load in Virtual Reality language learning: Implications for pronunciation instruction," featured in Educational Technology Research and Development. This research meticulously examined the cognitive load exerted on learners during pronunciation practice within immersive VR environments. Through the integration of eye-tracking technology and cognitive load measurements, the study unravelled the intricate interplay between VR design and learners' cognitive resources. The insights garnered from this study hold the promise of optimizing instructional design for more effective pronunciation learning outcomes. These studies show that Virtual Reality improves EFL learners' pronunciation. Virtual Reality therapies promote pronunciation, motivation, engagement, and perceived development in learners. Virtual Reality boosts language learning in EFL pronunciation education by providing immersive and engaging experiences. Virtual reality has also been studied in EFL learners' language and pronunciation. These studies show that virtual reality increases speech accuracy, fluency, student motivation, and language learning results in EFL.

The gap

Previous research on virtual reality simulations for EFL pronunciation education demonstrates its efficacy and good effects on pronunciation abilities. The literature on Jordanian EFL learners is still lacking. The literature lacks research on Jordanian EFL learners' pronunciation accuracy, fluency, and language proficiency after using virtual reality simulations for pronunciation instruction. Virtual reality has been used to teach EFL pronunciation. However, most research has focused on learners from various cultures and educational environments. In Jordan, where English is taught as a foreign language, virtual reality simulations must be tested. Jordanian EFL learners struggle with pronunciation due to a lack of native English speakers and realistic language contexts. Thus, research on the effects of virtual reality simulations on Jordanian EFL learners' pronunciation and views of virtual reality as an educational tool is needed. This study attempts to fill a vacuum in the literature by investigating how virtual reality simulations might improve EFL pronunciation abilities in Jordanian university students. This work will benefit EFL instructors and curriculum designers in Jordan and other countries by incorporating virtual reality into language learning.

Methods

This experimental research included 40 Jordanian University English language students. The study chose individuals with comparable language competence and no previous experience with virtual reality simulations for EFL pronunciation teaching. In this study, language-competent 18-22-year-old male and female students were chosen using stratified sampling. Stratified sampling divides the target population by relevant factors like language competence. Participants were randomly selected within each grouping to ensure proficiency diversity. The researchers employed stratified sampling to better compare the experimental and control groups' pronunciation. This selection strategy attributed pronunciation disparities to

instructional interventions rather than linguistic proficiency. Stratified sampling focuses on and controls the effects of studies on participants' pronunciation, improving internal validity. Stratified sampling improves sample accuracy and representativeness and allows controlled group comparisons in research. This research examined the effects of virtual reality (VR) simulations on English as a Foreign Language (EFL) pronunciation using stratified sampling to guarantee an impartial comparison between the experimental and control groups.

Stratified sampling in this situation is described in detail as follows:

1. Group division: The researchers acknowledged that the target group, Jordanian University English language students, differs in language competency. Some pupils may speak English well, while others may not. To capture this variation, researchers separated the population into linguistic competence-based subgroups or strata. These groupings have strong, moderate, or poor linguistic proficiency.

2. Random selection: Participants were randomly picked within each language competency stratum. This step is critical to guarantee that the sample includes a fair mix of individuals from various competence levels. By doing so, the researchers may prevent bias that might occur if only highly skilled or less proficient pupils were studied.

3. Improved comparisons: Stratified sampling enhances research results' accuracy. Since participants in each subgroup have similar language competence, any differences in pronunciation between the experimental and control groups are likely due to the instructional interventions (VR simulations).

4. Confounding factor control: Controlling confounding variables is a major benefit of stratified sampling. This research may be confounded by participants' basic pronunciation abilities. By grouping participants with similar language competence and randomly assigning them to groups, researchers can be more confident that instructional interventions caused pronunciation skill changes.

5. Improving internal validity: Stratified sampling enhances the study's internal validity, allowing for strong attribution of observed changes to experimental treatments. The researchers can better isolate the impact of VR simulations on pronunciation by stratifying language competency.

The experimental group utilized the VR program PronounceVR to practice pronunciation, while the control group got traditional pronunciation teaching. PronounceVR enables students to practice pronunciation in a range of circumstances using interactive pronunciation activities and simulations. Participants utilized VR headset-equipped PCs in a language lab to access the virtual reality application. The PCs have strong Central Processing Units (CPUs) and specialized graphics cards for seamless virtual reality experiences. This configuration enables participants to thoroughly immerse themselves in virtual reality simulations and successfully practice pronunciation in a realistic and interactive virtual realm. EFL texts and audio recordings were given to the control group. Pre- and post-tests assessed participants' pronunciation abilities. Before the instructional interventions, both groups took the pretest to assess their pronunciation ability. The post-test assessed pronunciation progress following the instructional sessions. In addition to the pretest and posttest, both groups completed a survey questionnaire on the instructional interventions and virtual reality simulations. The Likert-scale and open-ended questionnaire allowed participants to evaluate virtual reality-based pronunciation teaching (see Appendix A).

The trial lasted ten weeks. The test measured pronunciation accuracy, fluency, and intelligibility in the first week. After the pretest, the experimental group got virtual reality-based pronunciation teaching, whereas the control group received conventional instruction. The experimental group used a virtual reality speech application to practice vowels, consonant clusters, and intonation patterns. Participants used VR headset-equipped PCs in a language lab to access the virtual reality application. This study's pre-post-tests assessed participants' pronunciation abilities before teaching. It tested a range of pronunciation skills.

The first test assessed participants' sound-generating skills. They were given difficult words to speak. It tested participants' articulation and sound reproduction. Word stress was also important. Participants identified and emphasized stressed syllables in words. This component tested word stress patterns and their application. Participants' ability to recreate spoken language intonation patterns was assessed. They had to reproduce phrases with increasing or dropping intonation. This component revealed participants' intonation creation and meaning-transfer abilities. The test also tested participants' sentence-level rhythm comprehension and production. They were given rhythmic phrases or words to repeat with an emphasis on timing. This segment tested participants' rhythm and stress patterns in lengthier utterances. Reading aloud assessed pronunciation fluency and accuracy. They read a paragraph aloud and were graded on pronunciation, emphasis, and intonation. This component assessed participants' ability to speak naturally with accurate pronunciation and intonation. Pretest pronunciation training targeted difficult sounds and phonetic contrasts. Minimal pairings practised distinguishing similar sounds. They were tested on their phonetic contrast recognition and production. Finally, the pretest included listening and repetition. Participants were instructed to repeat recorded words or phrases with correct pronunciation, emphasis, and intonation. This component assessed their aural perception and reproduction of accurate pronunciation elements.

The control group received classroom-based pronunciation training, including teacher-led drills, textbook exercises, and peer practice. The educational exercises addressed comparable pronunciation aspects to the virtual reality curriculum but without the immersive and interactive parts. Both groups got the same number of pronunciation teaching hours throughout the intervention period. The

post-test assessed pronunciation progress in both groups after the instructional sessions. To evaluate the instructional interventions, participants filled out the survey form. The survey was conducted online to facilitate data gathering. Electronic surveys allowed participants to complete them at their leisure. Data analysis was easier with the electronic survey's automatic data input and storage. The electronic survey platform collects replies anonymously without personally identifying information. Research ethics required this method to protect participant privacy.

To analyze the data and to compare pronunciation scores between experimental and control groups, paired t-tests or ANOVA were used to evaluate pretest and posttest data. Qualitative survey results were evaluated thematically. Qualitative survey results were analyzed using thematic analysis. Thematic analysis is a prominent qualitative research method that finds patterns, themes, and categories. It aids researchers in understanding participant perspectives. To comprehend participants' thoughts and experiences with virtual reality-based pronunciation education, their replies and comments were categorized into categories. The participants' pronunciation abilities and opinions on virtual reality as a pronunciation instructional tool were assessed using data analysis. Qualitative survey results were analyzed using thematic analysis in this research. The Braun and Clarke six-phase approach (2006) was used to find patterns, themes, and categories in qualitative data. Rereading the survey responses was the first step. Keywords, phrases, and sentences from the research question were coded next. The original codes were used to identify probable themes by clustering them. To guarantee data consistency and meaningful representation, the themes were evaluated and revised in the fourth step. After defining and naming each topic, the researchers provided detailed explanations and pertinent examples to demonstrate their implications. The last phase included quotations or extracts from participants' comments to support the topics in the study report. Braun and Clarke's thematic analysis approach allows for systematic examination and comprehension of survey participants' underlying meanings and interpretations.

The instrument

PronounceVR uses virtual reality (VR) to improve language learning via focused pronunciation practice. PronounceVR uses immersive and interactive experiences to enhance pronunciation. PronounceVR's main features and advantages will be described in this section. PronounceVR's virtual language environments are impressive. Learners practice pronunciation at cafés, airports, and workplaces. Interactive pronunciation tasks are available in PronounceVR (see Figure 1). These exercises involve role-playing, dialogue simulations, and pronunciation drills. These tasks provide learners with immediate feedback on their pronunciation. The program uses natural speakers or language model avatars to talk to learners and provide them feedback on their pronunciation, fluency, and intonation. Interactive feedback helps students find areas for growth and improve their pronunciation.

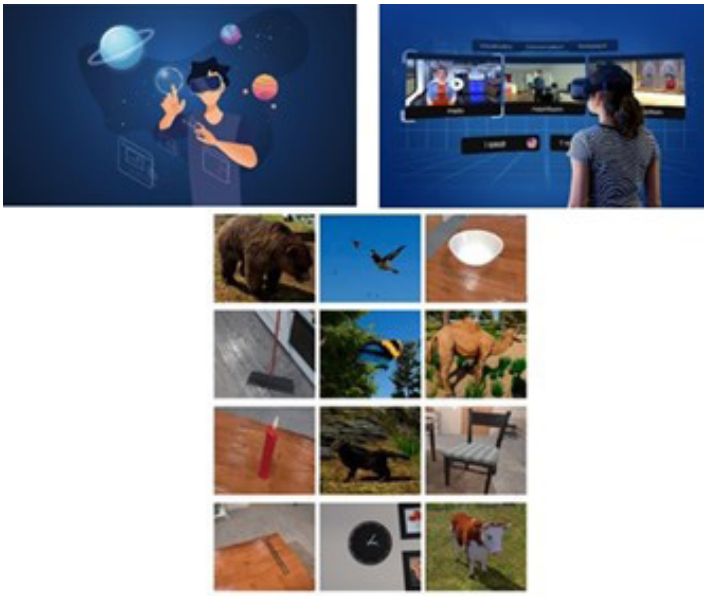

Figure 1. PronounceVR pronunciation drills.

PronounceVR uses voice recognition to test trainees' pronunciation in real-time. This allows the tool to immediately give pronunciation feedback and recommendations. Learners monitor their pronunciation growth through graphs, statistics, and progress reports. These individualized insights show growth and inspire learners by showing their accomplishments. PronounceVR adapts to learners' requirements and choices. Based on learners' performance and feedback, the application adapts pronunciation exercises and gives tailored suggestions for development. This tailored method guarantees that learners get relevant and acceptable pronunciation practice resources. PronounceVR promotes a safe and friendly environment for speech practice. The technology eliminates the shame of pronunciation practice in regular classrooms by employing virtual reality simulations. Learners confidently practice communication without fear of criticism. PronounceVR and other virtual reality simulations increase language learners' interest and engagement. PronounceVR motivates learners to actively practice pronunciation by delivering an immersive and interactive learning experience. PronounceVR is a sophisticated EFL pronunciation tool that uses virtual reality to analyze learners' pronunciation and provide real-time feedback. PronounceVR's interactive activities, tailored learning tools, and realistic language settings help learners improve their pronunciation in a fun and helpful way. PronounceVR and other virtual reality simulations improve pronunciation teaching and language acquisition.

Ethical considerations

This research considered various ethical issues to protect participants' rights. All individuals gave informed permission before participating. They learned about the study's goals, methods, and hazards. Before consenting to participate, participants had the opportunity to ask questions. Throughout the research, confidentiality and anonymity were maintained. Authorized researchers only had access to participants' personal data. Data was anonymized and reported in aggregate to protect participants' privacy.

The research also followed ethical norms and received permission from the University. Ethics were still considered in virtual reality pronunciation simulations. The virtual reality equipment for pronunciation practice was well explained to participants. They were given information about the simulation's goals and any dangers or discomfort connected with using the VR headsets, such as motion sickness or eyestrain. Participant anonymity was ensured by anonymizing individually identifying data. Participants were told that they might leave the pronunciation simulations at any point if they were uncomfortable or had side effects. Participants gave informed permission and were informed of their rights.

Results & discussion

This research compares the results of a virtual reality simulation-based intervention to a control group receiving conventional pronunciation teaching by answering the research questions qualitatively and quantitatively.

Quantitative data analysis

Before the instructional interventions, both groups took the pretest to assess their pronunciation ability. The posttest assessed pronunciation progress following the instructional sessions. Table 1 shows the pretest and posttest means and standard deviations of the experimental and control groups. The mean score shows the group's average performance, while the standard deviation shows its score variability. The pretest evaluates participants' pronunciation. It assesses their pronunciation competency at the start of the program. It comprises activities that assess sound generation, word stress, intonation patterns, and phrase rhythm. Reading aloud, pronunciation exercises, and listening and repeating words or phrases are tasks. The pretest assesses participants' pronunciation skills before any instructional interventions. After teaching, researchers compare pretest and posttest scores to determine speech development. They evaluate the effects on participants' pronunciation abilities by comparing them. The pretest assesses participants' baseline pronunciation skills before instructional interventions begin. It assesses pronunciation in several ways. Researchers compare pretest and posttest scores to assess whether the instructional treatments improved pronunciation abilities.

Table 1. Descriptive statistics of pretest and posttest scores.

Group	Measure	Mean Score	Standard Deviation
Experimental	Pretest	75.2	4.3
	Posttest	83.6	3.8
Control	Pretest	74.5	4.1
	Posttest	76.9	3.5

Table 1 summarizes the experimental and control groups' pretest and posttest scores. This information shows participants' initial pronunciation abilities and their progress following instructional interventions. In the experimental group, the mean pretest score is 75.2, with a standard deviation of 4.3, suggesting a pronunciation level. After the intervention, the mean post-test score was 83.6, with a standard deviation of 3.8, indicating speech improvement. The control group's pretest score is 74.5, with a standard deviation of 4.1. The mean post-test score is 76.9, with a standard deviation of 3.5.

Table 1 shows how scores vary by category. Both groups had reduced post-test standard deviations (3.8 for the experimental group and 3.5 for the control group), indicating more consistent performance. This supports Jones and Lee's (2020) conclusion that virtual reality-based education decreased pronunciation score variability. This study's virtual reality simulations improved participants' pronunciation. Table 1 shows participants' initial pronunciation abilities and their progress following instructional interventions. Virtual reality simulations improve EFL pronunciation, according to related studies (Al-Saidat & Al-Omari, 2020; Jones & Lee, 2020). The findings also support the theoretical framework of the current study, showing that virtual reality simulations generate an immersive and dynamic language learning environment.

Table 2 shows that the experimental group had a mean difference of 8.4 points between the pretest and posttest, with a t-value of 3.28 and a p-value of 0.002. The pronunciation of the experimental group improved significantly. This result supports Li et al. (2021), who found substantial within-group pronunciation improvements following virtual reality-based education. The control group had a mean difference of 2.4 points, a t-value of 1.42, and a p-value of 0.175. The control group improved, although it was not statistically significant. Johnson and Smith (2017) showed slight pronunciation gains in a control group that received conventional teaching.

Table 2. Paired t-tests for pretest-posttest comparison.

Group	Measure	Mean Difference	t-value	p-value
Experimental	Pretest-Posttest	8.4	3.28	0.002
Control	Pretest-Posttest	2.4	1.42	0.175

Table 2 shows the paired t-tests for the pretest-posttest comparison within each group, including mean difference, t-value, and p-value. Instructional interventions have improved EFL pronunciation abilities in groups from pretest to posttest. Chen and Wang (2018) used a pretest-posttest approach and found that an intervention program improved pronunciation scores. Table 2 shows that both experimental and control groups had higher mean scores after the pretest. Moreover, this research uses the acquisition theory by Long (1983). According to this theory, individuals always strive to improve their talents and gain new ones. The theoretical framework proposes that focused education, like virtual reality simulations, might enhance EFL pronunciation abilities. Table 2 shows that the experimental group improved pronunciation abilities, as seen by the increased mean difference, t-value, and p-value. These results agree with similar research and support the theoretical framework's claim that focused education, such as virtual reality simulations, improves EFL pronunciation. The non-significant improvement in the control group further underscores the potential efficacy of the virtual reality simulation-based intervention compared to conventional education alone.

Table 3 shows that the experimental group had a higher mean post-test score. These results corroborate the theoretical framework's claim that VR simulations improve

EFL pronunciation. The experimental group's reduced standard deviation shows that virtual reality simulations improved pronunciation more consistently.

Table 3. Comparison of post-test scores between experimental and control groups.

Measure	Group	Mean Score	Standard Deviation
Posttest	Experimental	83.6	3.8
	Control	76.9	3.5

Table 3 compares experimental and control post-test results, including mean scores and standard deviations. This study shows pronunciation discrepancies between the two groups. Virtual reality simulations for EFL pronunciation skills have shown substantial post-test score differences between experimental and control groups. Wang et al. (2019) observed that virtual reality-based education improved posttest performance compared to the control group. Table 3 shows that the experimental group scored 83.6, whereas the control group scored 76.9. Cognitive theory argues that active involvement, feedback, and meaningful practice promote learning (Bandura, 1997; Vygotsky, 1978). The theoretical framework of the current study implies that virtual reality simulations offer an immersive and engaging learning environment that aids pronunciation acquisition and development in EFL.

Table 3 shows that the experimental group scored 83.6, whereas the control group scored 76.9. This difference in mean scores implies that virtual reality simulation-based education improved the experimental group's pronunciation. Garcia et al. (2020) found greater post-test results in the experimental group following virtual reality simulations. Table 3's standard deviations also show each group's pronunciation variation. The experimental group had a 3.8 standard deviation, and the control group had a 3.5. These data show group score dispersion. Lower standard deviations indicate that the virtual reality simulations have helped the experimental group develop their pronunciation abilities more uniformly. Table 4 shows the independent t-test or ANOVA findings comparing post-test scores between experimental and control groups. This investigation shows whether the two groups have different pronunciation abilities.

Table 4 shows the independent t-test/ANOVA findings comparing post-test scores between experimental and control groups. This investigation shows whether the two groups have different pronunciation abilities.

Table 4. Independent t-test or ANOVA results for post-test comparison.

Measure	Test	t-value/F-value	p-value
Posttest	Independent t-test/ANOVA	2.96/4.62	0.015
Group	Experimental vs. Control Group		

The table compares experimental and control post-test scores. This investigation examined if the two groups differed in pronunciation. The table shows a t-value/F-value of 2.96/4.62 and a p-value of 0.015. The p-value is below 0.05, indicating that the experimental and control groups vary in pronunciation. This suggests that the post-test score differential was not random. Substantial improvements in EFL pronunciation were seen in the experimental group as compared to the control group on post-tests. In a similar research, Lee and Kim (2018) discovered that the experimental group outperformed the control group in pronunciation scores. Table 4 shows that post-test scores change significantly. The t-value/F-value is 2.96/4.62, and the p-value is 0.015. This research uses Vygotsky's sociocultural theory (1978), which emphasizes social interaction and environmental aspects in language acquisition. The theoretical framework of the current study suggests that interactive and immersive instructional methods, such as virtual reality simulations, give EFL learners authentic contexts for practising pronunciation and receiving feedback, improving language acquisition. Table 4 shows a 2.96/4.62 t-value/F-value and a 0.015 p-value. The experimental and control groups had significantly different post-test results. The substantial p-value shows that virtual reality simulation-based education improved pronunciation abilities in the experimental group compared to the control group. In a comparable virtual reality simulation study, Liang et al. (2019) found a substantial posttest score difference favouring the experimental group.

Virtual reality simulations' interactive and immersive learning environment helps improve EFL pronunciation abilities, as shown by the large posttest score difference. These results support constructivist language acquisition theories that stress active involvement, social contact, and feedback. Table 4 shows that EFL pronunciation skills improved with virtual reality simulation-based education. These results confirm the theoretical framework's claim that virtual reality simulations offer genuine and participatory situations for pronunciation practice, improving language learning.

Qualitative data analysis

In addition to the pretest and posttest, both groups completed a survey questionnaire on the instructional interventions and virtual reality simulations. The open-ended questionnaire allowed participants to evaluate the virtual reality-based pronunciation teaching.

Table 5. Themes and patterns from qualitative data analysis.

Theme	Description
Immersion	Participants reported feeling fully immersed in the virtual reality simulations, which enhanced their engagement and motivation to practice pronunciation.
Realism	The realistic environment and virtual avatars in the simulations helped participants feel as if they were interacting with native speakers, contributing to improved pronunciation skills.
Feedback	The instant feedback provided within the virtual reality simulations allowed participants to identify and correct pronunciation errors, leading to noticeable improvements.
Self-confidence	Participants expressed an increased sense of self-confidence in their pronunciation abilities as a result of the virtual reality-based instruction.
Enjoyment	Participants reported enjoying the interactive and immersive nature of the virtual reality simulations, which made pronunciation practice more engaging and enjoyable.

