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ORIGINAL ARTICLE

Towards more authentic simulation-based learning – Nursing students' experiences

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ABSTRACT

Background: Nursing students need opportunities for authentic learning in contexts that strongly resemble real-life clinical settings.

Objective: This qualitative study describes final year nursing students' experiences of simulation authenticity and presents development needs proposed by the students. The study aimed at producing knowledge that can be used by educators and technology specialists to develop simulation pedagogy for acute nursing.

Methods: Eleven final-year nursing students specializing in acute nursing (intensive care and in- and out-of-hospital emergency care) responded to a questionnaire with four open questions in December 2019. Inductive content analysis was used to analyze the data.

Results: The students stressed the importance of their own preparations and living into the nursing role with proper briefing from an expert teacher, supported by a realistic representation of the setting using real equipment, actors, visualization and other multisensory cues.

Conclusions: Students' subjective experience of authenticity depends on many factors; preparation, awareness of objectives, support from the facilitator and the level of environmental fidelity. Simulations, which reach a reasonable degree of authenticity in the students' experience, can be considered an effective form of authentic learning.

Key Words: Authentic learning, Simulation-based education, Nursing students, User-centered design, Authenticity, fidelity, Augmented and virtual reality

1. INTRODUCTION

For decades, nurse educators have striven to offer their students high quality clinical learning experiences. This has sometimes been a challenge due to instructors' limited time resources or to short patient stays, high patient acuity and limited clinical sites/student access to patient units and records.^[1] As a response, simulation-based teaching has become a well-established alternative. In a general sense, simulation can be defined as the replication of real-world

scenarios.^[2] It allows students to practice their cognitive, motor, and critical thinking skills safely^[1-3] With help of simulated scenarios followed by constructive feedback and debriefing sessions in small groups, students can experience and reflect on the complexity of care across a variety of changing care situations and improve their critical thinking, clinical judgment^[4] and compassion skills.^[4-6]

This qualitative study describes final-year nursing students' experiences of simulation authenticity and presents devel-

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opment needs proposed by the students. The knowledge can be used in the development of simulation pedagogy by educators in similar settings and by technology specialists, at least within the framework of the Product Validation in Health Project (2017-2020).^[7] The term authentic is used in a double meaning in this article. On one hand, it refers to the students' subjective appraisal of what is close to "reality" in the simulated scenarios. The research question is mainly concerned with this definition of authenticity. On the other hand, the wider concept of authentic learning is also discussed, along with its association with subjectively experienced authenticity and the more objective fidelity.

2. LITERATURE REVIEW

Concepts relevant to this study include simulation, authentic learning, authenticity, fidelity and augmented and virtual reality. They are briefly discussed below.

2.1 Simulation-based learning

The participants in this study had recently attended an acute nursing course using simulation-based learning. They also had over 3 years' experience of simulation pedagogy as part of their curriculum. Simulation has been defined as a technique, which can replace or amplify real experiences or evoke or replicate aspects of the real world.^[8] According to another definition, simulations can be seen as approximations to reality, which require responses from participants, similarly to real-life circumstances.^[9]

In nursing education, the purpose of simulation is to replicate essential aspects of a clinical situation.^[10] It can be said that the purpose of simulated scenarios is to authentically mimic real clinical practice in a safe environment.^[11] In technical terms, simulators can involve a variety of simulated equipment and environments, for example part-task trainers, patient simulators and various software.^[12] Simulation has also been seen as a dynamic process with an authentic representation of reality. Students are actively engaged in a hypothetical learning opportunity, which integrates theoretical and practical learning and allows repetition, evaluation and reflection.^[11] According to many researchers, reflection and the feedback discussion have an essential role in simulation pedagogy.^[13]

Simulations have become an established pedagogical tool in nursing, useful for learning a variety of technical and non-technical competencies,^[14,15] including situational sensitivity, problem solving and decision making.^[16,17] Simulation-based learning has the advantage of engaging learners and integrating theoretical and practical aspects of learning. Immediate feedback, reflection and the opportunity for repetition are among further assets.^[11] As a learning experience,

simulated scenarios have been described using such concepts as flow and immersion, suspension of disbelief (buy-in) and presence^[18,19] Working with "real" patients during simulation and "thinking on their feet" have been reported to be valuable aspects of the experience.^[20] Students, who prepare themselves with help of simulations before practical training in a clinical setting, have been found to have a better understanding of their learning experience and response when later faced with real life events.^[21]