The thematic analysis of participants' responses yielded several distinct themes that shed light on their experiences with virtual reality (VR) based pronunciation instruction. The first theme, "Immersion," underscores participants' unanimous sense of being fully absorbed within the virtual reality simulations. As Participant A vividly expressed, "It felt like I was transported to a different place when I put on the

headset. I was in that situation, having those conversations." This heightened immersion not only enhanced their engagement but also kindled their motivation to actively engage in pronunciation practice, as articulated by Participant C: "I've never felt so engaged in learning English. It's like the virtual world becomes your world." The second theme, "Realism," encapsulates participants' perceptions of the simulations' authenticity. The realistic environments and virtual avatars led participants to feel as if they were interacting with native speakers, as Participant Y highlighted: "When I spoke to the virtual characters, it was like I was actually interacting with native speakers. It's a different kind of practice." This immersive realism contributed significantly to refining their pronunciation skills, as attested by Participant Z: "The café environment was so authentic. It felt like I was ordering coffee and chatting with friends in a real café."

"Feedback," the third theme, highlights the crucial role of instant feedback within the VR simulations. As Participant I conveyed, "The moment I mispronounced a word, the system highlighted it. It's like having an instant tutor who corrects you right away.

This immediate feedback mechanism empowered participants to promptly recognize and rectify pronunciation errors, fostering tangible advancements in their pronunciation accuracy, a sentiment shared by Participant III: "Getting immediate feedback on my pronunciation made me aware of my mistakes and motivated me to correct them." The fourth theme, "Self-confidence," encapsulates participants' newfound confidence in their pronunciation abilities. The immersive nature of the VR-based instruction appeared to boost their self-assurance in delivering accurate and fluent pronunciation. As Participant B emphasized, "The surroundings, the people, everything felt so real. I wasn't just practising, I was living it."

Lastly, the theme of "Enjoyment" signifies participants' enthusiasm for the interactive and immersive aspects of VR simulations. These elements not only rendered pronunciation practice more captivating but also instilled a sense of enjoyment in the learning process itself. As Participant IV described, "I was amazed at how authentic the virtual characters looked and sounded. It's like I was interacting with real people, which made practising pronunciation more meaningful." These quotes from participants underscore their experiences and contribute to a richer understanding of the themes that emerged from the qualitative analysis.

Table 5 shows themes and categories from qualitative data analysis of participants' experiences with virtual reality simulations for EFL pronunciation education. This investigation reveals participants' views on virtual reality-based training. Language learners' experiences and impressions of virtual reality simulations have been comparable in previous research. In a qualitative study, Chen et al. (2021) discovered immersion, realism, feedback, self-confidence, and satisfaction, which supports Table 5. These studies support Table 5's findings, showing participants' consistency across settings. This research uses contextual learning theory, which stresses real environments and active learning. The theoretical framework suggests that virtual reality simulations provide situated experiences where EFL learners can practice meaningful and interactive pronunciation, receive feedback, and develop their linguistic and communicative competence. Table 5's themes match comparable research and support the theoretical framework's claim that virtual reality simulations provide genuine and compelling situations for pronunciation practice. These results emphasize the need for immersive, realistic learning environments with interactive feedback to boost learners' confidence and pleasure. Table 5 summarizes the qualitative data analysis's themes and patterns, showing participants' views on virtual reality simulations for EFL pronunciation education. These results agree with similar research and support the theoretical framework's claims about contextual learning, feedback, and emotional components in language acquisition.

Discussion

My study aimed to assess the effectiveness of VR simulations in enhancing English as a Foreign Language (EFL) pronunciation skills among Jordanian students. The study's theoretical framework draws upon several key models and theories in second language acquisition and technology-enhanced learning. The Input-Interaction-Output Model and the Interactionist Approach underscore the significance of providing learners with understandable input, promoting active language practice, and encouraging meaningful language output. VR simulations are interactive, like socio-cultural theory, which promotes social engagement and collaborative learning in language development. Technology-Enhanced Language Acquisition (TELL) informs the research by examining how technology enhances language acquisition. VR simulations, an immersive technology, provide realistic pronunciation practice scenarios, supporting TELL's objective of providing interesting and effective language learning environments. VR simulations enable students to actively connect with language in meaningful ways, making Kolb's experiential learning theory applicable to the research.

The research incorporates the Cognitive Load hypothesis, which recommends designing learning materials to control the cognitive load. VR simulations improve cognitive load by delivering contextualized and interactive learning experiences and improving pronunciation. The research findings match the theoretical framework and related studies in various respects. "Immersion," "Realism," "Feedback," "Self-confidence," and "Enjoyment," the qualitative analytical themes, align with experiential learning, interactionist techniques, and cognitive load management. The immersive and interactive character of VR simulations addresses the theoretical focus on active engagement, meaningful interaction, and regulated cognitive load. In Tables 1-4, the quantitative findings reveal that VR simulations improved pronunciation abilities in the experimental group compared to the control group. These results support the Input-Interaction-Output Model, Interactionist Approach, and TELL, which stress interaction and context in language acquisition. In conclusion, the research confirms that theoretical frameworks and VR simulations affect EFL pronunciation. VR simulations' immersive and interactive

nature engages learners in experiencing language practice, supporting second language acquisition theories and technology-enhanced learning. The research shows how VR simulations may improve language learning and contribute to language education.

Moreover, the present study's findings are similar to numerous other research studies that have used VR to improve EFL learners' pronunciation abilities. Al-Saidat and Al-Omari (2020) found that VR technology significantly increased pronunciation accuracy and learners' confidence. Similarly, this current study's qualitative themes of "Immersion," "Realism," "Feedback," "Self-confidence," and "Enjoyment" resonate with Al-Saidat and Al-Omari's findings. Participants in both studies highlighted the immersive and engaging nature of VR simulations, which contributed to improved pronunciation skills and learners' confidence in their abilities. The findings of Ahmed et al. (2020) align with this study's emphasis on VR strategies enhancing pronunciation accuracy through engaging tasks and immersive experiences. The notion of VR simulations immersing learners in real-life communication contexts and improving fluency and pronunciation also corresponds to the qualitative themes of "Immersion" and "Realism" observed in the current study. The studies by Alghamdi and Alzahrani (2018), Chen and Hsu (2018), Jin and He (2020), and Lee and Park (2019) collectively highlight the positive impact of VR simulations on language learning outcomes, including pronunciation accuracy, fluency, motivation, and learner engagement. These findings align with this study's demonstration of significant improvements in pronunciation scores for the experimental group exposed to VR simulations. The work of Wang and Chen (2019) and Merchant (2017) supports this study's emphasis on the benefits of immersive and interactive learning environments in VR for improving language skills, including pronunciation. The concept of serious games, especially those involving VR, immersing learners in real-life circumstances and motivating them to engage in learning activities closely relates to the "Immersion," "Realism," and "Enjoyment" themes observed in this study. The findings from Kang et al. (2020) also resonate with this study's results, highlighting how immersive virtual reality positively impacts pronunciation accuracy, motivation, and learner engagement. Collectively, these related studies validate the efficacy of using virtual reality simulations to enhance EFL learners' pronunciation skills, aligning with the findings of the current study. The consistent patterns observed across these studies highlight the potential of VR technology to create immersive and engaging learning environments that facilitate language learning, particularly in terms of pronunciation accuracy and learners' overall language development.

Conclusion, implications, and recommendations

This study sheds light on how virtual reality (VR) simulations affect university students' EFL pronunciation. The experimental group, which used virtual reality simulations, had better pronunciation than the control group. Virtual reality improves pupils' pronunciation, suggesting its promise as a language instruction tool. The study's qualitative examination validated virtual reality simulations' benefits. The immersive and lifelike virtual settings gave participants a unique chance to improve pronunciation in actual circumstances. The interactive simulations provided quick feedback, which boosted self-confidence and speech motivation. Students' learning experience and attitude toward pronunciation training were increased by the virtual reality sessions' fun and engagement. This study has important pedagogical consequences; virtual reality simulations can improve EFL speech and language learning. Virtual reality makes studying more relevant and interactive by delivering genuine and engaging pronunciation practice. It lets instructors construct dynamic and immersive language learning settings that simulate real-world circumstances, making pronunciation skills contextually rich and interesting. This research supports virtual reality in language instruction. Virtual reality simulations increase language acquisition and encourage active learning. Virtual reality's interactivity encourages pupils to take charge of their pronunciation improvement. This emphasizes the need to use technology to improve language learning, especially pronunciation instruction. This research suggests many actions. First, virtual reality technology for EFL pronunciation education requires extensive teacher training and professional development. Teachers should be trained to use virtual reality simulations to improve students' pronunciation. Virtual reality simulations' long-term effects on EFL speech and language ability need more study. Future research might examine virtual reality simulation characteristics and designs that improve pronunciation. The language education sector might benefit from studying how these results apply to diverse learner demographics and instructional environments.

Finally, successful implementation requires fair access to virtual reality technology and resources. Schools should emphasize equipping pupils for virtual reality simulations. Virtual reality simulations may make language training more accessible by collaborating with technology suppliers and allocating enough funds. In conclusion, this study helps us understand how virtual reality simulations improve EFL pronunciation and offers useful suggestions for pedagogy, technological integration, and future research. The results show how virtual reality may improve language learning outcomes and engage students in immersive, interactive, and meaningful learning.

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Appendix

Appendix A: The survey

Your valuable insights and responses will greatly contribute to the study's understanding of the effectiveness and potential of VR simulations in enhancing pronunciation skills. Thank you for your participation.

Part	Likert Scale Questions	Open-Ended Questions
Part 2	Perception of Immersion and Engagement	16. In what specific ways did the VR simulations contribute to your language-learning journey?
4.	The VR pronunciation simulations provided an immersive learning experience.	
5.	The VR simulations made me feel actively engaged in practising pronunciation.	
6.	I felt as if I was a part of the scenarios presented in the VR simulations.	
Part 3	Realism and Authenticity	17. Did you encounter any challenges or limitations while using the VR pronunciation simulations?
7.	The virtual avatars and characters in the VR simulations appeared realistic.	
8.	Interacting with the virtual characters felt similar to interacting with native English speakers.	
9.	The scenarios presented in the VR simulations accurately represented real-life language contexts.	
Part 4	Impact of Immediate Feedback	18. How do you envision the integration of VR technology in future language learning contexts?
10.	The immediate feedback provided by the VR simulations enhanced my awareness of pronunciation errors.	
11.	The feedback from the VR simulations helped me improve my pronunciation accuracy.	
12.	The immediate feedback positively influenced my motivation to practice pronunciation.	

Part 5	Overall Experience and Learning	
13.	Using VR simulations for pronunciation practice enhanced my overall language learning experience.	
14.	The VR simulations provided a unique and effective approach to improving pronunciation skills.	
15.	I would recommend the use of VR simulations for	

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Online laboratory simulations as a pedagogy to reduce anxiety and build confidence for student success

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Keywords

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Abstract

The pivot to blended learning in the post-COVID-19 higher education environment has led to the increased adoption of virtual online laboratories as a mechanism for ensuring that students attain learning outcomes. The fostering of knowledge acquisition and simulation of the practical skills required for laboratory-based disciplines is well established. In this study, we used grounded theory with students as partners to co-create interviews and surveys. The aim of the surveys and interviews was to capture the student experiences and perceptions of the use of virtual online simulations in their studies. A cohort of over 1000 students use virtual online simulations in their programme of study. Of this cohort, approximately 150 students who use the simulations to support practical skills-based aspects of their module assessments were invited to undertake interviews and questionnaires. The online virtual simulations of key scientific techniques were embedded in the virtual learning environment. A common theme that arose through surveys and coding of interview transcripts was that students used virtual simulation as a way of regulating the anxiety they felt towards face-to-face laboratory teaching. Whilst knowledge and skill acquisition are the major focus of university assessment, the self-regulation of anxiety felt by students is a major predictor of success, and this key finding is an under-studied and under-appreciated aspect of the use of virtual online simulations. Virtual online simulations offer a solution to both of these paradigms. They may be sought out by students who see the need to enhance their self-efficacy, and this may go some way to reducing awarding gaps and supporting widening participation in the university student body.

Introduction

Following the COVID-19 pandemic, educational institutions have responded with the further development and widespread adoption of hybrid delivery. In a hybrid learning curriculum, the learning environment consists of both online content and face-to-face teaching. Much of the online content either supports or replaces some face-to-face delivery, and delivery can be synchronous, in the case of streamed lectures, or asynchronous with materials that are accessible at any time through the Virtual Learning Environment (VLE). One of the key advantages of hybrid education is its flexibility and accessibility. Online components of hybrid courses allow students to access course materials and participate in learning activities at their own pace and convenience (Lomellini et al., 2022). The online component of the educational resources enhances the learning experience and provides students with opportunities to engage with course content in a more interactive and immersive manner (Wismer et al., 2021). Hybrid education also offers increased flexibility for both students and instructors in terms of when and where the course is delivered. Instructors can utilise a variety of instructional strategies, such as online lectures, digital simulations, discussion forums, and multimedia presentations, to engage students and facilitate active learning of the curricula (García-Castejón et al., 2021). The use of online platforms and tools facilitates the continuation of teaching and learning activities, ensuring that students can access educational resources and engage in meaningful learning experiences when not in face-to-face activities (Lomellini et al., 2022).

In STEM subjects and particularly in the bioscience disciplines, virtual online laboratories have been used to teach laboratory techniques with significant market penetration and increased popularity in the post-COVID-19 pandemic educational environment (Senapati, 2022; Venter, 2020; Wismer et al., 2021). Labster is one such prominent virtual laboratory that has been widely utilised and it consists of a suite of gamified online simulations of laboratory techniques, procedures, and skills (Makransky et al., 2019). One of the key benefits of digital simulations is that they provide a flexible and accessible learning environment that allows students to engage independently in a self-managed way (Lateef, 2010). In providing simulations as one strategy to support hybrid learning, the students gain the opportunity to access and perform experiments in online virtual laboratories without having to be present on the university campus; students can enhance their understanding of complex scientific concepts and procedures and gain core scientific skills (Hamadani & Wirpsza, 2018). One of the key advantages of virtual online simulations is their ability to connect theory with practice, which bridges the gap between classroom learning and real-world applications (de Vries & May, 2019; Dyrberg et al., 2017). Over and above the simulation of the scientific technique, the Labster platform provides students with a scientific context as well as guidance and support, mini MCQ tests with prompts to theory content, which facilitates their inquiry-based learning (Makransky et al., 2020). The incorporation of MCQ assessments as gatekeepers to simulation progression, coupled with instant feedback, ensures student engagement, and allows them to monitor their progress and identify areas for improvement (Makransky et al., 2020). The use of Labster simulations in hybrid delivery improves student learning outcomes and motivation when compared to traditional lecture-style instruction (Tsirulnikov et al., 2023). Engagement in Labster simulations resulted in higher levels of motivation, self-efficacy, and learning outcomes (Tsirulnikov et al., 2023). The ability to demonstrate laboratory training and the ability to operate in a laboratory-based environment is central to the external validation of many practice-based degrees, such as the role of biomedical scientists in the UK. The Institute for BioMedical Sciences (IBMS) UK provides IBMS accreditation, which covers academic and practical skills and laboratory experience which are required to meet the Health and Care Profession Council (HCPC) standards of proficiency for biomedical scientists and allows those with the accredited qualifications to qualify for laboratory-based roles within the National Health Service (NHS) UK laboratory services. With accreditation of proficiency-based training, it is critical that hybrid delivery has support for proficiency-based training over and above face-to-face sessions. To this end, Labster has also been found to be effective in practical-oriented education, such as where virtual Labster laboratory simulations have been shown to aid in motivation, study intensity, and learning among laboratory technician students (de Vries & May, 2019). The use of simulation in hybrid delivery has enabled students to connect practical laboratory procedures and instrument techniques with theoretical knowledge whilst enhancing the student technicians' understanding of molecular processes (de Vries & May, 2019). Simulations have also proven effective in the education in the wider biopharma industry (Wismer et al., 2021).

One of the advantages of using digital simulations, such as in science education, is the potential to increase access and inclusion for students in the sciences (Lavendier et al., 2022). Accessible technology can be used to provide students with disabilities or campus access issues a more equitable learning experience by enhancing the online offering and thereby increasing their engagement with the hybrid mode of delivery (Lomellini et al., 2022). Education conference presentations have shown an additional benefit of using online simulations in the ability to reduce student anxiety (Damo et al., 2020). Studies showed a theme of increased confidence in face-to-face laboratory sessions, and students viewed virtual laboratories as more approachable and mastered the underlying content better than in purely face-to-face laboratories (Dyrberg et al., 2017; Gao et al., 2020). Online simulation providers seek to support diverse learners by respecting differences in socioeconomic status, culture, ethnicity, gender, and sexuality (Lavendier et al., 2022). The majority of studies of educational simulations relate to medical and clinical scenarios including nursing (Shin et al., 2019) and medicine (McCoy et al., 2016). Whilst the use of laboratory simulations in the biosciences and sport disciplines has not been a focus, the pivot to online learning has increased focus on the use of virtual laboratories either as a replacement for face-to-face sessions or as a support of them. We sought, in this retrospective study, to capture the experiences and perceptions of a large cohort of over 1,000 bioscience, biomedical scientist and sport students accessing online virtual laboratory simulations.

In this study, we used Phenomenological Grounded Theory (Noble & Mitchell, 2016), in which we explored the experiences of students that had used online virtual simulations of laboratory procedures, such as Labster, in their learning journey. We sought to explore the meaning students attach to their experience of support for practical science delivered through simulations of key scientific techniques (Ortiz et al., 2016; Tsirulnikov et al., 2023; Wismer et al., 2021). The principles of Grounded Theory were used to construct in-depth interviews with participants in which we gathered detailed data about their experiences. The interviews were semi-structured, allowing for flexibility to further explore interviewee perspectives (Truter et al., 2021). Interviews were co-constructed with student interns who had previous experience of using digital simulations to support their learning (Figure 1). The data collected from these interviews were analysed using a systematic approach to develop coding, categorise responses, and identify themes (Deterding & Waters, 2021).

The qualitative interview process was combined with a quantitative survey, again co-created with student interns. This provided a mixed methods research approach that used both qualitative and quantitative data to integrate findings and provide a more complete picture (Johnson & Onwuegbuzie, 2004).

Methods

Grounded Theory was used to undertake an iterative project design (Noble & Mitchell, 2016). A two-stage process of study design was undertaken. In the first stage, a student studying biomedical sciences with experience in using digital simulations was interviewed in an online educator forum about their personal experiences of Labster (*Times Higher Educational Supplement*, 2021). In the second stage, the outputs of this presentation and subsequent interviews with this student were used to form concepts and ideas for questions for interviews and quantitative Likert-style surveys. A focus group of two academic staff, who use Labster simulations in their practice, and two student interns, with experience in using the simulations in their studies, were asked to develop interview questions that would explore individual student narratives. The focus groups developed interview questions which focused on gathering rich participant-driven data and therefore were semi-structured to allow exploration of individual narratives. Additionally, Likert-style questions were constructed that developed the themes of the semi-structured interview questions and allowed some quantitative data on these themes to be surveyed in the interviewed students. The questions were grouped into categories, relationships identified, and data was collected in a round of interviews and surveys undertaken by two student intern researchers. The questionnaires were constructed and delivered through the JISC online survey tool (JISC, 2023). Sampling strategy relied on convenience-based sampling, with recruitment emails sent to the cohorts of two modules with a total of approximately one hundred and fifty students out of the total cohort of over one thousand students who had had access to online digital simulations. Recruitment was focused on these two modules from biosciences and sports and these modules were targeted as they used the digital simulations to support assessments in the module and therefore had good engagement in the student cohorts. Approximately 8% of these student cohorts came forward and consented to be part of the study with 12 participants from sports and bioscience disciplines completing the survey. Of these survey participants, nine participants provided recorded interviews (Figure 1) that used the semi-structured interview questions. Semi-structured interviews were recorded digitally using a Philips SmartMeeting recording device and transcribed using Sembly.ai transcription artificial intelligence software; a solution designed for capturing voice-to-text in business meetings. Prior to coding of content, transcriptions were parsed for accuracy and edited before use in further analysis.

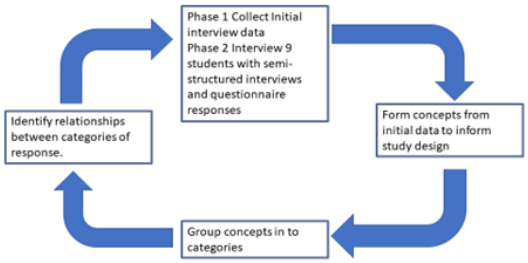

Figure 1: Flow diagram providing a visualisation of the development of the Grounded Theory methodological process.

An initial interview with a student presenter was used to inform focus groups with student interns and academic staff as co-researchers, during which questionnaires and semi-structured interview questions were constructed following the development of concepts and grouping of categories. Interviews were performed and transcripts were then processed and further coded by researchers producing a theoretical framework that explained the data.

All participants were provided with a participant information sheet and consent form on which they could provide consent to participate. Participants were assigned a randomised identifier using the CANDIDATE ID randomiser, available at https://frode-sandnes.github.io/CANDIDATE/ (Sandnes, 2021). This ensured anonymity of interview transcript files used in coding and surveys. No incentive was offered to participants in the survey or interview, nor was it linked to any taught session or assessment in order to reduce response biases. Once surveys were completed, respondents could not edit their results, but they could withdraw their consent, and this was explained to each participant. Students could unenroll from their study at any point, and the randomised identifier used was removed and their records destroyed in obeyance of General Data Protection Regulation (GDPR) UK regulations.

This research is "co-researching and co-inquiring", following Healey et al.'s (2016) conceptual framework, where there is an overlap between subject-based research and scholarship of learning and teaching. Working in partnership with

students is one of the two principles of good practice in Scholarship of Teaching and Learning (SOTL) (Fanghanel et al., 2016). We used it as a pedagogical framework in which we sought to foster authentic engagement of students in collaboration and transformative learning experiences. Northumbria University Research Ethics Committee granted ethical approval for the project, semi-structured interviews, and survey.

Findings and analysis

The initial student interview revealed challenges around practical attendance and anxiety; therefore, the semi-structured interviews and Likert-style questionnaires of the interviewees investigated this topic further.

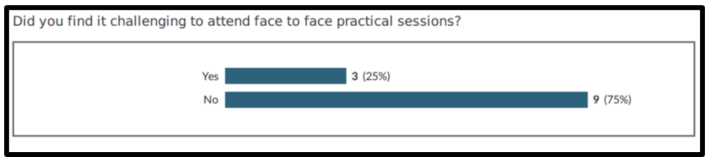

Figure 2: Question on finding attendance challenging with a quarter of student interviewees responding "yes".

In an additional companion question, "If you selected Yes, please specify?" the reasons given were, Response 1 "People sometimes cannot make it on time…we cannot enter the lab and we miss the entire practical…", Response 2 "Social anxiety", Response 3 "COVID".

The transcription and coding of the semi-structured interviews showed that one of the key reasons given for using the simulations was to reduce anxiety surrounding the practical sessions, which was backed by the questionnaire responses. A quarter of interviewees answered yes to finding laboratory attendance challenging (Figure 2) and the interviews generated narrative responses such as:

> And I think it's just a little bit scary to work with people to get stuff done, because like, I feel like if I make a mistake, then that affects their work as well.

The coding of interviews showed anxiety around their ability to perform in the lab. The simulations can be used to gain confidence before laboratory sessions as a pre-laboratory preparation activity. Indeed, when asked, "What did you use Labster for?" in the questionnaire, the most common response from the interviewees was a pre-practical session activity (Figure 3). This was further confirmed as a common theme in the interviews with quotes such as:

> …using them before the practical…I use them mainly as preparation to ease off that anxiety and to gain more confidence on what to expect before practical sessions.

Illustrating that the use of simulations as preparation is a way for students to self-manage their anxiety, illustrated by the quote:

> Yes, I felt anxious during my first lab session so yes, after using Labster it gave me that confidence.

Again, interviewee questionnaire responses confirmed the interview codings with the management of anxiety as a motivation, with common answers being "To gain confidence" and "To reduce anxiety about practical sessions". The outputs from interview coding and interviewee questionnaire align and it would appear the simulations enabled students to self-regulate their emotional response to practical sessions which they may view as stressful. Whilst definitive reasons for student anxiety were not given, quotes connected anxiety to fear of not having the expected knowledge required to perform well in a face-to-face laboratory.

> I use them mainly as preparation to ease off that anxiety and to gain more confidence on what to expect before practical sessions.

> Yes, I felt anxious during my first lab session so yes, after using Labster it gave me that confidence.

> It was something that I really needed to use to be able to pass my degree and to be able to understand what we were supposed to be doing in the lab…

Survey responses show a number of reasons for wanting to use virtual simulations before laboratory sessions: The majority of interviewees used the simulations as pre-practical session preparation, whilst other interviewees viewed it as an alternative to attending practical sessions (Figure 3), which may support students who find attendance challenging. This was illustrated by a written comment on the interviewee questionnaire (Figure 2):

> People sometimes cannot make it on time…we cannot enter the lab and we miss the entire practical.

Laboratory sessions, where students have to attend a safety brief before commencing work, require timekeeping that some students may find more challenging and may act to exclude them from a learning opportunity; these students are more likely to be from widening participation backgrounds (Pickering, 2021).

Another common theme from the interviews was that students saw the simulations as most useful during Years 1 and 2 of their three-year BSc programmes, with the simulations acting as an adjunct to the practical content, as illustrated by the quotes:

> First, I used Labster for practical skills in the first year and microbiology and immunology… principles of cellular and biomolecular analysis in the second year and sometimes cellular pathology and transfusion science…

> I suppose if you can't do it, it would be an alternative, but I would say it's more of an additional… (to practical laboratory sessions).

In addition to the use of simulations to support self-regulation of anxiety and confidence, the students also use the simulations for knowledge acquisition with half or more than half of students selecting "Revision" and "To gain basic knowledge on the subject" respectively in the interviewee questionnaire (Figure 3). Coding of the semi-structured interviews revealed a common coding of response was around "Supporting Learning and Filling Knowledge Gaps" with many interviews producing quotes that support the coding.

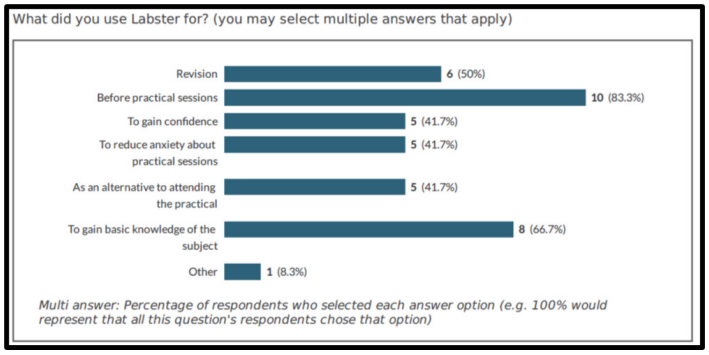

Figure 3: Question "What did you use Labster for?" allowing multiple-response selection by each participant, showing a range of uses for student learning.

Despite the use of simulation being seen as a positive the majority of students were either neutral or negative about the use of imbedded MCQ questions for providing summative marks in the assessment of learning outcomes; with half disagreeing or strongly disagreeing with use in assessment and a total of 91.7% of the interviewees disagreeing or being neutral to use as summative assessment (Figure 4).

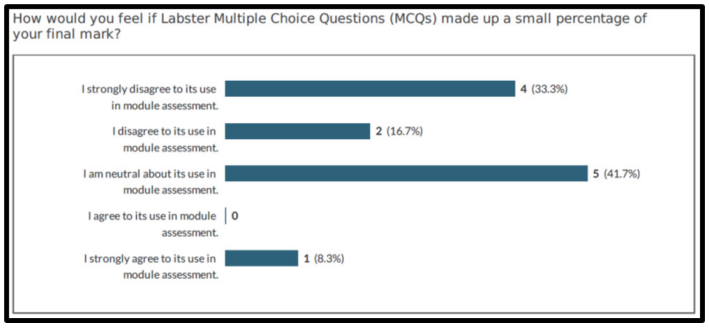

Figure 4: Question on using as a component of summative assessment. With most responses neutral or negative (Total 91.7%).

Discussion and conclusions

The use of Virtual online laboratory simulations in STEM subjects has been well established (Hamadani & Wirpsza, 2018; Makransky et al., 2016; Tripepi, 2022; Wismer et al., 2021; Yap et al., 2021), however, the motivations of student users is less well understood.

From our analysis, a theme on the use of simulations as a means by which students self-regulate their anxiety over attendance of face-to-face laboratory sessions has been developed. In the post-COVID-19 pandemic educational environment, students who have experienced disruption to their university or school studies seek to gain confidence in science topics through knowledge acquisition using the gamified simulations of practical applications and theoretical underpinnings. Student anxiety around face to face laboratory work and their use of simulations to self-regulate the anxiety (Alkan & Erdem, 2013; Damo et al., 2020) is an area of study that would benefit from further development (Logothetis & Flowers, 2020).

Academic tutors often concentrate on the achievement of learning outcomes and assessment performance as a way of measuring success of both the course curriculum and students' knowledge and skills acquisition. Virtual Laboratory simulations have an established pedagogy of successfully fostering knowledge and skills attainments (Makransky et al., 2019; Makransky & Petersen, 2019; Tripepi, 2022; Tsirulnikov et al., 2023). Concerns about the use of online only science courses focus on the applicability of skills for laboratory work.

> The question remains, are students who are exclusively enrolled in online science courses equipped with the cognitive ability to operate laboratory equipment within a physical laboratory? (Rivera, 2016)

However, in this study, using grounded theory with students as partners in the co-construction of questions for questionnaires and interviews has led to a focus not on assessment performance and learning outcome attainment but on the use of virtual laboratory simulations as a way to control anxiety and build self-efficacy. The students who were interviewed mainly used the virtual online laboratory simulations as a preparation for laboratory sessions and as a method for enhancing their knowledge and reducing their anxiety. Laboratory anxiety in scientific disciplines has been reported previously in chemistry laboratory sessions (Galloway et al., 2016), nursing laboratory simulations (Miller & Sawatzky, 2017) and ethnically marginalised students have been shown to have a higher baseline anxiety in laboratory sessions (Soto et al., 2012). With the pivot to blended learning, online virtual laboratory sessions may become a tool that students seek out to address underlying anxiety and enhance their confidence through knowledge acquisition. Whilst anxiety can have detrimental effects on student performance, self-regulation and self-efficacy is one of the main factors that predict success (Duraku & Hoxha, 2018). It may be that our post-COVID-19 blended learning cohorts of students seek out Virtual Laboratory simulations as a way of achieving success. This study shows that the use of virtual online simulations including Labster can be a valuable resource for students allowing them to gain key laboratory skills. Student narratives highlight caution against the growing paradigm of using these simulations for assessment with students on large bioscience and sports cohorts preferring to use them to build confidence and self-efficacy.

Of the students consenting to be interviewed, eight were female and one was male. This somewhat reflected the gender biases of the two courses under study, with sport being under-represented for females and biosciences being under-represented for males. Whilst the focus group did not consider gender or student background in the construction

of semi-structured interview questions and the interviewee Likert-style questionnaires study design, it is interesting that most of the interviewees came from ethnically marginalised or widening participation backgrounds. Although this could represent an increased willingness of these students to volunteer in these roles as a means to have a voice and foster a sense of belonging, the data presented show that virtual online lab simulations used in a preparatory manner may have particular value in overcoming barriers to participation and reduce awarding gaps, which is a well-known problem in the biosciences (Cassambai et al., 2022). The role of online digital simulations in creating a more accessible curriculum in widening participation students will be further investigated and we will also seek to support student researchers to think reflexively about their experiences.

We conclude that this study shows that the use of online virtual simulations is a valuable resource for students and supports acquisition of knowledge and lab skills. Online virtual simulations can enhance the success of blended learning in the new post-Covid-19 educational environment but there needs to be "*a pedagogy that is student-centred… capitalises on the strengths of both synchronous and asynchronous learning.*" (Zhao & Watterston, 2021). Only by considering the students' motivations for the use of online virtual simulations can we appreciate the value they place in them and properly utilise them for a more inclusive and supportive curriculum.

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'We need more conversations like this': The impacts of working with student pedagogic consultants in developing simulation-based pedagogies

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Abstract

The growing global teacher recruitment and retention crisis has ensured that discussions regarding how best to promote preparedness for classroom practice are more important than ever, with significant implications for initial teacher education (ITE). Adopting a multi-stage collaborative autoethnographic inquiry approach, this research paper contributes to the emerging field of simulation-based pedagogies (SBP) in ITE, as well as the strong research base in other disciplines, by outlining the impacts of working with student pedagogic consultants (SPCs) upon staff professional understanding of the effective planning and implementation of SBP. Findings suggest that working closely with SPCs affirmed staff pedagogic choices in deploying SBP, indicating a shared understanding of the benefits of simulation, and provided valuable insider perspectives to enhance staff pedagogic understanding and suggest improvements to the design of simulation sessions. However, accounts also highlight challenges experienced in the pedagogic consultancy process itself, including logistical concerns such as the use of time; discussions around power dynamics; and tensions arising from epistemological differences between staff and students. The authors conclude by advocating the wider adoption of SBP in ITE and further exploring working in partnership with students as SPCs to inform and improve the design and implementation of such pedagogies.

Introduction

Simulation-based pedagogies (SBP) remain infrequent and under-developed in the field of education, often limited to "research prototypes used in experimental settings" (Kaufman & Ireland 2019, para. 2). This article adds to the growing body of literature which adopts the position that, when educating future teachers in Higher Education contexts, SBP offer a means of developing knowledge, skills and attitudes within a 'safe space' (Ferry et al., 2004), enhancing feelings of preparedness and confidence for practice (McGarr, 2021). Nevertheless, to realise the potential for professional learning afforded by SBP in the relatively unfamiliar context of Initial Teacher Education (ITE), there is a need to carefully consider the planning and implementation of these pedagogies, questioning our underlying assumptions as educators to ensure that simulation-based provision meets the needs of the students it is intended to serve.

This article, therefore, explores the potential value of engaging with authentic student voice in supporting – and challenging – staff professional understanding of the design and implementation of effective SBP. Engaging with students in their role as 'expert witnesses' in their own educational experiences (Lodge, 2005, p. 129) enables access to insider perspectives that are often unavailable to those educators working with them. However, despite the possible advantages these interactions may afford, some sources maintain that they remain under-utilised in relation to curriculum design (Healey & Healey, 2018). This study aims to address this gap by offering a multi-stage collaborative autoethnographic inquiry (Devnew et al., 2017), detailing the experiences of nine academic staff working in partnership with a team of four undergraduate student-teachers in their role as 'pedagogic consultants'.

In examining this issue using data collected via independent, reflective accounts, the research begins with two central questions. Firstly, how do staff perceive and experience working with students as pedagogic consultants (SPCs) to gain insight into student perspectives of SBP? Secondly, what are the implications of this for staff professional understanding of the effective planning and implementation of SBP? The article begins by outlining the potential contribution of SBP in ITE before discussing existing research around the importance of student voice and pedagogic consultancy for developing a professional understanding for educational contexts. It subsequently develops by sharing the theoretical framework underpinning the study, together with the research design, before presenting the findings. Finally, the study concludes by offering considerations regarding the potential role of student pedagogic consultancy and engaging with authentic student voices to further inform staff professional understanding of SBP.

Simulation-based pedagogies in education

Internationally, the education sector is experiencing significant challenges in ensuring and maintaining an adequate teacher supply, with varying reported rates of attrition, including 28% within Europe (Federičová, 2021) and estimates of 13.5% in Australia (Kelly et al., 2019), alongside accounts of increasing teacher shortages in the United States (Miller & Young, 2021; US Bureau of Labour Statistics 2022). These challenges are also replicated in England; currently, more than 30% of teachers leave the profession within five years of qualifying (DfE, 2023; Long & Danechi, 2021), with some evidence suggesting that the Covid-19 pandemic has further exacerbated this issue, with applications to ITE programmes experiencing historically low-levels of recruitment (McLean et al., 2023).

Whilst it is likely that multiple factors and nuances contribute to this current crisis (NFER, 2023), a number of previous studies suggest links between feelings of preparedness upon entry to the profession, effectiveness, and retention (Hulme & Wood, 2021; Livers et al., 2021; Mayer et al., 2015; Sims & Jerram, 2020). In England, this has corresponded with the increased emphasis on intensive placements evident in the Department for Education's (2021) Market Review, combining taught content with opportunities for observation and practice to facilitate the rehearsal of techniques prior to implementation in school-based contexts. Similarly, guidance from the Education Endowment Foundation (2021) emphasises the importance of clear instruction, as well as opportunities for rehearsal and feedback, as part of a balanced approach to teacher professional development, which increases the likelihood of sustained and embedded changes to teacher behaviour.

In acknowledgement of these influences, ITE providers are increasingly seeking to complement existing provisions by exploring the use of SBP to bridge the perceived divide between theoretical and professional knowledge (McGarr et al., 2017; Mulholland et al., 2022). Although existing research regarding simulation in ITE is limited, there is a wealth of evidence suggesting the benefits of SBP in preparing pre-service professionals in other fields, such as social work (Meredith et al., 2021) and health (Platt et al., 2021). For example, several previous studies highlight the role of SBP in providing an authentic yet supportive learning environment within which students are safe to develop and rehearse vital professional skills and competencies (Kaufman & Ireland, 2019; Siddiqui et al., 2021; Walsh et al., 2017; Yu et al., 2021). Evidence also suggests that SBP is associated with increased feelings of confidence and preparedness for practice (Fischetti et al., 2022; McGarr, 2021), as well as improved learning outcomes resultant from the opportunities it affords for reflection, feedback and the critique of professional practice (Levin & Flavian, 2022; Motola et al., 2013).

However, despite these potential advantages, the literature also offers a note of caution. Some studies, for example, suggest that students may be hesitant to engage with role-play or fictionalised examples due to perceptions of inauthenticity or irrelevancy to the day-to-day realities of their professional practice (Meredith et al., 2021) or that the contextualisation of learning through SBP can increase extraneous cognitive load, thereby inhibiting learning (Fraser et al., 2015; Mulholland et al., 2022; Sun et al., 2017). Similarly, Nario-Redmond et al. (2017) propose that the expert-novice gap between facilitators within simulation scenarios can lead to feelings of disempowerment and marginalisation, as well as the perpetuation of stereotypes. For those educators

seeking to implement SBP positively and constructively into ITE provision, the authors, therefore, argue that there is a need to actively seek out student perspectives and lived experiences to tailor provision to better suit their needs and requirements.

Working with students as pedagogic consultants: the theoretical underpinnings

To address these potential concerns, this article explores the impact of working with students to further develop and refine SBP. Student-staff collaboration can take various shapes and forms. However, for the purpose of this study, we adopted the definition of pedagogic consultancy proposed by Healey et al. (2014), which moves beyond superficial engagement with student voice to establish deeper and more sustained interactions seeking pedagogic advice and consultation. In examining this issue, this study draws upon the theory of critical pedagogy (Freire, 1970; Giroux, 2020), corresponding with the work of Gower (2017), suggesting that, through supporting student-teachers democratically to examine their experiences as teacher-educators, we gain greater insight into our own practices.

Whilst collaborations of this nature are relatively rare (Healey et al., 2014), the potential benefits for both students and staff are considerable. For staff, the opportunities afforded by student pedagogic consultancy allow insight into students' insider perspectives (Lodge, 2005) to inform and enhance pedagogic understanding, with positive implications for teaching quality and learning outcomes (Cook-Sather et al., 2014; Mercer-Mapstone et al., 2017). For students, student-staff collaborations are also associated with improvements in engagement, motivation, confidence, and self-efficacy (Cook-Sather, 2018; Hayward et al., 2017; Healey et al., 2014), and more frequent opportunities for metacognition (Mercer-Mapstone et al., 2017). Evidence also suggests that student-staff partnerships can result in greater understanding and appreciation of the other's experiences and perspectives (Dwyer, 2018; Healey et al., 2019; Matthews et al., 2019), leading to improved relationships (Healey et al., 2019; Matthews et al., 2019), and positively influencing underlying power dynamics (Dwyer, 2018; Healey et al., 2019; Mercer-Mapstone et al., 2019; Moore-Cherry et al., 2016).

Nevertheless, despite these potential benefits, some studies suggest that challenges can occur due to disparities in expectations surrounding the roles, responsibilities and purposes of partnership working, colouring participants' experiences and willingness to engage in the process (Healey et al., 2019). Similarly, some studies identify the potential obstacles posed by institutional procedures and systems which may limit capacity for change (Dwyer, 2018). Consequently, any attempt to establish authentic systems for pedagogic consultancy must consider both the systems within which the consultancy process takes place as well as the underlying assumptions of participants.

Our pedagogic consultancy process, therefore, assumed a dialogic approach, with students and staff working together to co-develop effective pedagogic practices rather than merely perpetuating what Freire (1970) called the "banking concept of education". Through pedagogic consultancy, students became active participants who were partners in leading their own learning and setting the agendas rather than receiving and reproducing the pedagogy and practices already affirming the status quo. Thinking critically about our lived reality, our relationships, and our values, we hoped, would help reveal so much of what we know to be 'invisible' in teaching but crucial to its success (Giroux, 2020). In this study, student pedagogic consultants (SPCs), therefore, became critical agents through actively questioning teacher-educators' enacted suppositions about students' lived experiences and reflectively challenging the assumptions that legitimise our own practice as teacher-educators.

Methodology

This study follows a multi-stage collaborative autoethnographic inquiry (Devnew et al., 2017), where nine experienced academics shared independent, reflective accounts of their experiences from working with SPCs to develop a shared understanding of simulation-based pedagogy. We framed our research within a relativist ontology, constructing meaning from our pooled personal reflections of professional conversations with SPCs. Our positionality is based within the philosophical grounds that reality can be multiple truths relative to specific events, experiences, places, and at any given time (Guba & Lincoln, 2005). In this way, universal 'truths' grant precedence to negotiated 'truths' facilitated through a transactional process in meaning creation.

As a group of academics interested in simulation-based pedagogies, we recognise that there is no one reality that can explain individualised interpretations. Instead, we see value in sharing our individual reflective experiences to create meta-accounts of meaning that are organised at the group level (Denzin, 2013). As a method, collaborative autoethnography (CAE) procedures mirrored our ontological and epistemological stances and were, therefore, an appropriate choice for the study. We built on autoethnographic traditions that typically locate 'self' through personal experiences, leading to a critical awareness of practices (Adams et al., 2014). Adopting these principles, we worked within a locus of polyvocality, where the 'whole' of our collective voices is represented more than the sum of its individualised 'parts'. All voices contribute and matter: our procedure of reflexive dialogue was not to reach a consensus but to include all aspects of our views.

The collaboration process under these conditions continues from start to finish, from the conception of research materials to their analysis and interpretation. It follows what Chang et al. (2013, p. 24) describe as a way "in which researchers work in community to collect their autobiographical materials and to analyse and interpret their data collectively to gain a meaningful understanding of sociocultural phenomena reflected in their autobiographical data". Collaborative autoethnography, therefore, broadens typical ethnographic traditions in that, for us in our study, were dynamic and multifaceted. We aimed to work with invested people (Ellis & Rawicki, 2013), in this case, our SPCs, who shared our passion for developing knowledge about simulation-based

learning pedagogies and their design.

Procedure

In the first stage, having gained approval to work with human participants from our institution's Ethics Committee, we recruited four undergraduate SPCs to contribute to professional learning conversations about simulation-based learning activities they all previously took part in. Two academic team members facilitated the conversation, which lasted approximately one hour at the host University. We designed our project in line with BERA (2018), making particular use of opportunities to check in with participants before and after the conversations through constant debriefing. We provided opportunities for the SPCs to reflect on their simulation-based experiences by reminding them about previously completed ones. The conversations were driven by a series of open-ended questions to engage each of the SPCs to share insider knowledge (Ellis et al., 2011) of their experiences of participating in simulation-based activities and their insights of working alongside academics in developing them. Our goal was to interpret their meaning.

The academic team co-created the open-ended questions and probe statements used to guide the professional learning conversations to ask SPCs about their experiences of SBP. One of the distinct advantages of the collaborative approach was offering support, questioning, and requesting specific information to shape our inquiry. This protocol was embedded using Brookfield's (2017) four lenses for each stage of the study. We reflected on our own autobiographies in formulating and delivering SBP, which made for fruitful discussions. These discussions raised questions about programme design and its purpose for students. Moreover, it uncovered our paradigmatic assumptions of what we felt worked and did not work, thus providing a frame to consider SPCs' views as a point of enquiry in professional learning conversations.

From our collective discussions, the line of questioning and prompts targeted aspects of professional knowledge, praxis and simulation programme design. The professional learning conversation questions were validated for content validity by the academic team to ensure fidelity to our research objectives and to identify any ambiguities. Example questions included: 'Is there anything further you can identify from the programme, or your understanding of the role of a teacher, that simulated learning would have been of benefit to support your professional learning?' And 'Do you think there is a particular format that is more beneficial, or does it depend on the simulation?' Our open and flexible approach to framing these questions is a convergent step (Ngunjiri et al., 2010) that provided a safe and rigorous attempt to crystalise our collective experiences of simulation-based teaching and learning.

Following the professional learning conversations, the second stage involved individually listening back to recorded conversations. We made individual notes and used a memo-ing technique (Polit & Beck, 2006) to document our thoughts from initial conceptions to detailed abstractions. For this activity, we adapted Driscoll's (1994) reflective framework to ask: 'What was the biggest implication for staff understanding of the planning and implementation of simulation-based learning sessions?' 'So what were your feelings at the time, and have they changed following the conversations?' And: 'Now, what might you do differently in the future?' In the next section, we outline the final stage that culminated in data analysis.

Data analysis

Our study followed an inductive reflexive thematic analysis following Braun and Clarke's (2019) analytical strategy. Firstly, we became familiar with our pooled written reflections and took the opportunity to listen back to the recordings for a contextual understanding of the professional learning conversations. It provided an opportunity to get back in touch with the original data and make further refinements where required.

Next, we generated initial codes from our pooled reflective accounts, which provided another opportunity to discuss and share our interpretations ahead of drawing any conclusions. This reflexive process enabled us to develop a sense of 'internal dialogue' (Feucht., 2017, p. 235) that challenged our own experiences, emotions, and motives. In addition, it allowed us to test multiple assumptions to 'achieve rich interpretations of meaning, rather than attempting to achieve consensus of meaning' (Byrne, 2022, p. 1393). Finally, we generated several themes from the data; these are presented in full below.

Findings

The following section explores the impacts of working with SPCs on staff understanding of SBP. Analysis of the reflective accounts identified themes relating to the benefits and challenges of working with SPCs and the use of SBP itself. These themes can be seen to operate concomitantly, aligning with Schön's (1987) model of reflection, demonstrating both reflection on action, examining staff experiences and perceptions after they occurred, and reflection for action, offering considerations for the future development of both SBP and collaboration with SPCs.

Within these two distinct yet inter-related domains, a number of sub-themes were evident:

- Developing SBP:
  - Affirmation, or the extent to which SPCs supported and confirmed staff assumptions regarding the potential benefits of SBP.
  - The role of personal epistemologies in prompting unease or tension due to conflicting pedagogic beliefs and assumptions.
  - Learner insight as a means of enhancing staff pedagogic understanding with positive implications for learning and teaching.

- Improvements to the design of SBP, including specific recommendations relating to the format and nature of tasks and simulation materials.

• Benefits and challenges of working with SPCs:

- Logistical challenges encountered, including time and capacity for engagement.

- Student-staff relationships and power dynamics, considering the extent to which interactions between staff and SPCs succeeded in providing challenge and critique.

Each of these findings will be discussed in turn below.

Developing simulation-based pedagogies

Affirmation

The initial decisions informing SBP design and implementation were drawn from the underpinning literature concerning both gaps in knowledge and theory, as well as findings regarding the potential benefits of SBP more widely (e.g. Fischetti et al., 2022; Levin & Flavian, 2022; McGarr, 2021; Motola et al., 2013; Siddiqui et al., 2021; Walsh et al., 2017). Staff accounts – reflecting *on* action (Schön, 1987) – revealed that working with SPCs provided feedback which acknowledged and affirmed these original choices:

> When listening to the feedback, I feel proud of what we have achieved. SBP is developing knowledge, aiding student-teacher preparedness and developing their professional understanding.

> This is clearly an effective pedagogic approach which is loved by students. They talk about SBP very positively and identify how the input has supported their development. They describe SBP as a safe space for developing, engaging, motivating, and valuable learning experiences.

These accounts reflect almost a sense of relief in the alignment between staff perceptions of the key advantages offered by SBP and those of SPCs, including enhanced feelings of preparedness for practice and the opportunity to develop key skills and practices within a safe and engaging learning environment. For academic staff, this confirmation is valuable in justifying changes to pedagogic practice which have already been made, as well as providing a further mandate for ongoing development (Zdravković et al., 2018).

In addition to broad reflections regarding students' experiences of simulation sessions, insights gained through engaging with SPCs highlighted the role of SBP in establishing a more secure professional identity:

> There was acknowledgement of other people and their perspectives, and maybe that working as a teacher in school was going to be very different from being a student.

> The ways in which students talked about the value of 'thinking like a teacher' and making 'in-the-moment decisions' particularly struck me. I expected that they would gain these experiences during placement. However, one pedagogic consultant said that she feels like you get a 'student-y' experience on placement, where perhaps you're shielded from more challenging situations – and you always have someone else who is ultimately responsible for the class. So SBP actually provides more of an opportunity to feel in the role of teacher, and responsible for decision-making.

These reflections indicate that academic staff were encouraged by the extent to which SBP enabled students to assume the role of teacher due to increased responsibility for autonomous decision-making, in contrast to the more scaffolded – or '*student-y*' – experiences gained during school-based placements. This resonates with the work of Sollars et al. (2021) in highlighting the potential value of SBP in strengthening pre-serving professionals' emerging professional identity through providing opportunities to assume the role of a teacher within authentic simulated scenarios and to reflect upon these experiences.

The role of personal epistemologies

When engaging with SPCs, staff accounts suggest the potential for tension arising from the personal epistemologies held by both students and staff (Healey et al., 2019; Nichol et al., 2023; Pintrich, 2002). This occurred when feedback from SPCs conflicted with the pedagogic beliefs and assumptions of academic staff:

> We've worked really hard on the SBP materials. It can also sometimes be tempting to dismiss students' perspectives because we know the rationale underpinning some of the choices we've made.

This reflection *on* action (Schön, 1987) expresses the emotional response which can be experienced when confronted with a perceived challenge to practice and the inclination to diminish or ignore feedback which conflicts with existing, deeply held beliefs and philosophical approaches. It is also important to acknowledge that staff responses to student feedback operate within the wider Higher Education (HE) context, whereby institutional pressures and accountability measures such as the National Student Survey and Teaching Excellence Framework can lead to the positioning of students as consumers (Woodall, 2014), and a consequent desire to yield to customer pressure (Cuthbert, 2010). This affords SBP the potential to offer both opportunities for students in terms of ensuring an engaging and purposeful learning experience which offers increased 'value' for students on professional programmes. However, caution is encouraged as, in departing from traditional didactic approaches to teaching and learning, there is risk in challenging underlying personal epistemologies and conceptions of the nature of learning itself (Curnow et al., 2019).

However, it is important to acknowledge that, within the current study, instances of contrast in the personal

epistemologies of academic staff and SPCs were relatively infrequent:

> Listening to the pedagogic consultants, I was struck by just how much their views align with mine – and I think those of our larger staff team. Does this mean that pedagogic consultants aren't representative of the wider student cohort? Or just that we're broadly in agreement and that I'm worrying too much!

As this reflection indicates, the close correlation between the views of both academic staff and SPCs may prompt questions surrounding the extent to which SPCs are representative of the wider student body and the potential implications of this when seeking to gain insight into the broader student experience. This echoes the wider literature, which suggests that engagement in voluntary activities of this nature is associated with higher levels of academic attainment (Farsides & Woodfield, 2007).

The potential implications of the non-representative nature of SPCs are significant, curtailing the potential for insight into students' lived experiences more generally as well as the unpinning theoretical intentions of this study, which positions collaboration with students as partners as a means of affording honest and authentic insight into our pedagogic practice (Gower, 2017). Therefore, moving forward and reflecting *for* action (Schön, 1987), this raises questions regarding the extent to which pedagogic consultants can and should be recruited to enable engagement with a more representative student group.

The role of student insights in developing SBP

Across the data, participant reflections demonstrated that engaging with the SPCs provided insight on the development of simulation-based pedagogies. These insights were acknowledged to be of great value to academic staff:

> Students offered an inside voice to the session. They supported us, as staff, to see what it was like on the other side. This meant we could effectively reflect on each session.

Indeed, it is also important to note that some staff accounts suggest that the rich detail evident in the insights from the SPCs exceeded that of the staff themselves:

> I think that the pedagogic consultants' insights into the structure of sessions, the importance of having authentic tasks to do, and of collaboration with peers from the outset of sessions so that they can consider a wide range of views were aspects of this work that I hadn't considered in as much depth as they seem to have done, so these are very useful to ensure that they are consistently included when designing any future sessions.

This demonstrates how working with SPCs afforded opportunities for reflection on action (Schön, 1987), whereby staff were able to triangulate their own experiences and perceptions of SBP with those of the students. However, also evident is that collaboration with SPCs also prompted reflection *for* action (Schön, 1987) by creating opportunities to learn from students' insider perspectives to enhance staff pedagogic understanding (Mercer-Mapstone et al., 2017), with positive implications for learning and teaching.

> You understand how SBP supports their development as a primary teacher. Without this focus group and consultation, we would not be aware of some barriers to learning which they highlight.

This provided a lens through which to access student perspectives and experiences of SBP, prompting awareness of further opportunities to develop and enhance future SBP design and delivery. As such, these accounts can be seen to align with those elsewhere in the literature in suggesting the potential value of creating opportunities to actively engage with students' insider perspectives (Lodge, 2005) in order to better-understand students' perceptions of their learning experiences (Cook-Sather et al., 2014; Daviduke, 2018) and enhance staff pedagogic understanding (Mercer-Mapstone et al., 2017).

Improvements for the design of SBP

Accounts demonstrated reflection *for* action (Schön, 1987) prompted by engagement with SPCs, highlighting several aspects of SBP for further development and improvement. These include the need to clarify and clearly signpost links between theory and practice, considering the timing of simulation sessions across the academic year, particularly in relation to practice-based placements, and the use of non-idealised scenarios.

One of the most frequently cited benefits of SBP is the metaphorical bridge that these provide between theoretical and professional knowledge (McGarr et al., 2017; Mulholland et al., 2022). However, in the context of this study, working with SPCs indicated to staff that they had not been sufficiently explicit in clarifying and signposting links between theory and practice:

> Pedagogic consultants' references to the 'subtle' links between theory and practice really stood out for me. I don't think we want these links to be subtle (or at least not always!). I worry that this may mean that you need a pretty decent knowledge of theory (like these strong students) to spot the connections and that this means that many other students will miss these! I think we may need to be more explicit about how SBP is connecting to prior learning, research and theory to help students make these connections more easily.

Reflecting *on* action (Schön, 1987), it was evident to staff that if the SPCs, all of whom had strong academic profiles, considered the references made by staff to theory as 'subtle' then there may be other students for whom these connections would remain unrecognised and unacknowledged. This indicates that, in the initial planning and implementation of SBP, staff assumptions regarding students' understanding of theory and our subsequent ability to connect this to a

simulated context were inaccurate, potentially resulting in missed opportunities to promote professional learning.

In response to this, staff accounts also demonstrate reflection *for* action (Schön, 1987) in calling for greater awareness of this issue and the need to more carefully consider how the relevant links between theory and practice can be signposted for students:

> Students have provided some perspectives that I wouldn't have considered – we haven't made the links between theory and practice clear enough."
>
> "Clearly, we need to link theory to practice more explicitly and acknowledge the imperfect nature of this.

This resonates with the work of Nestel and Bearman (2015), who emphasise the importance of ensuring a shared understanding of the nature of 'theory' between both staff and students, as well as explicit discussion regarding the point at which these theories should be acknowledged and enacted. For example, this could be achieved through providing pre- or mid-session tasks which signpost relevant theory or through incorporating pauses within the session to allow both staff and students to re-group to share their understanding of how theory is impacting upon practice and to support decisions moving forward.

In addition to reflections regarding the transparency of connections between theory and practice, engaging with SPCs also emphasised the need to align these more purposefully to taught content:

> It was also interesting – and so sensible! – to consider students' reflections around the timings of different simulations, particularly so that these come before different placement experiences. At the moment, we're really just trialling SBP. However, as we're finding out how much these opportunities are valued by students, I wonder whether it is now the time to consider the timing and sequencing of different SBP opportunities more carefully to maximise their potential to complement taught content.

This reflection *on* action (Schön, 1987) echoes that made in relation to the connection between theory and practice and can be seen to correspond with the wider literature regarding the under-utilisation of students' perceptions and opinions in curriculum design (Healey & Healey, 2019).

In assuming full ownership and control, the staff team made decisions that did not necessarily reflect the preferences or learning needs of the students for whom the provision was intended. As this account demonstrates, in reflecting *for* action (Schön, 1987), collaboration with the SPCs highlights not only the importance of identifying the most appropriate points for the rehearsal and application of professional knowledge and competencies within a programme but also the potential value of actively seeking out students' views and perspectives to inform this. This would encompass not only *what* students find challenging to deal but also when is it that they begin to feel particularly vulnerable (Shanks, 2014) in those identified aspects of practice as novices in the expert environment in which they find themselves on their school-based placements.

A final improvement to the design of SBP prompted through engagement with SPCs is the use of non-idealised scenarios. These non-idealised situations – circumstances within which a greater number of factors required intervention or where appropriate support was unavailable – were cited by the SPCs as a potential means of enhancing the learning resultant from SBP. However, here it is interesting to note that SPC consideration of simulated scenarios of this nature contrasted with a careful decision made by the staff team:

> This idea of learning through mistakes and the strong desire students seem to have for non-idealised situations. We have planned relatively straightforward scenarios because we were conscious of cognitive load – and of not scaring students with some of the very challenging and complex situations which can arise when they are still at a very early point in their training.

In reflecting *for* action (Schön, 1987), this adds to existing studies (Nicholet al., 2023) in raising important questions relating to the distinction between providing the educational provision that students may *want* and that which they may *need*. This tension is encapsulated in the following account:

> If we dismiss ideas too quickly, then we miss opportunities to develop our work. And it may not be that our approaches/choices are wrong. It may just be that we need to communication the reasons for our choices more explicitly so that students understand them.

In this specific context – as the students considered within this study are also pre-service teachers, for whom education is both the vehicle by which learning is accomplished and its subject focus – we believe that this underscores the importance of clearly communicating the rationale for the pedagogic choices made. In this way, students may also gain an increased understanding of the rationale underpinning designed teaching and learning sessions, thereby equipping students with professional knowledge to inform both their own future teaching practice and their capacity to act as metacognitive role models to the pupils with whom they work (Wall & Hall, 2016).

Working in collaboration with SPCs

Whilst recognising the benefits of working with SPCs evident both within this study and the wider literature (Healey et al., 2014; Nichol et al., 2023), it is important to acknowledge that this was not without compromise. Practical challenges, including logistical issues, were experienced across relationships, and the power dynamics inherent to the position of those engaged as either students or staff also influenced both willingness and capacity to engage in the pedagogic consultancy process. It threatens what Healey et al. (2014) describe as establishing deeper, sustained connections with students' active voices in seeking

pedagogic advice and consultancy.

Logistical challenges

In reflecting *on* action (Schön, 1987), staff accounts highlighted a range of logistical concerns whilst working in partnership with students, the most common being the paucity of time in very busy schedules to meet and work directly with SPCs. For example, challenges experienced in attempting to schedule meetings when both staff and SPCs were available to attend left staff feeling a little discontented with elements of the process:

> I think that mainly I feel mildly frustrated. I see so much value in working with the pedagogic consultants, but I just don't think that any of us – students or staff – have as much time as we'd like to really make the most of the opportunities for learning that working in partnership could offer."

> I do still maintain that the opportunity should be there for discussion, but we've not had everyone together to do that, which is a shame.

Furthermore, staff accounts suggest that there was a particular awareness of SPCs dual role as both students and consultants and were conscious of the potential of this additional commitment in over-loading students, hampering their studies or placements:

> Having the time/capacity to invest in this as much as I really want to. Everyone is so busy, and we are really conscious that our pedagogic consultants have assignments and placements that need to be their first priority.

For staff and students, initial teacher education is a labour-intensive programme, and perhaps this reality may just need to be accepted (Carter, 2015; Perry et al., 2019). However, despite this, in reflecting *for* action (Schön, 1987), staff suggested possible approaches to make more efficient use of their time moving forwards:

> I'll keep thinking how we could keep informal conduits of communication open...I think it would be incredibly valuable - and perhaps more frequent communication would also help relationships to become easier as we become more familiar with each other.

> I wonder if, rather than working for an hour here and there, it would be more beneficial to block work (e.g. during school/university holidays) so that we could work together for a sustained period of time. Would this help to develop effective working relationships more quickly? Would it help us to gain deeper and richer insights and collaborations?

> Would building in more face-to-face meetings facilitate the development of these effective working relationships? What about establishing working relationships over a longer time span – 2 years?

Interestingly, these reflections centre around the importance of building and strengthening relationships rather than the logistical concerns themselves. The lack of time was not deemed significant in terms of task completion, as this was not highlighted, but instead, accounts emphasise the need to foster positive relationships between staff and pedagogic consultants to enhance the consultancy process. According to Snijders et al. (2022), relationships form a key part of effective student-staff partnerships, therefore, ensuring sufficient time to build these relationships should be an important consideration in the planning and preparation for working with SPCs.

Student-staff relationships and power dynamics

Further to these considerations regarding the nature of student-staff relationships, staff accounts also raise questions regarding the ways in which this may have impacted upon the nature of the feedback shared. It was anticipated that SPCs would challenge the pedagogic approaches deployed by academic staff. However, this was not something that fully materialised:

> Student roles were to be honest and constructive, staff to be open and non-judgemental. The students were articulate and insightful at times although not offering solutions – which suppose is the staff's job.

> I had hoped there would be some Damascene moment when I would have my views challenged in a constructive and enlightening way, but that hasn't happened... yet.

In reflecting *on* action (Schön, 1987), staff can be seen to consider the possible reasons for this, including the potential role of power dynamics in influencing interactions:

> all of the right emotions are there, all of the desire to genuinely work together, but we can't ignore the different roles and that power relationships do exist.

> I'm also conscious that there are power dynamics at play. We are responsible for teaching (and assessing!) the pedagogic consultants. Surely, this must mean that they feel like they can't always be as honest with us as they'd like to be. I feel like we haven't spent enough time face to face, working in this capacity, to establish the working relationships (hopefully on a slightly more equal footing) that I'd like to have. I wonder if an away day or two at the beginning of establishing a partnership could help to facilitate this.

From this, we recognise that staff may not have had their desired *Damascene moment* as, operating within an academic environment, students - even when assuming the role of SPC - may feel constrained by power relationships that encourage silence on the students' part (Patrick, 2013).

In considering this issue, it is important to revisit the theoretical underpinnings of this study: that, in collaborating with SPCs, we would be able to enact a form of critical

pedagogy (Freire, 1970), emphasising the social nature of learning and an honest reflection of the power dynamics between students and staff so that learning is collaborative rather than imposed. On reflection, the very processes of recruiting and appointing SPCs undermined this intention by reinforcing the traditional hierarchical relationships between staff and students. Through the application process, SPCs were interviewed by the staff who would be working with them if they were formally employed. From the outset, this can be seen to establish the roles and associated power dynamics of employer and employee, subject to employment systems which required that staff also assumed responsibility for approving time sheets for hours worked, further maintaining this imbalance.

This aligns with the work of those such as Dwyer (2018) in underscoring the potential obstacles presented by institutional procedures and systems which may restrict the capacity for change (Dwyer, 2018). Any restructuring of this power dynamic would not be something which would occur naturally. Both staff and Higher Education Institutions (HEIs) would need to proactively take steps to redress this in order to encourage more open and perhaps challenging communication with SPCs. However, as Freire argued, one of the roles of an educator is to "unveil opportunities for hope no matter what the obstacles may be" (1994, p. 9). Collectively, we believe that the potential value of collaboration with SPCs is significant and, reflecting *for* action (Schön, 1987), we must now acknowledge our own roles in this scenario and consider future avenues of working to better support SPCs to critique and question the power structures of which we were a part.

Conclusions

The purpose of this paper was twofold: considering both staff perceptions and experiences of working with SPCs to gain insight into student perspectives of SBP, as well as the implications of the consultancy process for staff professional understanding of the effective planning and implementation of SBP. As authors, we believe that the benefits of collaboration with SPCs to inform the planning and implementation of SBP largely outweigh the challenges. Working alongside SPCs provided opportunities to question underlying assumptions regarding the pedagogic choices underpinning SBP, providing valuable insider perspectives which enhanced staff pedagogic understanding and prompted further consideration of the design and development of the simulated sessions. The use of the reflective models ensured the staff understood more deeply their role in student engagement, helping to overcome challenges that were previously unrecognised.

Drawing on critical pedagogy theory (Freire, 1970), the pedagogic consultancy process was enhanced through the traditions that examined and challenged the power structures and inequalities in our HE environment. Critical pedagogy, as a philosophy of education and social movement, encouraged critical thinking whilst challenging the typical nuances within staff and student relationships. We believe that our findings provide a possible framework for implementing SBP and conclude by advocating both the wider adoption of SBP in ITE as well as the further exploration of working in partnership with students as SPCs to inform and improve the design and implementation of such pedagogies. However, to realise the true potential of student pedagogic consultancy, careful consideration must be given to the time constraints within which authentic collaboration and consultation operate, as well as the underlying systems and procedures which may succeed in perpetuating, rather than challenging, the hierarchical power structures inherent to traditional student-staff interactions.

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Virtual reality check: A realist evaluation protocol for exploring the use of Immersive Virtual Reality (IVR) to support pre-service teachers' understanding of approaches to behaviour management

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Abstract

Amidst international challenges in teacher recruitment and retention, understanding how best to prepare pre-service teachers for professional practice is of the utmost importance. Managing pupil behaviour is of particular concern due to a rise in reported challenges experienced by teachers following the COVID-19 pandemic, with consequences for the wellbeing of teachers and pupils, as well as for teacher retention. Simulation-based learning (SBL) within Immersive Virtual Reality (IVR) environments provides a means by which pre-service teachers can be supported to develop essential skills in a safe, supportive environment. However, the use of SBL for Initial Teacher Training (ITT) remains in its infancy, with few previous studies in this field of enquiry. In addressing these issues, this research protocol proposes to target pre-service teachers undergoing an ITT programme in a realist evaluation to further understand how they embrace behaviour management strategies in an IVR environment. Adopting a sequential mixed-method approach, we plan to collect qualitative and quantitative data with stakeholder groups in the development of a holistic evaluation framework. Our intended outcomes are to synthesise data to explore the key factors needed to design, implement, and evaluate IVR within SBL approaches to better understand their potential as a form of professional learning.

Background

Reports of teachers experiencing difficulties in managing pupil behaviour in English schools are increasingly frequent, with evidence suggesting a significant increase in primary-age pupils' emotional and behavioural difficulties following the partial school closures during the Covid-19 pandemic (Blanden et al., 2021), as well as a rise in pupil mental health and wellbeing problems as a result of the pandemic (Nelson et al., 2021). These challenges are also reflected in an annual survey conducted by the UK government's Department for Education (DfE) which indicates that 62% of teachers and school leaders reported disruptions to lessons in the past week, with an average of 6.3 minutes of lost learning for every 30 minutes of lesson time (Department for Education, 2021).

This is of particular concern when situated within the wider context of a national and international teacher recruitment and retention crisis. In England, one-third of teachers leave the profession in the first five years following qualification (Department for Education, 2021; Long & Danechi, 2022), and these challenges are also replicated internationally, with estimated attrition rates of 13.5% in Australia (Kelly et al., 2019), 28% within Europe (Federičová, 2021), and reports of mounting teacher shortages in the United States (Miller & Young, 2021; US Bureau of Labour Statistics, 2022).

Whilst the underlying causes for this crisis are multiple and complex, it is likely to be influenced by these challenges. For example, research conducted by the Department for Education (2018) to explore factors affecting teacher retention identified that some teachers identified a specific 'trigger' point, such as a particular behavioural incident involving pupils or their families, as their reason for leaving the profession. Similarly, 60% of teachers and school leaders reported that pupil behaviour negatively impacted their health and wellbeing (DfE, 2023).

Early Career Teachers (ECT) are more likely to experience challenges in managing pupil behaviour (Mayer et al., 2015; Pfitzner-Eden, 2016; Department for Education, 2019), with some teachers expressing dissatisfaction with the extent to which initial teacher training prepared them for practice in this regard (Department for Education, 2018). There is also some evidence to suggest that, when experiencing difficulties, pre-service teachers may be more likely to resort to autocratic approaches which can escalate disruptive behaviour, rather than lead to a positive resolution (McGarr, 2021).

Simulation in education

In response to these challenges, one area that has the potential to enhance authentic learning experiences for pre-service teachers lies in simulation-based learning (SBL). In its broadest terms, SBL provides training opportunities to practise responding to a realistic imitation of a real-world situation in controlled and safe environments (Kim et al., 2016; McGarr, 2021). Pedagogically, it is used within training programmes across various professional disciplines, such as health (Chernikova et al., 2020), social work (Craig et al., 2017) and medical education (Heitzmann et al., 2019). It takes form through different guises, whether physical, virtual or a hybrid of both conditions (Frei-Landau & Levin, 2023), and typically involves students taking part in predetermined activities that reflect their professional field (Rayner & Fluck, 2014). For example, in Dalinger et al. (2020)'s study, pre-service teachers were physically placed in lab-based sessions that involved using software to simulate parent-teacher discussions, where adult avatars played the role of parents. A similar approach was adopted in Ledger et al. (2019)'s study that investigated preferred teaching strategies of pre-service teachers delivered through a combination of virtual and physical interactions.

Whilst SBL in Initial Teacher Training (ITT) is still in its infancy (Fischetti et al., 2021; Frei-Landau et al., 2022), there are encouraging signs of its use in developing pre-service teachers' skills and knowledge. Recently, two systematic reviews reported skill and knowledge enhancements in response to taking part in SBL activities. The review by Theelen et al. (2019) found studies that reported students' classroom management and generic teaching skills to be positive following exposure to various forms of computer-based classroom simulations. They find consensus across studies that report students feeling better prepared because simulation experiences were authentic and mirrored real classroom environments. Similarly, in Ade-Ojo et al. (2022)'s review, they report the benefits of mixed-reality simulations, where students take part in simultaneous physical and computer-based simulations. They find benefits to students' pedagogical thinking skills, self-efficacy, and confidence in using professional language. Both reviews argue for the expansion of SBL research, particularly focusing on the potential of how SBL can form teacher-training practice and be embedded into professional curricula. Moreover, Judge et al., (2013) have called for research to consider the role of teacher trainers or faculty staff involved in preparing, delivering, and evaluating SBL activities. Perhaps more significantly though is Ade-Ojo et al. (2022)'s call for UK-based studies in this field of enquiry given their complete absence.

Virtual reality research in education

Higher Education (HE) continues to be transformed through technological advancement and change across all its activities (Ingleby et al., 2019). Within learning and teaching, the development of increasingly sophisticated web-based applications, delivered through an assortment of smaller, portable, and more powerful technologies and devices, facilitates the progressive use of creative pedagogical approaches (Englund et al., 2017).

These developments, amongst several other factors, have ensured an increased expectation that users are able to access learning from anywhere and instantaneously (Dholakia et al., 2004) whilst, in teacher education programmes, teacher educators hope to maximise the parity of learning opportunities offered to large cohort student groups. The reliance on traditional face-to-face lecture modes of learning is being superseded by greater accessibility to alternative delivery mechanisms, with SBL being one such opportunity

for providing parity of experiences, in an inclusive, safe environment, for students to access (Pelly et al., 2020; Walsh et al., 2017; Kaufman & Ireland, 2019; Siddiqui et al., 2021; Yu et al., 2021).

However, for staff and students to engage successfully with SBL, there is a need, from a practical, theoretical, and pedagogical base, for a deeper understanding of the benefits rather than the 'potential' that has been promoted for many years (Goodchild & Speed, 2019). The nature of knowledge, what is worth knowing and what is valued, has been and will be, dramatically affected by technology. The dynamic and changing nature of technology informs and influences pedagogical models and their application to practice. The holding of knowledge is no longer good enough; information is too freely available, so the traditional model of education will need to adapt to embrace the underlying change in the way we perceive and interact with theory, knowledge and information, and its application to practice. The simulated practice has, for several years, been a pedagogical approach favoured by a range of professional disciplines, namely social work (Meredith et al., 2022), health (Platt et al., 2021) and, more recently, teacher education (Kaufman & Ireland, 2019; Mulholland et al., 2022; McGarr, 2021).

Perhaps the most recent developments around SBL, have progressed through the more creative use of technology-driven advancements. According to Steuer (1992), Virtual Reality (VR) refers to those technologies that highlight the sense of existence in a simulated, online, computer-generated, graphical environment, whilst Immersive Virtual Reality, (IVR) is described by Hamilton et al. (2021) as the presentation of a simulated environment that replaces users' real-world surroundings convincingly enough that they can suspend disbelief and fully engage inside the created environment. Simulated IVR, as a vehicle for pedagogic delivery in ITT, can therefore, redefine the traditional learning environment. Students are given the opportunity to explore complex topics in ways that traditional didactic, theory-driven learning and teaching methods cannot, using immersive content through a creative graphical interface and head-mounted-displays (HMD), for example, the Meta Quest or Apple's much anticipated Vision Pro.

There is promising evidence to strengthen the use of IVR simulation in ITT. For example, a pilot study by Chen (2022) found the use of IVR technology improved the classroom management skills of pre-service teachers. In their study, the students improved the time to locate and manage challenging behaviours of classroom avatars. These skills were applied to real-world classrooms with sustained effects compared to the VR immersive experience. The use of technology, however, is not without threat or compromise. Cost (Ingleby et al., 2023), negative impact on users' mental health (Haidt & Allen, 2020) and the impact on cognitive load (Dror et al., 2011) are just a selection of challenges facing educators tasked with application, and all need thorough examination prior to implementation.

This article offers insight into how this drive towards a form of SBL, namely IVR technology, is experienced and interpreted by pre-service teachers, together with an understanding of the intentions behind the materials that teacher educators make available via these platforms. Working in partnership, this collaboration with an education technology business whose vision is to create revolutionary virtual reality learning experiences that are accessible to all staff in schools and children including those with special educational needs (SEN) and who may be at risk of permanent exclusion, we aim to bring our collective vision to life through the development of a prototype, immersive, interactive VR environment. The SBL and focus for this development is to provide an opportunity for pre-service teachers to experience the virtual reality of decisions they make, in real-time, that impact behaviour management. Ultimately, by combining virtual reality technology with a deep understanding of the unique challenges faced by teachers, we aim to create a learning platform that is both educational and empowering to those involved.

Methods and analysis

Objectives

1. To develop a realist evaluation framework to conceptualise and assess contextual factors relevant to the use of IVR within SBL approaches to ITT.

2. To undertake qualitative and quantitative data collection with stakeholder groups (teacher educators and pre-service teachers) to determine the acceptability, feasibility and relevance of outcomes proposed in the evaluation framework.

3. To synthesise data to understand the key factors needed to design, implement, and evaluate IIVR within SBL approaches.

Research questions

1. What value do pre-service teachers and teacher educators place on the learning which takes place in IVR SBL as a method of relating the theory of behaviour management to practice? For example, do they perceive that IVR simulation has enhanced their ability to transfer theory to practice?

2. What specific mechanisms are effective which can be transferred into the development of the IVR SBL software from a prototype to a fully developed pedagogical tool?

Methods

Location of the research

ITT is a core part of the subject offered at the Higher Education Institution (HEI) where the research team are located. The Bachelor of Arts (BA Honours) in Primary Education prepares trainee students to teach children ages 3-11 years in the UK. Specific to this research, we will undertake a robust recruitment process with trainees from the Year 2 cohort of the BA programme and the staff involved with their training during this academic year (approximately

100 students, 10 staff). This Year 2 cohort has been identified due to the existing teaching focus and input on behaviour and behaviour management at this stage of their training. This cohort has had no prior experience of SBR as part of their ITT studies.

Theoretical approach

Realism is a philosophical position located between positivist and constructivist stances. It seeks to know what is working, in what circumstances is that the case, and why it is working (or not) in those circumstances (Pawson, 2006). Therefore, a realist evaluation methodology has three key foci: the context of an intervention, the mechanisms used, and the recorded outcomes. These are often referred to as the context-mechanism-outcome (CMO) configuration (Pawson & Tilley, 1997). Context refers to the specific conditions and reality where an intervention is applied and takes place. Within a Higher Education environment, it is crucial that the pre-existing social context of the programme is acknowledged (Graham & McAleer, 2018). Mechanisms refer to the 'what happens and why' of an intervention that leads to a particular set of outcomes; there is a focus on the future potential the mechanisms can afford (De Souza, 2013) if they are applied. Finally, outcomes refer to the consequences, both planned and unplanned, of the mechanisms applied to the specific context of the research.

Realist evaluation stages

The proposed realist evaluation has three distinct stages:

1. Theory generation

- Generation of initial theories from existing academic literature, including the use of IVR SBL as a pedagogical tool both within ITT and a wider educational context such as health education and training.
- Questionnaires for stakeholders' pre-use of IVR SBL.
- Use of the IVR SBL tool by the pre-service teachers and teacher educators.

2. Theory refinement

- Questionnaires for stakeholders' post-use of IVR SBL.
- Focus group interview with a proportion of stakeholders who have completed both the questionnaires and attended the VR SBL session.
- Refinement of the theories based upon the focus groups and interviews.

3. Theory development

- Development of theories into a definitive set.
- Proposed theories to be shared with stakeholders in a focus group interview.

Using literature already published on the use of IVR SBL within ITT and wider educational contexts, and the pre-IVR SBL questionnaire, we will develop a set of initial theories which will seek to define the contexts, mechanisms, and outcomes of using IVR SBL within ITT. The pre-service teachers and teacher educators will then take part in an IVR SBL focusing on dealing with challenging behaviour in a classroom environment. The theories will then be tested and refined through focus group interviews with both pre-service teachers and teacher educators as well as the analysis of the post-IVR SBL questionnaire. The data collected will then be used to develop the proposed VR SBL theories into a definitive set. The proposed theories will then be shared with the focus group for discussion and final development. This definitive set of theories will be used as the basis for future large-scale research utilising a fully developed IVR SBL package with pre-service teacher students across multiple HEI contexts.

Data analysis

Data from both pre- and post-IVR SBL questionnaires will be analysed using SPSS software. Pre-IVR SBL questionnaires will focus on understanding the participants' pre-existing knowledge and awareness of both IVR SML and behaviour management. Post-IVR SBL questionnaires will be used to gauge both the value placed on the IVR SMB experience as well as any development of knowledge and awareness of behaviour management. These questionnaires will be used to develop a range of starting point questions for the focus group interviews. The focus group interviews will be recorded with the consent of the participants and the data will be transcribed and uploaded into NVivo analysis software. A thematic analysis of this data will then be conducted by one of the research teams adhering to the Braun and Clarke (2006) framework to identify and code initial emergent themes. This thematic analysis will follow an inductive process where themes will be directly driven by the data collected as opposed to being led by theory. These themes will then be discussed with the whole research team, and a set of emergent themes will be refined into a definitive set of theories which will be shared and evaluated with the focus group.

Ethics and governance

All procedures involving human participants will be approved by the host University's Ethics Committee. Data collected from this work will be managed in accordance with the General Data Protection Regulation (GDPR) (Regulation 2016/679) (Official Journal of the European Union, 2016). In specific relation to the focus group interviews with pre-service teachers and teacher educators, the authors will ensure participant confidentiality and no identifiable

information will be published in any subsequent work. Written consent will also be obtained from all participants prior to the start of the research.

Results

This project will enable our collaborating external partner to better understand the IVR SBL prototype they have created to further develop the software to meet the needs of the intended users. The project will also contribute to the growing body of knowledge on the use of IVR and SBL with pre-service teachers within the HEI context. We seek to inform the development of the ITT curriculum within England and the training of teachers internationally. We will, therefore, disseminate our findings to national and international colleagues.

Discussion

This project builds upon previous simulation projects in which several members of the research team have been involved where a series of SBL scenarios and resources were developed to help bridge the theory-practice divide that pre-service teachers have identified, to give added realism and relevance to their university-based experiences.

These simulations were framed within a 'virtual' school context which consisted of Year 2 and Year 6 class cohorts. The 'simulated' children all had personal profiles and backstories including assessment data, Special Educational Needs and Disabilities (SEND)and pupil premium information. Simulation scenarios were developed in collaboration between both teacher educators and a group of pre-service teachers working as 'pedagogic consultants' and were drawn from collective experiences of practice (Luke et al., 2023). They were designed to reflect lived realities and include video and audio materials, simulated documentation (such as emails and school planning and policies), and live interactive role-play.

Adopting the position that having a detailed, shared understanding of the same class allows staff and students to have meaningful and insightful discussions about potential barriers to and opportunities for learning, teaching and assessment, this innovative approach is currently being embedded across the ITT programmes at the HEI. The initial research received enthusiastic support from pre-service teachers, and participant accounts from that pilot project (Mulholland et al., 2022) reported increased engagement, confidence, and feelings of preparedness, indicating that SBL promotes parity of experience for pre-service teachers through offering authentic contexts to rehearse essential skills within a risk-free environment.

Conclusion

This project will further develop an understanding of SBL by looking specifically at the use of IVR technology as a pedagogical tool which may enable pre-service teachers to bridge the gap between theoretical understanding and professional experience in practice. This research will be used to create an exploratory theoretical understanding of how to plan, implement, and evaluate IVR SBL within the ITT curriculum. We aim to identify potential strengths and limitations of the use of IVR SBL within the HEI context and make recommendations for how such an approach can be embedded within existing ITT provisions.

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Contending with controversy: Using a decision-based simulation for preservice teacher education on addressing challenged books

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Abstract

This paper shares an innovative use of an online decision-based simulation to help preservice teachers examine contentious issues, such as challenged books in elementary and middle school classrooms. Challenged books, particularly those around gender diversity topics, can be contentious as well as emotionally laden. The online simulation that uses a combination of recorded actors, writing exercises, and various decision paths requires the preservice teachers to contend with multiple stakeholders and various priorities in a rich sociocultural context. The teacher educators share key strengths of this use that include using a mistake-friendly learning environment, replaying the simulation multiple times to connect decisions with consequences, and engaging in a complex, nuanced, and responsive learning context. This article provides an overview of the simulation and what was found to be useful when using simulations to address contentious topics.

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Introduction

As teacher educators in the context of the United States, we are attempting to build new teachers' efficacy around various competencies such as supporting all students and enacting tasks such as planning, classroom management, and relating with various stakeholders, such as colleagues, parents, and administrators which have been found to be challenging for new teachers in the classroom (Kozikoğlu et al., 2018). In the United States, where we currently prepare future teachers, we are faced with an increasingly contentious environment regarding "controversial" topics such as gender and race, which novice teachers find particularly challenging to support and address (Pace, 2019). This lack of efficacy of novice teachers can impact their effectiveness in the classroom. Moreover, research shows that teachers' implicit biases cause a lack of confidence among students that can lead to diminished expectations, particularly for students from diverse groups (Hanselman et al., 2014).

Teacher educators have tried to support their college teacher candidates by providing content, classes on diversity and diverse practicum placements, and support learning through in-depth cultural experiences within communities. Despite these efforts, research has pointed to the problem of what teacher candidates learn in university coursework and its divergence from what is practiced in the field, especially regarding culturally responsive practice and addressing diversity (Daniel, 2016). More recently, in the last decade, teacher educators have turned to the school practicum, particularly in "diverse settings," as a critical opportunity and a potential solution to connect coursework and practice to build future teachers' confidence and skills to support all students (AACTE, 2018, p. 14). However, researchers and practitioners are finding that the practicum, which focuses on skill development, often does not provide time or space within the mentor teacher's schedule to address issues dealing with diversity; the diversity issues, such as curriculum that is challenged or supporting student identities. In addition, concerns have long been raised about the moral and ethical issues when children, often with the most needs, are subjected to novice teachers who often do not have the skills or confidence to address issues of racism and inequities (Carrington & Troyna, 2012; Hixon & So, 2009). Over three decades ago, Delpit (1992) pointed to the problem of teachers practicing on other people's children, which is traumatizing for students who may be dealing with issues of oppression, implicit bias, and racism from our teacher candidates. To address the need to build our future teachers' efficacy in supporting all students in the classroom and navigating the complexities of multiple stakeholders in a contentious environment, we sought out the use of a simulation approach where children would not be "practiced on", and our teacher candidates could make mistakes.

This paper aims to share the power of an online simulation that is decision-based and used to engage elementary and middle school future educators in addressing the complexities of a challenged book. This online simulation effectively provides a space for emotionally laden and sometimes contentious discussions around diversity and provides a rich sociocultural context intended to build candidates' thinking, efficacy, content knowledge, and problem-solving skills. In the next sections, we will provide a short background on the literature regarding the use of simulations, then turn to online simulation and our experiences using it over the last few years.

Literature review

Teacher education institutions worldwide are beginning to recognize the benefits of simulations and are incorporating them into their curricula. They provide spaces for teacher candidates to practice teaching skills and some to examine challenging topics within a simulated context (Kaufman & Ireland, 2016). For example, studies in Australia and New Zealand have highlighted the benefits of virtual reality simulations in helping pre-service teachers develop their classroom management skills and enhance their professional experience (Ryall et al., 2021). Similarly, European institutions are integrating simulations into teacher education with encouraging results (Goldsman, 2010). In North America, current simulations using virtual reality computer technology and video gaming have been effective in raising teacher candidates' efficacy regarding certain tasks, such as classroom management (Bautista & Boone, 2015), student-teacher interactions, and teacher-parent interactions (Mursion, 2021) and teacher preparation such as Quest2teach, a suite of game infused learning experiences for pre-service teachers. In terms of addressing the needs of various clients, various fields, such as nursing, have been using different types of simulations to increase knowledge regarding the use of an "equity lens" that informs how to apply nursing skills to patients from varied racial and cultural backgrounds (i.e., Buchanan & O'Connor, 2020) and even with particular genders (Tyerman et al., 2021). Unlike the focus of this best practice example, these simulations often use avatars or actors and focus on specific targeted skills. For example, in a recent study by Chen et al. (2021), a mixed reality approach that used avatars for the online simulation was used to help geoscience faculty increase their knowledge and efficacy regarding infusing a more inclusive environment and content in their courses.

Though these efforts are lauded for helping the field to examine the power of simulations to address issues surrounding diversity, equity, and their ability to increase efficacy in terms of skill development and awareness (i.e., Chen et al., 2021) they often lack a deeper immersive and complex context that requires preservice teachers to engage address multiple stakeholders and competing priorities. In addition, Sternberg et al. (2007) found that many teachers do not even understand the importance of sociocultural differences among students and do not possess practical knowledge to enhance their students' academic achievement from diverse socio-cultural backgrounds. Also, research has revealed that teacher education institutions do not often embed content or experiences that help candidates address issues of bias and critical thinking regarding institutional structures that reinforce inequitable schooling (Marchitello & Trinidad, 2019). The need for a more immersive online simulation that addresses these concerns led us to the current online simulation that we have been using for two years.

The next section describes the creation of the simulation and our collaboration with Schoolsims and then the specific simulation that we have been using for the past three years. We will end with learnings and suggestions for those using such simulations to engage in discussions on diversity within elementary and middle schools.

Overview of the simulation

The genesis of the simulation began with undergraduate researchers who were developing problem-based learning modules to foster learning about diversity-related issues in the elementary classroom. With the student's permission, the two faculty expanded the story greatly and collaborated with the company Schoolsim to house it on their online domain. The online system uses a decision tree structure to move the teacher candidates through the story. Candidates make choices that then move them through various situations. There are no avatars, but rather, actors were used to create the videos and narrations that help the story come alive. As candidates engage in the simulation, once they make a choice, they must move ahead to the next situation and decision, just as one does in life. When the candidates reach the end of the story, they will receive a report that chronicles the decisions they made and suggestions that were developed by the teacher educators. Candidates can engage in the simulation as many times as they would like. Throughout the simulation, candidates engage with varying stakeholders who, including families, students, administrators, community members, and colleagues. Depending on the choices that are made, you encounter particular individuals and groups as well as their responses to the decisions made. Below is the overview of the simulation platform.

> SchoolSims is an innovative educational platform that offers immersive, video-based simulations in a choose-your-own-adventure format. . . . participants enter a virtual world of education where they face a series of linked scenarios, each presenting them with critical decisions and challenges. These simulations are powered by artificial intelligence, guiding participants down different paths based on their choices and showcasing the consequences of their actions realistically and interactively. (https://schoolsims.com/product/).

The overall goal of the simulation, *Building inclusive classrooms: Defending challenged books*, is to help candidates foster an inclusive environment in the elementary and middle-level classroom. Gender diversity is often missing from teacher education coursework and rarely discussed in these settings (Gorski et al., 2013). This 'hard topic,' due to its developmental nature in schooling and the emotions and politics surrounding it, provides an excellent example of the potential power of simulations to help candidates think through how to support all families in their elementary classrooms. This simulation is based on books that are challenged in the United States due to their connections and content regarding diverse family structures. The early childhood book *And tango make three,* by Peter Parnell and Justine Richardson, and the upper elementary-middle school book *George* by Alex Gino, now titled *Melissa*, have been consistently challenged in school districts.

Simulations can provide safe spaces for mistake-making and engagement in deeply analyzing emotionally laden topics, such as supporting students and families within the Lesbian, Gay, Bisexual, Transgender, Queer, Intersect, Asexual collectivity (LGBTQIA+) school context and curriculum. The learning is achieved by allowing users to consider options, make mistakes, and draw conclusions from experience. In the case of this sim, participants examine how to expand the curriculum that validates students' lived experiences and build allies within their community to advocate for their students. Therefore, a simulation's overall goal is not to provide participants with a recipe for addressing decisions in the classroom and school but to examine and fully understand that we have various decisions to make, which have consequences for perpetuating systemic inequalities as harming students.

The simulation scenario

In this simulation, *Building inclusive classrooms: Defending challenged books*, on the Schoolsim website, a narrator sets the scene of you being a 3rd- or 6th-grade teacher who is promoting reading in your class by asking your class to read 1,000 books by the end of the year. To foster reading, you have had your class do 30-second commercials on a book they read to encourage other students to read it. These are posted weekly on the class website, which is available for you to view. The story begins with a phone call about one of these videos of a book commercial, either *And tango makes three* (in the 3rd-grade sim) or *George* by Alex Gino (in the 6th-grade simulated story). The message does not reveal the concerns at that time. Your first decision of which you will have four choices are to either call immediately, text the parent, call on the weekend, or wait until Monday. Though seemingly inconsequential, this decision can set up the next series of events. Based on the decision you choose, the simulation takes you to the next part of the story. The story continues in this fashion, with you choosing an option out of four to five at each decision point. The simulation is designed to embody some key decision points and factors for you to weigh. There are over seven decision points that have various outcomes depending on what you choose. These include balancing parents' concerns while supporting students and dealing with the administration and school board while helping students advocate for their interests. Each point also brings in different stakeholders, depending on your previous choice, that includes other parents, the students involved, the librarian, and administrators. You cannot reverse any decision but must move forward. Each decision can have consequences in terms of impact on students, colleagues, and families. In addition, you must deal with competing priorities, actions, and decisions that seem to be simultaneously amidst busy teaching days. For example, whose phone calls do I respond to first? When do I bring in my principal? How do I deal with any weekend fallout as parents talk amongst themselves? How do I support students who may have heard about the books or issues through families? Peers? Do I understand all the opinions regarding book contents and the LGBTQIA+ community?

Though actors are not playing avatars, the emotions surrounding the situations that emerge are communicated through the tone in the video clips representing various stakeholder perspectives, as well as any written text.

The following sections will point to how the simulation has been used and the three opportunities the use of the simulation has provided to teacher educators and their students. These include creating spaces for difficult discussions, making mistakes, and engaging with educational issues within a complex set of circumstances, relationships, and contexts. The next section first discusses the ways teacher educators have used the simulation.

Simulation use

Teacher educators and their candidates have engaged with the simulations in multiple ways. For example, some faculty have candidates engage in homework where they individually participate and then reflect. In contrast, other faculty will have a whole class engage as a community through the simulation or a combination of both. In whatever way candidates engage, the teacher educators have been able to embed the experience within their curricula, connecting to various topics and themes. Three predominant strengths emerge in using the simulations in all these variations. One, the simulations create spaces for difficult discussions and serve as a vehicle to assist teacher educators in teaching this "hot" topic. Two, it provides candidates with a safe space to make mistakes as they struggle with the messiness of schools' sociocultural context embedded in communities. Moreover, it requires candidates to address the needs of multiple stakeholders with competing agendas and needs, thus increasing an understanding that there are not often right or wrong answers, just better decisions informed by the school's sociocultural context. We explore these three foci in depth in the next section.

Creating spaces for difficult discussions

Addressing complex or controversial topics when planned can be challenging for teachers and, more so, for novice teachers. However, when these conflicts arise unexpectedly, anxiety, avoidance, and fear emerge, making it difficult to deal effectively with the situation (Caser et al., 2021). There is this fear of potentially causing harm by making 'mistakes' with their decisions and actions. The simulations provide a space of safety in that candidates can make 'mistakes' and redo the simulation multiple times. Also, candidates know that they are not possibly harming students, families, or colleagues as they work through these situations. The candidates and novice teachers can make various decisions, some better than others, to address the situation without harming children, breaking relationships with colleagues in the school, or harming a relationship with an administrator or family.

This online space allows our candidates to put themselves in a sticky situation that raises anxiety and often confusion. They must deal with the competing perspectives of one parent, Kate, who wants to limit access to books connected with LGBTQIA+, and Angela, who wants students to engage. Candidates may not be comfortable discussing the topic of LGBTQIA+, as well as what they believe. The strength of the online simulation is that candidates can engage in private spaces and with their peers in a safe context; this allows, especially candidates outside of the LGBTQIA+ community, opportunities to feel it is okay to be confused and to 'make mistakes.' At the onset of the simulation, candidates can engage with the various educational resources before engaging with the scenario. Providing private spaces increases engagement with the topic and a feeling of safety.

The other safe space is for the teachers' educator, who may not feel comfortable addressing topics such as LGBTQIA+ identities or curricular materials. Using the simulation can divert or shift the topics away from the personal beliefs of the instructor to the content within the simulation. Fear of sharing one's beliefs on challenging topics can derail discussions and engagement within the teacher educator's classroom. One of the first activities is that candidates must self-assess their feelings and comfort level in dealing with the situation. This provides a beautiful opportunity to talk about the fear, anxiety, and challenges of addressing conflicts in your classroom community and among your future families. In addition, conversations arise regarding their knowledge base and comfort in addressing books dealing with LGBTQ content.

The simulation provides a way to deflect from the personal embarrassment candidates and their teacher educators may feel in not knowing terms or the topic. In the initial pages, candidates can privately educate themselves about terms and other issues with the suggested links. This allows them to come to the class with some knowledge. The same goes for the teacher educator, who may feel uncomfortable or knowledgeable. The simulation provides a facilitator guide and background information in preparation for a discussion. Examining this privately allows teacher educators to prepare and "save face" in front of their candidates. It also provides opportunities for teacher educators who may not know how or be uncomfortable addressing LGBTQI identities using the simulation to guide the discussion.

Moreover, the facilitator guide will provide the teacher educators with ways to consider their context regarding political, emotional, complex, and hot topics. The facilitator guide provides questions at critical points. Not all of these are regarding identity issues, but they involve several topics, such as family relationships and building relationships with colleagues.

Another safety point is for the live children in a practicum or student teaching placement. Such discussions in a space where the children are absent provide candidates and teachers a space to share confusion, concerns, and responses. There is no mistake-making at this point on children but thinking ahead of the situation(s) that may occur. Because of this safe space, candidates can make mistakes, which will be discussed further in the next section.

Making mistakes

Schools are complex environments where teachers must navigate and use their emotional intelligence, professional dispositions, and educational skills. Novice educators or teacher candidates only sometimes have accountability for decisions regarding hot topics, such as a challenged book. The focus is often on skill development, particularly in practice and student teaching. In addition, classrooms and learning take place in complex settings. These complexities may be missed in a practicum or even student teaching due to those situations controlled and essentialized nature. In addition, they have a protective net from experienced teachers and mentors, as they should in these situations. They also will not take risks in addressing complex topics, as their success in student teaching and practica is critical to subsequent graduation and certification as a teacher. A struggle for novice teachers is being able to examine the complexities of the sociocultural context of the classroom. In the simulation, they can take those risks without harming anyone. They have 'accountability' with their decisions as they can see where it leads them next.

As novices who have never had to deal with administration, colleagues, or families on these topics or even in situations where there is conflict, they get to play out the impact of their decisions. This is remarkably freeing as they do not directly impact real children or colleagues as they progress through the simulation. They can essentially try out various decisions and see their impact. It is emphasized that there is no one right answer, though given the context of the situation, state politics, and school procedures, there may be better decisions than others. This is particularly important given the diversity of contexts across the United States and district responses to such situations. To support candidate learning at the end of the simulation, each user is provided an overview of their decisions with feedback. The feedback raises points to consider regarding the decision that was made, prompting reflection. One of the teacher educators remarked, "I also loved the feedback form at the end of the experience. What a great conversation starter to use in our courses. Also, I see these leading to discussions on what else could be done. Or what would you do differently? Why?" (AC). The following section focuses on the power of examining decisions within a complex set of relationships, realities, and perspectives.

Engaging issues within a complex set of circumstances, relationships, and consequences

Due to the complex nature of the classroom and school context, teachers must navigate multiple needs daily, read various situations, and respond in the best ways possible. As a teacher, we try to anticipate, but issues can emerge as families, students, and administrators react to a decision that was made with unexpected consequences. Depending on how the teacher addresses the issue, it can be even more controversial and contentious (Casar et al., 2021). Due to the nature of practice and the student teaching experience, candidates often focus more on teaching skills and practicalities than the nuanced environment and sets of relationships. So sometimes, in the complex system within a classroom, something that seems inconsequential can become a significant, thorny issue in the classroom. For example, in this simulation, a simple assignment of having your students record 30-second commercials about a book they read to encourage others turns into a hot topic, as one of the books and its related commercial is requested to be removed from the website. The candidate must wrestle with how to respond. Should they immediately take the commercial down? What does that communicate to the students, their families, and other students if they do? Should you stop the book challenge overall or just the assignment? Is this a single situation? Who should be involved in this decision with this issue when the book comes from the library? The simulation provides a space to reflect and respond to competing perspectives and potential consequences.

For example, Decision Point 1: Initial response to the incident. For novice teachers or teacher candidates, this type of situation, when quick decisions are required, can increase anxiety and stress. This first decision provides an opportunity to discuss 'what should I do first' and then what might be the implications. This is also an excellent opportunity to help teacher candidates look at the priority of safety, order, and learning. We begin with the candidate checking in on how they feel about the situation. This provides a beautiful opportunity regarding novice stress in addressing complex situations.

Another decision point after this one is how to address the competing perspectives of the two parents. In several decision points, you need to decide whom to call first and how to deal with the different perspectives on the situation. One parent, Kate, wants the commercial taken down and possibly have library books on LGBTQIA+ put in a particular section, while other stakeholders believe that families and their students should have access to these books. Later, the parents' students become aware of the conflict and express confusion. You must decide among these stakeholders whom to address when, how, and what related implications from the administrative level. You have to wrestle with multiple perspectives and potential impact on what you communicate to students about books and hot topics and address the concerns of your class families. Having these multiple stakeholders, possible implications, and competing perspectives provides you with opportunities to wrestle with such hot topics in a safe space. The simulation provides opportunities for candidates to engage or discuss these topics within a classroom environment privately. Teacher educators can facilitate multiple discussions, including curricular decisions, family relations, organizational priorities, one's own beliefs and ethics, and others.

At each decision point, candidates must decide how to address or respond to a previous decision. Often, these are in relationship to their colleagues, students, and administrators. By basing these decisions within a broader context, they will experience how one's decisions do not occur singularly and in an isolated context. Often, this is the way in our courses because of the nature of discussing possible actions I might take. In the simulation, the candidate is provided with a response to their decision, thus simulating the emotions and even confusion that can emerge as they engage in real-

time decision-making. The decision's contextualization and simulated reality are critical to building a more ecological framework for teachers' work.

The discussions help candidates to see in their context what would be a typical approach, as well as some issues that can arise that open the door to support students who are reading about this topic or are members or allies of the LGBTQIA+ community. Though teachers in the classroom do not want to address pedagogically controversial topics, there is research on the challenges associated with hot topics that emerge. When doing this, the candidates must examine the issues as they emerge within a provided context.

Conclusions and recommendations

Overall, simulations can provide safe spaces for candidates to examine complex and contentious topics and experiment with decision-making in ways that do not harm themselves or the students. Faculty can also build curricular pieces that support the rich learning available in a simulation. We have found that the simulation provides teacher educators with a 'ready-made' learning opportunity to facilitate discussions based on the simulation. The simulation supports teacher educators who need to be more comfortable or knowledgeable. It also provides a safe space for our candidates to examine these topics. Candidates have appreciated the realistic nature of the simulation and the messiness they may face in their future classrooms. One key learning has been how and when to use the simulation. Some have found that full class discussions reap many rewards in learning as the class struggles through decision points. At the same time, other teacher educators and their students have appreciated first individually engaging and then discussing the simulation and individual responses. In any of the approaches, the candidates will benefit if the simulation is embedded purposefully into the course and includes reflection and discussion. Furthermore, it provides candidates with resources.

Overall, there are particular strengths that are especially aligned with preparing teachers to address complex and challenging issues in the school environment. Below is a list of five.

1. Preservice teachers can play the simulation repeatedly, making different choices each time. This helps them understand the consequences of their choices.

2. A friendly environment provides safety, which improves engagement, knowledge retention, and efficacy. In the real world, mistakes can have serious consequences. However, in a simulation, teacher candidates can make mistakes without real-world consequences. This safe space for error allows candidates to learn from their mistakes and improve their teaching strategies. It helps them engage more fully in the learning process, retain the knowledge they've gained, and improve their teaching efficacy.

3. Conversations compel learners to understand not just the 'how' but also the 'why' and often reveal hidden biases and uncover areas of improvement. The discussions foster deeper understanding and self-reflection. Participants don't just learn how to do something but also why they're doing it. For example, a teacher candidate may realize, through discussions, that they have a bias towards a certain teaching style, which may not suit all students.

4. Simulations provide opportunities to wrestle with school policies and relationships with families, students, colleagues, and administration. They can be designed to mimic the complexity of real-life educational contexts.

5. The 'messiness' that is more the reality of teaching than the simple steps to addressing every situation: Real-life teaching involves complex challenges that can't be solved with a one-size-fits-all approach. Simulations can mimic this 'messiness' by presenting teacher candidates with nuanced, complex situations that require careful thought and decision-making.

Despite the noted benefits, implementing simulations in teacher education is not without its challenges. These include technological barriers, costs, time investment for training, and resistance from stakeholders. Solutions may involve securing funding sources, conducting professional development for educators in effectively using and integrating simulations, and fostering a culture that supports technological innovation in teacher education. Beyond these challenges, the pedagogical design of simulations must also be considered. To support the development of socio-cultural consciousness among teacher candidates, simulations should authentically represent diverse learning contexts and student identities. This requires collaboration between simulation designers, teacher educators, and cultural competency experts. Furthermore, it is critical that such simulations not only expose teacher candidates to diverse contexts but also foster critical reflection and discussion about the decisions they make within the simulation. The Schoolsim decision-based simulation that we use provides a rich, story-based context that mirrors an actual situation with decisions and related consequences that reflect the ways that schools in the United States react. Simulations embedded in a particular sociocultural context can provide safe spaces for candidates to wrestle with the relationship between their actions and decisions, student learning, community building, and addressing difficult topics in their teaching.

Looking ahead

As technology advances, the potential for simulation-based teacher education grows. For example, the emergence of artificial intelligence (AI) can further enhance the realism and personalization of simulations. In the near future, simulations could adapt to users' responses, offering a highly individualized and responsive learning environment. Moreover, research on the long-term impact of simulations

on teacher candidates' skills and efficacy, particularly their ability to address various contentious situations in their classrooms, is needed to inform the continued evolution of simulation use in teacher education.

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Understanding law through simulated learning – A study of student perceptions of mooting

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Abstract

Mooting (also referred to as "moot court") is a type of mock courtroom exercise that takes place in many law schools. In 2018-19, for the purposes of completing a Professional Doctorate in Law at Northumbria University, I organised a series of moots among student research participants and interviewed them about their experience of mooting. The purpose of this was to understand, through the lens of experiential learning theory, from the perspective of the student participants, what is involved in preparing for, participating in, and receiving feedback after a moot; the differing perceptions of students involved in a moot experience, and to analyse the learning experience of the students taking part in the moots. This article is a summary of the research that I undertook, what I learned from it, and how the experience of that research can inform further development of teaching and learning.

Introduction

Before commencing this study, I had formed preliminary views, based upon my experience of working with student mooters during inter-mural and inter-varsity moot events, and particularly in observing the development of student mooters throughout their involvement in the latter events, that mooting is capable of being not just an enjoyable extra-curricular activity or a way to develop practical skills, but a valuable method of learning substantive law. These views were based principally upon the many comments that I had received from student mooters to the effect that they believed themselves to have acquired, as a result of their preparation for and performance in the moot, a greater understanding of the substantive law involved in the moot problem than they had believed to be the case for them beforehand. My intention behind this study, therefore, was to answer the question of *how students' experiences of, and approaches to mooting affect their learning of substantive law and understanding of the law*. To begin to do this, it is necessary to understand how mooting has played, and still does play, a role in legal education.

The origins and development of mooting in legal education

The first recorded moots took place in the Inns of Court and Chancery, which are believed to originate in 1292, following a writ issued in that year to authorise attendance at court by "a certain number, from every county, of the better, worthier, and more promising students" (Jacobs, 1936, p. 71). In the Inns of Chancery, students would become familiar with the basic procedures of oral pleadings for initiating and defending cases in court. In the Inns of Court, more advanced courtroom techniques were taught, along with tuition designed to equip the students with "a detailed knowledge of English law". Both involved an expectation that students attend the nearby courts, "readings" (a combination of lectures and seminars), and moots (Jacobs, 1936, pp. 57-58). The four Inns of Court (Gray's Inn, Lincoln's Inn, Middle Temple, and Inner Temple) all still exist and remain the only entities authorised to admit (or "call") practising barristers, but none of the ten (Baker, 2003, p. 453) Inns of Chancery survive.

The origin of the moot system is unclear, but it has been suggested (Walsh, 1899, p. 417) that it arose out of the system of "disputations" held in universities before the establishment of the Inns. One of the meanings of the term "to moot" at that time referred to pleading a case in court (Baker & Thorne, 1989, p. xlix), and a moot took the form of a mock legal dispute arising out of a fictitious legal problem, contested between two pairings of two students, with one pairing representing either side of the dispute (Brand, 1992, p. 58).

The practice of such exercises comprised the barristers' training and took approximately ten to twelve years (Brand, 1992, p. 58). Mooting was an essential part of a barrister's qualification (Prest, 1967, p. 310) and regarded as fundamental to the acquisition of legal understanding necessary to practise law: Thomas Wilson (writing in 1553) stated that he had "knowne divers that by familiar talking, & moutyng together have come to right good learning without any great booke skil" (Wilson, 1553, p. 38). However, by the seventeenth century, these exercises came to be of decreasing importance, in favour of study based upon "the proliferation of printed texts" (Prest, 1967, p. 313) that were by then available to those seeking to learn the law. The exercises continued to be practised, but by the mid-eighteenth century, they "had dwindled away" to "meaningless forms" (Holdsworth, 1972, Volume XII p. 79).

In light of concerns for the future of the legal system and the safety of the public generally, in 1846, a House of Commons Select Committee recommended that universities should teach and award degrees in English law (Select Committee on Legal Education, 1846, p. xlvii), which should be distinct from the routes to professional qualification administered by the Inns of Court and (for solicitors) the Law Society law (Select Committee on Legal Education, 1846, p. lxi). However, students still had the option of qualifying as barristers by attending lectures only until 1871, at which point the Inns Council of Legal Education made examinations a compulsory assessment for qualification as a barrister (Gower, 1950, p. 141).

Amid this reform, the moot system remained neglected. It was noted that while "interesting evidence upon the point" was given, mooting "received scant notice amidst the numerous larger issues which were dealt with in [the Select Committee's] reports (Walsh, 1899, p. 420). At the end of the nineteenth century, the programme of moots organised by the Gray's Inn Moot Society was the only known attempt to carry on the moot tradition at the Inns of Court: a state of affairs that the Society's Secretary lamented, writing that "learning, however profound, is, in the law above all places, of little avail without an equivalent of readiness and skill in application" and that the demise of the moot system was evidence that "pure book-learning" had been "made a fetish" which "in the law everything is sacrificed to" (Walsh, 1899, p. 425). Despite adjurations (Walsh, 1899, p. 424; Pollock, 1903, pp. 259-260) that the moot system becomes a compulsory part of English legal education, it would re-enter English legal education in a form adopted from the legal education system in the United States of America. There, a tradition of competitive mooting, originally administered by universities, but from 1870 organised by student-administered "clubs", had begun to thrive (Walsh, 1899, p. 421). English universities, in fact, adapted to this before the Inns, mooting having been conducted at the University of Cambridge before 1889 (Pollock, 1889, p. 227), and similar initiatives were taken up by student-run societies at other universities (Bathurst, 1943, p. 11). These were enthusiastically received, and by 1950, it had been observed that "[g]enerations of London law students will testify to the value they derived" (Gower, 1950, p. 189) from the moots organised by the University of London's college law societies. Elsewhere, the first inter-university moot court competition opened to English universities, the Philip C. Jessup International Law Moot Court Competition, commenced in 1960 (Brown, 1978, p. 333).

There has since been an "explosion" (Dickerson, 2000, p. 1224) of inter-university moot court competitions, with more than twenty competitions open to students (*Get*

Mooting: Rundown of Competitions, 2023). At the university level, research in 2005 found that 93% of the participating universities involved their students in mooting, with 60% stating that mooting formed part of their curriculum (Gillespie & Watt, 2006). This slow realisation of the ambition set out by Walsh and Pollock has been described as "the rediscovery of an ancient treasure of legal education" (Snape & Watt, 2010, p. 13).

Recognised benefits of mooting include the opportunities for student participants to improve their ability to research and to recognise the importance of working well as part of a team. The latter has been recognised as a matter often given insufficient attention by a legal education system that emphasises individual achievements and encourages competition on this basis (Finneran, 2017, pp. 126-127). Additionally, mooting has been described as "a specific form of simulation which enables students to practise and develop a range of skills" (Wolski, 2009, p. 46), those being the need for students to manage their time effectively. In doing so, preparing them for the pressures that practising lawyers are subjected to (Dickerson, 2000, pp. 1217-1218) and creating an environment which will require law graduates to be confident and resilient in order to thrive (Parsons, 2016, p. 14); (Parsons, 2018, pp. 12-17). Moreover, the enhanced confidence and improved analytical skills, as well as improvements in students' written and oral communication skills and their ability to "think on their feet" (Dickerson, 2000, pp. 1217-1218), have been noted as transferrable attributes making involvement in moots advantageous to students seeking any employment (Dickerson, 2000, pp. 1226-1227). This is particularly important when applying to be a pupil barrister, in relation to which it has been stated that "there can be no excuse for getting to a pupillage interview without having done a moot" (Kramer, 2007, p. 89).

Other acknowledged benefits of mooting include "the thrill or rush of competition", improvements to self-confidence (Ringel, 2004, p. 460), the opportunity to analyse and synthesise points of law arising out of the case law researched and to devote a degree of time to doing this that the time constraints of "normal classroom" instruction precludes, which has been described as "a skill critical to lawyers", and "something which we in the classroom increasingly deny our students" (Gaubatz, 1981, pp. 88-89). The ability to do this and to then express a clear oral or written understanding of "what may be very complex legal material", which mooting "nurtures", has been described as lying "at the heart of [lawyers'] skills as lawyers" (Snape & Watt, 2010, p. 13).

The moot system has long been criticised for lacking realism insofar as the moot court environment does not sufficiently resemble a real court hearing, resulting in "an obviously artificial make-believe air" (Blatt, 1936, p. 417) or more damningly, "a mere game" (Gaubatz, 1981, p. 87). This particular criticism has its source in part in the moot problems that students are required to base their submissions upon, which are often by their nature outlandishly unrealistic in substance (Gaubatz, 1981, p. 87), as well as in their plain setting-out of the facts of the moot case, which has been described as potentially causing students to believe incorrectly that "facts in real life are defined, concrete, and knowable rather than uncertain, slippery and complex" (Wolski, 2009, p. 55). Thus, it fails to appreciate the demands involved in real case preparation, where the facts are far from clear (Gaubatz, 1981, p. 88) or may be "missing" (Wolski, 2009, p. 56) and in relation to which the outcome of "most appellate cases turn" (Kozinski, 1997, p. 189). Also, the fact that moot preparation requires students to focus solely upon points of law has been criticised as an inaccurate representation of real appeal court procedure, in that such proceedings invariably involve procedural issues that are not addressed within personal lives in helping them come to terms with those problems rather than risk an adverse effect to their careers (Hernandez, 1998, p. 78).

Many of these criticisms are more likely to arise because of the way that a particular university organises its mooting programme, rather than mooting itself, and can be resolved by a well-planned and implemented programme of study and "full, enthusiastic support" from the academic staff involved (Hernandez, 1998, p. 89). As such, mooting has much potential to be used in legal education not just as a vehicle for skills training or as a "fun" activity (Gillespie, 2007, p. 21) but as a method of teaching substantive law.

Literature review and theoretical framework

Mooting as experiential learning

The nature of mooting as a method of education has been explained as a form of experiential learning insofar as it relies upon the performance of an experience, followed by reflection and improvement (Wolski, 2009, pp. 51-52). The most influential exponent (Burridge, 2002, p. 30) of the theory of experiential learning is David A. Kolb, who describes experiential learning as "the process whereby knowledge is created by the transformation of experience" (Kolb, 2015, p. 49). A key characteristic of this theory relates to the distinction between "apprehension" and "comprehension" (Kolb, 2015, pp. 69-77), the former concept being the appreciation of an experience, while the latter being the ability to "create for [one]self and communicate to others a model of that situation that could last forever" (Kolb, 2015, p. 69). Knowledge as such is conceptualised as a spiral, whereby a learner reflects upon their experience and uses that reflection to transform and develop not just their understanding of the subject that they are learning but the world that they have constructed as an environment in which to learn (Kolb, 2015, pp. 63-65). The research involved in my study of mooting is underpinned by the theoretical understanding of experiential learning as constructed by Kolb and informed by Kolb's theories when attempting to understand the role of mooting as a method whereby learning by experience occurs in legal education.

Kolb's conception of the process whereby a person learns by experience relies upon his theory that such a process is determined by the "form of learning" (Kolb, 2015, pp. 100-101) that an individual will make use of, as well as the "learning mode" used by the individual to deploy that form. Kolb states that the identification of these factors can be used to determine the "learning style" that best suits an individual.

The concept of experiential learning, as defined by Kolb, propounds a mode of education whereby the educator sets in motion conditions that enable the learner to access a "life space" within a "system in tension" by way of which the learner can translate the conditions that they are experiencing into knowledge. The conditions under which this knowledge has been acquired by the learner allow it to endure and ensure a more meaningful effect upon the learner than the knowledge that has been acquired by way of "segregated learning" (Dewey, 1933, p. 48).

A review of empirical studies on mooting

My review of the literature that this study was devised to contribute to take as its starting point the structure suggested by Golden-Biddle and Locke (1997). The gaps evident in this sub-category of literature (Billings, 2017; Boylan-Kemp, 2013; Daly & Higgins, 2010; Gerber & Castan, 2012; Gillespie, 2007; Kammerer, 2018; Kammerer, 2020; Keyes & Whincop, 1997; Krupová et al., 2013; Lynch, 1996; Marsh & Ramsden, 2015; Turner et al., 2018; Watson & Klaaren, 2002) can be demonstrated by reference to the terms used by Golden-Biddle and Locke in describing how a reviewer can complete the tasks of "Constructing Intertextual Coherence" (Golden-Biddle & Locke, 1997, p. 26), and "Problematizing the Situation" (Golden-Biddle & Locke, 1997, p. 35).

The literature is "linked by disagreement" (Golden-Biddle & Locke, 1997, p. 33) as to the most suitable application of mooting in legal education. The conclusions to the articles reviewed differ greatly on this point, including proposals that mooting be mandated as part of compulsory study and assessment (Boylan-Kemp, 2013), that it ought to be integrated into the teaching of substantive law as a means for providing formative feedback (Keyes & Whincop, 1997; Gillespie, 2007); that it is best situated as part of a separate skills-based module (Turner et al., 2018); that it is particularly beneficial if it forms part of a voluntary inter-varsity competition (Gerber & Castan, 2012; Billings, 2017), and that it provides no real educational benefit at all (Watson & Klaaren, 2002).

The literature is "inadequate" (Golden-Biddle & Locke, 1997, p. 37) in that it does not address the specific experience of mooting by first-year law students, particularly those at English universities, in the context of their other learning experiences. It is also insufficiently underpinned by an understanding of experiential learning theory. This inadequacy is apparent when reviewing the literature in light of the observations on this subject in what appears to be the first published empirical study of mooting (Lynch, 1996, pp. 78-79). In that study, Lynch recognises that mooting is a form of experiential learning and refers to Kolb's Experiential Learning Cycle in order to help understand the process of learning that can take place in a moot. This demonstrates a gap in research into mooting that demands further investigation by applying Kolb's theoretical framework to the practice of mooting. Such a gap is emphasised by Lynch's subsequent comment that "there is very little written on the learning benefit of mooting" (Lynch, 1996, p. 92). However, none of the subsequent studies cited above have involved any such investigation. Indeed, very few of these studies address experiential learning theory in any meaningful sense, and some do not mention it at all.

The literature is "incomplete" (Golden-Biddle & Locke, 1997, pp. 36-37). The literature does not contain qualitative research focussing upon the learning experiences of the individual students who took part in the moots that form the basis for the research. Although the quantitative methods deployed in the studies reviewed may have been satisfactory to answer the questions set therein, more focussed qualitative research is necessary in order to fully understand and appreciate the nature of, and issues involved in, the student learning experience.

Having reviewed the extant literature that my study was intended to make a contribution towards, I formulated the tentative proposal that students perceive participation in mooting to be beneficial towards their understanding of the law. The method and methodology that I used to conduct the study are set out below.

Research method and methodology

My study was underpinned by a constructivist epistemology. This holds that *"the "facts" themselves* upon which knowledge" is determined are in themselves the result of perspective (Schwandt, 2017, p. 125). My experience of teaching students and judging moots, and of observing the wildly different layers of meaning attributed by students to the same source material, has come to lead me to view with scepticism the contrary position of positivism, which holds that what is posited is the same as that which is observed (Crotty, 1998, p. 20). Rather, as it has been noted (Cunliffe, 2003, p. 988), the radical differences between meanings, combined with the interpretation of the teacher/observer of those perceived meanings, constitutes a distinct "reality" constructed "intersubjectively", which a reflexive researcher must recognise and interpret in turn.

To collect data for this study, I chose to conduct a series of focused interviews with moot participants. I intended to select a group of between six and twelve students, all in their first year of study. I chose to interview students from this particular group on the basis that the phenomenon under investigation concerns the experience of learning from the perspective of students who were new to the higher education system, and therefore, less likely to have developed their own approach to learning the subjects taught in higher education than might have been the case for more experienced students.

My intention was to collect data following an initial moot, which would be revisited after the students had taken part in a second moot and then again when they had mooted a third time. In this way, the extent to which the students' involvement in mooting informed and made an impact upon their studies could be tracked throughout the course of the year. Following my judging of each moot, I provided each group of students with feedback on their performance based on the notes that I took and my contemporaneous recollections of what had happened during the moot.

The interviews deployed an interview guide process. The nature of an interview guide is such as to set out suggested areas for inquiry, as opposed to rigidly scripted questions. I recognised the risk of curtailing the respondents' self-explorations and bringing about an abrupt break in the interview by "forcing a topic" or "cleav[ing] too closely" to the interview guide, and that when using the interview guide method, the interviewer should be primarily oriented towards the implications of the remarks made by the respondent, in reply to which questions can be improvised (Merton et al., 1956, p. 554).

During the interviews, I asked a question (e.g.: "Please tell me about your experience of mooting and how you feel it compares to other ways of learning about the law") that introduced the topic and then encouraged the interviewees to speak freely one by one about their experiences (Pedersen et al., 2016, p. 633). I intervened where necessary with the objective of developing a scaffolded narrative on the interviewees' experience of mooting within the context of their study of law, and in order to maintain the focus of the interview upon a constructivist approach to legal education to avoid discussion of positivist theory (e.g.: "finding" the law, etc.), explicitly signposting if necessary the constructivist nature of the study to the students taking part as the studies are repeated. In doing so, I took care to strike a balance between a reflexivist approach to an interview based on my own theoretical perspective and stifling interviewee responses. This approach was monitored during and after each interview (Gough, 2003).

I followed up these initial interviews by interviewing the students' seminar tutors using similarly phrased questions put to the criminal law seminar tutors for the students whom I had interviewed. This allowed for consideration of the value of the learning experience of mooting from the perspective of an expert in the subject of the experience, as well as for the application of a different perspective from the students' subjective opinion to gauge what (if any) benefit the student derived from this experience, to make for a richer set of data.

Data analysis methodology

I adopted the methodological approach of analytic induction to analyse the data collected. Analytic induction has been described as a methodological approach that interprets the social world in a way that reflects assumptions about an "equation" between the researcher, the research participant, and the "framework of science" (Manning, 1982, p. 275). It is a form of the inductive technique deployed to make statistical generalisations from a limited sample (for example, in opinion polls) – this has been referred to as "enumerative induction" (Manning, 1982, p. 277). Studies involving analytic induction (e.g.: Thomas & Znzniecki, 1927; Lindesmith, 1947; Cressey, 1953; Bloor, 1978) make use of a "judgement sample" to make "universal statements containing the essential features of a phenomenon" (Manning, 1982, p. 277).

In researching the student experience of mooting, I was particularly interested in identifying student perceptions of any essential features of mooting that may have an impact on the students' learning experiences, but not with a view to propounding that the perceptions of these particular students typify the learning experience for all students, as a positivist approach to analysing the data might attempt. For this reason, I considered analytic induction to be of particular relevance when analysing the data, as this method attempts to make statements of universal application about a phenomenon but not to propound that the characteristics of the phenomenon identified are "sufficient"; only that they are "essential" – in other words, that the statements derived may not apply equally to a different subject experiencing the same phenomenon due to differential characteristics (Robinson, 1951, p. 817).

The stages of the method that I used to conduct analytic induction of the data derived from this study are similar to that used by Bloor in his study of tonsillectomy practitioners (Bloor, 1978, p. 546, and are set out below.

1. Formulation of a provisional hypothesis based upon initial understanding of the phenomenon. Although some analytical induction studies have been premised on the aim of forming a new theory and therefore avoided reference to existing theories totally (Lindesmith, 1947, p. 7), the nature of the present study, along with my own experience of the subject under examination, precludes such "an open mind" (Manning, 1982, p. 291). For that reason, my provisional hypothesis, with respect to the effect of mooting on students' understanding of substantive law was that it allows for the development of their understanding of the law they are studying by facilitating the assimilation (Kolb, 2015, pp. 34-36) of substantive legal knowledge into a student's practical experience.

2. I coded the data from the student interviews using open coding (Cohen et al., 2011, p. 561) to generate a provisional list of characteristics common to the students' expressed perceptions.

3. The hypothesis was then re-examined in the light of the data gathered.

4. The "deviant cases" (i.e., characteristics that do not exemplify the hypothesis) were then examined in order to see whether the provisional list of characteristics could be modified to include the deviant cases or whether the hypothesis could be modified in order to discount the deviant cases.

5. The hypothesis was then reformulated and re-applied to the data until a final hypothesis could be arrived at.

6. That hypothesis was then triangulated (Bloor, 1978, p. 550) (where possible) by reference to the data obtained in the interviews with the students' tutors.

Analysis and discussion

The study took place in three phases, in which the student participants mooted and were then interviewed about their experiences.

The dominant theme in Phase One of the study (in which five students participated – I referred to these in my notes as "I1-I5") was that all the students involved perceived the moot experience to be very challenging, but that they perceived themselves to have benefitted from the experiences overall in ways and to degrees that vary dramatically between students, and which were influenced by variables relating to their own personal perceptions about law, learning generally, and the other participants in their moot. Also to be noted is that there are two interviewees whose interviews contained the most detailed discussions of the benefits that they considered to have obtained from the moot, as contrasted with other learning experiences. Both described themselves as having been heavily motivated to succeed in their law studies due to upsetting personal experiences.

Following these interviews, I attempted to triangulate the perceptions expressed by some of the students taking part in this phase of the study by way of reference to interviews with their Criminal Law seminar tutors. I was able to interview two seminar tutors, one of whom (T1) was the tutor for the Criminal Law seminar groups, of which I2 and I4 were members, and the other (T2) was the tutor for I3's seminar group. Both I2 and I3's seminar tutors state that these students appeared, based upon their participation in the seminar discussions, to have an adequate understanding of the law involved in the seminars. Representative comments included the observation that I2 "seems to have a good grasp of the law and how to approach it" (T1 interview (I2), 6th December 2018), and that I3 was "one of the stronger students in the group" (T2 interview, 10th December 2018). The tutors' bases for these perceptions appeared to be their observations of the contributions made by these students during the seminars, which both students' tutors described as accurate in substance and of benefit in progressing the seminar discussions.

These observations are relevant when considering the data relating to these students' comments about the relationship between the potential effect upon them of the moot experience, and their pre-moot understanding of the substantive law revealed in my interviews with them. I2's interview contained statements to the effect that he perceived himself to adequately understand the substantive criminal law. This perception appears to have been given credence by his seminar tutor's observations, thus reducing the possibility that the data arising out of his interview regarding this aspect of the moot experience may be misconceived. Similarly, I3's generally negative account of her moot experience might have been attributed to her own lack of legal understanding rather than to the issues that she describes in her interview. However, her tutor's observations serve to reduce the likelihood of such a possibility.

Conversely, the interview with I4's seminar tutor contained observations suggesting a lack of legal understanding with respect to fundamental points of law on the part of that student, a representative comment being that the tutor "was often having to…re-explain things…to her, because she did not seem to really get it particularly easily" (T1 interview (I4), 11th December 2018). In the tutor's opinion, I4's difficulties arose as a result of "not necessarily [of] the concept[s], but [of] the way things are framed" (T1 interview (I4), 11th December 2018). The tutor explained that "usually after a couple of re-framings she can get right there" (T1 interview (I4), 11th December 2018), and attributes I4's difficulties in this regard to a combination of English language difficulties, and unfamiliarity with the culture adopted in English university tuition, particularly the Socratic model adopted in seminars, as compared to by-rote learning. These observations accord with the student's own descriptions of her difficulties during the moot (I4 interview, 27th November 2018), as well as provide further insight into why the nature of the moot format may have presented an obstacle for I4.

I2 and I4's seminar tutor perceived both students' involvement in seminars to have been influenced by the approach adopted by the informal sub-group within their seminar group with which the students had chosen to situate themselves. In I2's case, the tutor describes this as having manifested itself in a reluctance to volunteer contributions to seminar discussions unless asked to do so (T1 interview (I2), 6th December 2018). In the case of I4, the tutor described I4's difficulties in understanding the content in the seminars as having been common to the other students in her seminar sub-group, all of whom the tutor stated were not British in origin, and none of whom the tutor regarded as "able to pull each other up" (T1 interview (I4), 11th December 2018). These observations accord with views expressed by I4 in her interview regarding the importance for her of working as a member of a group to prepare effectively for seminars, as well as her expressed perceptions (referred to above) in respect of the importance for her of being able to complete the work necessary for the moot as a member of a partnership.

These findings call for further consideration with respect to the importance of a suitable group working environment for mooting to best facilitate student learning. The findings are of particular interest when compared to the perceptions expressed in respect of I3's approach to seminars by the other seminar tutor interviewed. Unlike the other students to whom reference was made in the tutor interviews, I3's seminar tutor perceived her to be more ready to volunteer contributions than the other members of the seminar group, and recalls an occasion in which I3 had commented to her on the reluctance of the other seminar group members to participate in group discussions, in which she referred to the other group members as "they" (T2 interview, 10th December 2018), suggesting that she regarded herself as not part of, or as "other than" the other students in her seminar group. This apparent lack of congruity between effective seminar participation and group membership on the part of I3 should be contrasted with her own expressed perceptions about the moot, in which one of the reasons given for her negative impression of the moot experience was a failure to "click" with her partner.

Tutors were also asked to comment upon their perceptions of the degree of confidence that was displayed by the students when expressing their legal understanding in

seminars, and whether the tutors perceived there to have been any difference in this regard between the seminars that took place before the students had mooted, and those that took place after. Here, a range of differing perceptions were expressed. I2's tutor stated that there was no observable distinction between the degree of confidence evident in respect of I2 in his contributions throughout the course of the seminars. This might be contrasted with I2's own perception that he had increased in confidence after the moot; however, the tutor pointed out that "he may personally feel more confident" (T1 interview (I2), 6th December 2018), notwithstanding that any increased confidence was not, in her opinion, apparent from I2's contributions to seminars. I3's tutor, however, was of the view that I3 appeared to have increased in confidence, based upon her participation in more recent seminars. As tempting as it may be to attribute this increase in confidence to I3's moot participation (in contrast to her own perceptions, referred to above), her tutor was careful to point out that this increase in confidence was not more noticeable in I3's case than in that of the other students, all of whom she regarded as having "gradually grown in confidence" throughout the seminar cycle.

These perceptions make it difficult to attribute an increase in confidence in respect of legal understanding to moot participation. This is particularly the case when considering the perceptions of I4's seminar tutor in respect of this issue. I4's tutor stated that during the seminars that took place after the date of the moot, I4 had made significantly fewer contributions to the seminar discussions than those prior to the moot, but also that those contributions that she had made suggested a more accurate legal understanding than was present from her pre-moot seminar contributions (T1 interview (I4), 11th December 2018). This accords with I4's own observations in her interview as to the importance of adequate preparation in order to develop an accurate legal understanding and suggests an adaptation to her own learning style in order to accommodate this, a consequence of which is, in fact, less confidence in expressing views that may not be accurate.

Before considering the findings following the remaining phases of the study, it is necessary to apply the analytical, inductive method to determine whether it is necessary to revise the "provisional hypothesis" set out above. Having drawn together the above points in respect of Phase 1, it is apparent that that hypothesis (that participation in mooting helps students develop their understanding of the substantive law involved) does not adequately account for three out of the five students observed. It is therefore necessary to consider whether any of the students whose characteristics are not exemplified by the hypothesis can be discounted as being "deviant cases" and on what basis. At this stage, it is necessary to have regard to some characteristics that might be obvious as being associated with certain of the three non-exemplified students:

Gender

The fact that both I3 and I4 were female gives rise to considerations of what barriers may exist for female students with regard to mooting, this being a system of legal training devised to train barristers at a time when only men were permitted to practise at the Bar. The prohibition on women joining the Bar was only removed in relatively recent times following the coming into force of the Sex Disqualification (Removal) Act 1920, and recent research has suggested that the legal profession remains, for women, a hostile environment (Sommerlad, 2016). Accordingly, any research into legal education would be incomplete without consideration of what difference gender may have made towards a student's learning experience, in the light of the feminist perspective that both the legal and education systems are "institutions of patriarchy constructed to perpetuate male power" (Auchmuty, 2015, p. 5), points that they have informed consideration of moot court practice in American universities (Morrison, 1995) in particular. However, while the two female student participants' individual perceptions of their mooting experience differed from those expressed by the male students, they in turn differ in other respects from each other, as well as sharing a common factor – the lack of apparent perceived benefit to understanding of the substantive law – with a male student (I2). Accordingly, the treatment of such cases calls for a more nuanced approach than discounting them based on gender alone.

Nationality

The extent to which the experience of mooting can differ for students based upon their ethnic or national origin has been noted (Watson & Klaaren (2002); Sands, (2013)). The participants in this study were not asked to identify themselves based upon such criteria, but I4 voluntarily stated that she was an international student. I4's interview responses, as well as those of her seminar tutor, clearly set out factors relating to language and cultural barriers distinguishing her experience of studying law from that of "home" students. These factors can be legitimately regarded as having affected her experience of mooting. However, as will be explained when considering the next phase of this study in the context of I6 (another international student), the presence of these factors cannot accurately be described as common to all international students, as the ways in which these two students appeared to have experienced their effect cannot be adequately explained solely on the basis of their being international students.

Presence of an opposing team

Notwithstanding I2's assertions that the experience of the moot was for him an incomplete one due to the lack of an opposing team, and the accompanying implication that his case can be discounted on this basis. This factor alone cannot serve to discount his case due to (a) the participation in the same moot of I1, whose perceptions differ greatly from his in this regard, and (b) the expressed perceptions of I3 and I4, in whose moot there was an opposing team (albeit only one member of which took part in the moot).

Divergence in learning styles

A comparison of the deviant cases shows that they all appear to adopt the Initiating style of learning, as opposed to the styles adopted by the students whose characteristics are exemplified by the provisional hypothesis. It could, therefore, be argued that the deviant cases can be discounted on this basis. However, Kolb's conception of a learning style is such that it is a description, not a cause, of an individual's approach to learning (Kolb, 2015, pp. 118-119). Accordingly, it would not be appropriate to discount these cases upon that basis, given that the nature of an approach to learning, conceived of from a constructivist stance, is such that it will develop over time as a result of the individual's continually changing perception of their own understanding, as opposed to the positivist position that an individual's understanding is the product of a reaction to their external environment (Hull, 1930, p. 512). As will become apparent, the learning styles demonstrated by the participants in this phase of the study did not remain static throughout the other phases.

As none of these obvious reasons serve to discount the deviant cases represented by these students, it is necessary, therefore, to consider what conclusions can be drawn from the findings of the other phases of the study, so as to attempt to identify a way in which the hypothesis can be modified to account for these deviant cases, or to discount them.

Phase 2 of the study involved a moot problem on the law of theft. This phase consisted of one moot between I4 and I6, acting for the appellant and I1 and I2 for the respondent (I3 and I5 withdrew from the study, permanently in I3's case). I1 and I2 had initially prepared to represent the party in the moot case that they were not instructed to represent and were required to alter these preparations at short notice. Mooting "off-brief" in this way is not common practice in English university moot competitions, although it is in the United States. The practice has been criticised on the basis that it leaves students with a distorted impression of real courtroom practice (Kozinski, 1997, p. 185). Such criticism has been rebutted on the basis that the practice "will help students develop the useful habit of carefully analysing all sides of an issue before developing a final argument" (Hernandez, 1998, p. 74).

The significance of Phase 2 lies in the evidence of the experiential learning process in operation to exemplify the hypothesis in the case of some, but not all, of the student participants. While the analysis of the findings from this phase shows some evidence of that development in the cases of I4 and I6, and that the pedagogical effect of that development may well be positive. The principal conclusion in respect of these students (as with I3 in Phase 1) that may be drawn based upon the evidence presented is that their perceived learning experience was "of a different kind" (Watson & Klaaren, 2002, p. 556) from that which they had experienced elsewhere in their studies.

The unifying theme that appeared to suffice to explain the deviant cases involved in this study thus far was the presence of *cognitive or affective barriers to learning*. The presence of affective barriers in the case of I3 was evident in respect of her reaction to her personal circumstances, as well as her explaining in her interview interpersonal difficulties in working with her partner. This latter factor is also apparent in the cases of I4 (based upon comments made by I4 and in her decision to withdraw from the study following Phase 2) and I6. Also evident in the case of these students are *cognitive barriers* impeding the comprehension of substantive law by way of either intention or extension due to the moot experience. These barriers may be due to a lack of "cognitive-academic language proficiency" ("CALP"), in respect of which students speaking English as a second language may be slower to develop than native English-speaking students (Watson & Klaaren, 2002, p. 554), or it may be a consequence of affective barriers obstructing effective teamwork to the extent necessary for these students to develop such comprehension.

In the case of I2, it is necessary to consider whether this characteristic describes his position following Phase 1. While there was no evidence in his expressed perceptions following that phase of any affective barriers arising out of either his personal circumstances or his working relationship with his moot partner, I2's focus upon apprehension rather than comprehension (Kolb, 2015, pp. 69-77) in this study may be due to *cognitive* barriers preventing the development of the experiential learning process for him at this stage. It is not clear from his interviews precisely what form these barriers may have taken, but there is some suggestion in both of his interviews, triangulated by the interview with his seminar tutor, that they may be due to a lack of confidence, manifesting what has been defined as "intellectual anxiety" whereby a moot participant lacks confidence in "presenting a complex cognitive argument". The impact of this factor, it has been noted, can be reduced by "close analyses of the cognitive content of the mooter's argument" (Thomas & Cradduck, 2018, p. 374). This appears to have been the case for I2, as suggested by his description of the additional preparatory work undertaken by himself and his partner for them to prepare their moot submissions. The consequent effect of this, it may be submitted, has been to facilitate the progression of his perceived understanding of the substantive law to a degree of comprehension not previously attained. It is submitted that further moot experience might have effected a similar transformation with respect to the other deviant cases.

Accordingly, the revised hypothesis is as follows:

The experiences of preparation for and participation in mooting will effect a positive transformation of a student's apprehension of the way in which case law is decided. These experiences can also effect a positive transformation of a student's comprehension of the substantive law involved in the moot. However, the student may encounter cognitive or affective barriers that impede this transformation. The experience of participation in additional moots may enable the student to overcome these barriers, and thereby effect this transformation.

I5 was the sole participant in the "moot" that was the subject of Phase 3 of the study and prepared submissions in support of both grounds of appeal. He had prepared his case on the basis that there would be a respondent team present but ultimately made these submissions unopposed.

I5's expressed perceptions in respect of this interview draw less upon the actual experience of the "moot" that preceded it and more upon his observations of the differences that his experiences of mooting have made to his understanding of substantive law, as well as the ways in which he has accommodated his moot involvement into his personal life and the consequent benefit that he perceives himself to have derived from this. Considered in the terms used by Kolb, this demonstrates a particular dominance of the "Abstract Conceptualisation" ("thinking about the concepts and ideas involved in order to arrive at a solution") and Active Experimentation ("practical application in order to determine what works as opposed to what is absolute truth" (Kolb, 2015, p. 105)). Learning Modes in respect of the ways in which I5 has conceptualised his learning substantive law by way of his moot experiences as a vehicle for facilitating development in this respect, and in doing so implemented the "Form of Learning" classified by Kolb as "Comprehension transformed by Extension" (or "CΔE" (the mental adaptation of a theoretical solution in order to arrive at a practical outcome" (Kolb, 2015, p. 101). This suggests a further demonstration of the experiential learning cycle ((Kolb, 2015, p. 51), whereby I5 drew upon his reflections of his prior moot experience to reconceptualise his understanding of the substantive law and to actively experiment by using this in practice. Observable also with respect to I5 is his transition from the "Initiating Style" exhibited in his interview following Phase 1 to the "Deciding" style. The "Initiating Style" is described by Kolb as "characterised by the ability to initiate action in order to deal with experiences and situations" (Kolb, 2015, p145). This typifies the perceptions expressed by the participants in Phase 1 in respect of the ways in which they made adjustments to their approach during, or prior to, the moot in order to take the steps that they perceived themselves to be necessary in order to surmount the challenges that they had taken on by engaging in this study. Conversely, the "Deciding Style" is described by Kolb as "characterised by the ability to use theories and models to decide on problem solutions and courses of action" (Kolb, 2015, p. 145). This can be seen in practice with respect to I5's explicit discussion of his adaptation and application of his moot preparation to ensure a perception of sufficient comprehension in order to prepare for assessments.

Revisions to preliminary hypothesis (Phase 3)

It is now necessary to consider whether these conclusions necessitate any further revision to the provisional hypothesis set out above. I5's case does not demonstrate, on the face of it, any characteristics of a deviant case in respect of the hypothesis as presented. However, it is necessary to consider one important factor that arises in relation to I5's participation in this study. This relates to his personal circumstances, both in respect of his preparation for the Phase 3 moot as explicitly discussed in this interview (I5 second interview, 28th May 2019) and as the stated reasons for his non-participation in Phase 2 (Email from I5 to Ross Fletcher, 14th February 2019). Clearly, these circumstances presented what is referred to above as *affective* barriers to moot participation for I5. However, I5 appears not only to have "overcome" the difficulties presented by these circumstances but to have, in fact, implemented them as part of the experiential learning process. It is, therefore, appropriate in this context to draw upon Piaget's theory of knowledge as based upon the "continuous construction of new structures" (Piaget, 1972, p. 91), and revise the hypothesis, in the light of I5's experiences, to refer to the *dismantling* of these barriers, and their *reconstruction* as components of the constructed learning experience.

The last sentence of the above hypothesis, therefore, should be revised as follows:

Further moot participation *may* enable the student to *dismantle* and *reconstruct* these barriers into an integrated part of the transformative learning experience.

Conclusions and recommendations

The above findings suggest that mooting can be beneficial in helping develop a legal understanding (c.f Watson & Klaaren, 2002), and as such, its implementation into the first year of a law degree programme should be considered. However, the qualifications to the hypothesis set out above suggest the presence of factors relating to mooting as a teaching tool that may prevent the efficacy of its use for that purpose. The presence of these factors in the case of the student who was the most enthusiastic (I4). This student's enthusiasm about the moot process was also commented upon by her seminar tutor (T1 Interview (I4) 11th December 2018). This suggests that such risks may not be apparent to either tutors or students at the start of the moot process. The nature of moot preparation is such that a tutor has limited capability to take steps to remedy the difficulties caused by these risks in the same way as might be the case for a student experiencing difficulties in (for example) seminar preparation. These present arguments against mooting as a compulsory teaching exercise (c.f Marsh & Ramsden, 2015) or summative assessment method (c.f Boylan-Kemp, 2013). However, the advantages perceived by the students that mooting has over other teaching and assessment methods, in the light of their own perceived learning experiences, suggest an argument for adopting mooting as either or both of the following:

An alternative method of studying any or all compulsory modules on an undergraduate programme of study.

This would allow any students who elected to do so to choose to study some, or all, of the modules offered on a law degree by way of an introductory lecture to the fundamental components of each subject, followed by primarily self-directed moots on each subject area, judged by the module teaching team. Formative feedback (q.v Lynch, 1996; Gillespie, 2007) would be provided to each of the student participants by the tutor-judge following each moot, as well as in the form of the students' own post-moot reflections. Students would have the option of transferring to the "traditional" model should they experience unforeseen difficulties impeding their engagement with this model.

Clearly, this is a radical departure from the commonly accepted approach to studying law and would have significant implications relating to resources. However, the educational and personal benefits to be potentially derived from its adoption are such that any higher education provider, with aspirations towards providing law students with a challenging, engaging, and research-rich learning experience, ought to seriously consider adopting it.

The method, or one of the methods, of teaching or providing formative feedback (q.v Keyes & Whincop, 1997) **in an optional study module.**

This is a less radical and less resource-intensive variant of Proposal 1 above, which would not involve such a significant alteration to the commonly agreed approach to undergraduate study of the law but would also allow for students electing to do so, to take advantage of the benefits highlighted by my study when learning an option that does not form part of the core degree curriculum.

These proposals bear consideration, particularly in the light of recently implemented recommendations for programmes of legal education (Solicitors' Regulation Authority, 2017), which include the requirement that the first stage of a prospective solicitor's education includes the assessment of "applied knowledge" (Solicitors' Regulation Authority, 2017, p. 5) of the law.

Of direct relevance here, in the light of the above conclusions, is the potential for mooting not only to teach such an attribute, but to facilitate the students' development of such an attribute to an extent not available by way of other teaching methods. The use of mooting to help students aspiring to become solicitors (Duncan & Kay, 2010; c.f Guth & Ashford, 2014) in their development of this attribute, either directly via Proposal 1, or indirectly via Proposal 2 above, should be given serious consideration by any prospective educator of future solicitors.

Also, there are findings from this study that should inform the practical elements of any proposed moot-based educational developments. Those findings that are of particular importance in this regard relate to the following:

The case-based nature of the common law system – this emerges from an observation by I2 that his involvement in mooting facilitated his apprehension of the common law system as being the result of cases decided in a courtroom as the result of human interaction and decision-making. This makes the case for the implementation into such a study module the requirement for students to reflect upon this discrete issue as part of a formative assessment.

Mooting "off-brief" – the practice of requiring students to present – possibly at short notice – submissions in support of the opposing party in the moot scenario to that on behalf of whom they have invested time and effort in preparing to represent has been the subject of both positive (Hernandez, 1998, p. 74) and negative (Kozinski, 1997, p. 185) academic commentary. However, the examples of I1 and I2, who in Phase 2 (albeit due to accidental errors on their part) engaged in this practice, demonstrate perceived benefits. This was evident particularly in respect of I1's account of the mental processing exercise necessary for him to undergo so as to rationalise his own sense of the "right" outcome of the moot, in accordance with his duty to represent his client, and was perceived by him to have been particularly effective in challenging his understanding of the way in which case law is decided. This supports a proposal that some degree of engagement in this practice should form part of a mooting-based study module, albeit with perhaps an advance notification in the preliminary study materials to that effect in order that the students are not taken completely unaware by an instruction to this effect.

Tutor/judge feedback - examples from the perceptions of I1, I5, and I6 demonstrate that they attached particular perceived importance to the judge's feedback. This implies that any legal education provider contemplating the development of a mooting-based study module should take care to ensure that the moot judges are provided with clear guidance to assist them in delivering feedback to the student mooters that is of practical benefit to their development of legal understanding, as well as moot courtroom practice, and is sensitive to the ethical considerations raised by the power imbalance between the tutor/judge and student/advocate.

Areas for further research

As with any qualitative study, it is necessary to acknowledge the limitations of this research, and, in turn, to recognise the areas that might be the subject of further research. These are as follows:

- the limited number of student participants. While this study has generated a rich set of data, it merits consideration whether a similar study involving a broader sample of student participants would generate a more diverse range of data, or whether a greater degree of student involvement would make for a more homogenous learning experience;

- the fact that this study involved only one fully comprised and contested moot. My initial plan was that the study would involve three such moots was disrupted by extraneous factors, and a further study not subject to such disruption would be useful to conduct in order to identify whether the perceived learning experiences of the student participants are further enriched by a greater degree of moot participation;

- thorough triangulation with the students' seminar tutors. It was not possible to fully carry this out due to a lack of responses to interview requests. Based upon the data obtained from the tutors who did take part, it is likely that full tutor involvement would generate a very rich set of data. Whether this would in fact be the case is a proposition that merits further investigation;

- moots on a different subject area. Due to the nature of the Year 1 teaching curriculum, all the moots in this study were on the subject of Criminal Law. Further research of a similar nature might be undertaken using moots in areas of law not commonly regarded as "immediately accessible" (Mills, 2017) to new law students (for example, Trusts and Equity) in order to consider whether the student participants perceived their understanding of the relevant subject area have been enhanced by their moot involvement;

- other types of experiential learning. In this study, I used mooting as the experiential learning vehicle to explore the understanding of substantive law by first-year law students. It would be interesting to see whether a similar learning process to that observed in this study would occur in a similarly organised study involving a different experiential learning activity.

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