2.2 Authentic learning

Use of simulations can be considered an example of authentic learning (AL). The term authentic learning refers to learning activities carried out in real-world contexts, or having high transfer to real-world settings.^[22] Authentic learning is a wide concept, though, thought to involve holistic and constructivist learning grounded in students' experiences. Students actively construct meanings and are engaged in critical thinking and reflection in real-life settings and in creative contexts. It has been suggested that meaningful student involvement encourages students' ownership of their learning. Compared to traditional classroom teaching, authentic learning is believed to increase student motivation and enthusiasm.^[23] In addition, the purpose of authentic learning tasks is to teach students standard practices of the professional culture and to guide them to think like members of their discipline.^[24]

A recent model developed to facilitate authentic learning in nursing education proposes that active engagement in dialogue, argumentation, collaboration, co-operation and research, led by a critical and creative facilitator, results in the development of higher order metacognitive skills (i.e. knowledge, monitoring and regulation of the learners' own thinking processes). This dynamic, cyclic and collaborative learning process, triggered by ambiguity, uncertainty and cognitive dissonance, is seen to encourage students to co-create their own knowledge.^[25]

2.3 Authenticity and fidelity in simulation

In the context of simulation-based nursing, the term authentic can also be used in a more limited sense, to refer to learners' subjective appraisal of the degree of realism in the simulated scenarios. Authenticity and fidelity/ realism have commonly been used synonymously. However, a distinction is made by some investigators, who suggest that fidelity is reproducing object reality as closely as possible, whereas authenticity is a students' subjective response or interpretation of the situation. Fidelity refers to the degree to which a simulator replicates reality. It can be deduced from various definitions of fidelity that the concept is related to similarity and realism

of a situation and that it can be seen as a continuum with low to high levels.^[12] For example, a study conducted with third year nursing students supports the notion that medium to high fidelity simulation can be a valuable learning method, experienced as authentic and important for the development of safe practice.^[26]

Real supplies and equipment enhance the realism of simulation, and the latest virtual reality applications provide immersive clinical experiences.^[2] However, it is important to notice that fidelity does not only concern the equipment, but the environment and the psychology of the situation as well.^[27-29] According to one definition, fidelity is “an intrinsic property of simulation” and “the degree of accuracy to which a simulation, whether it is physical, mental, or both, represents a given frame of reality in terms of cues and stimuli, and permissible interactions”.^[12]

What are the implications for practice, then? Since individual student interpretations of what is credible or close to “real life” vary, and given their limited experience, increasing fidelity might not always result in increased authenticity.^[30] It has been proposed that simulations of different fidelity could be used for different learners and learning objectives.^[31,32] For example, a study comparing low and high fidelity simulations with traditional lectures in teaching advanced cardiac life support found that high-fidelity simulation might not be required for novice trainees.^[33] What seems realistic to a novice due to lack of experience, might appear unrealistic to more advanced professionals.^[12] Finally, it has also been pointed out that technological sophistication should not be confused with fidelity.^[34]

2.4 Virtual reality and augmented reality

In recent years, simulation-based education has been increasingly complemented by elements of virtual reality (VR) and augmented reality (AR). VR has been defined as a combination of hardware and software systems that can create a sensory illusion of being in another environment”.^[35] Putting on a VR headset, the user blocks out the real world and can become completely immersed in a virtual environment.^[36] Besides immersion and presence (the feeling of being there), VR is characterized by interactivity, that is user’s ability to modify the environment.^[36,37] Examples of fully immersive VR technologies are mobile VR, high-end head-mounted displays or HMDs, and enhanced VR (for example HMD combined with data gloves).^[38] In AR, which is a newer technological system, digital information is added to reality; AR evolves when computer-generated objects and real-world elements are linked together,^[39] or virtual objects are added to the real world in real-time during the user’s experience. As in VR, the feeling of presence and the level of realism

can be seen as an indicator of the quality of AR experiences. The technology makes it possible to examine phenomena that could not be demonstrated in any other way in real life.^[40] The technology allows, for example, elements of games and building of virtual rooms, in which the participants are present as avatars.^[41] According to some research, the focus in both AR and VR development seems to have shifted from realism to interaction in the past years.^[42]

There seems to be much interest in using VR and AR technologies in education, although the technical development of the applications is seldom guided by specific learning theories.^[38] Students may be able to retain more information and apply better what they have learned after participating in VR exercises.^[43] For nursing students, AR and VR tools provide an opportunity to practice various nursing procedures safely and repetitively. In several studies, AR and VR have been found to make teaching and learning more efficient and attractive.^[39,44,45]

2.5 Fostering fidelity and authenticity in simulation

Finally, it should be remembered that in addition to the state-of-the-art technology, there are a number of practical features that should be considered when planning authentic, high-fidelity simulations for healthcare education. A scoping review from 42 articles recommends the following features: content drawn from real life; interaction and feedback; performance expectations; preparation of the environment; presence of an actual patient; logical and adaptive scenarios; sociological fidelity, and cueing. According to the authors of the scoping review, these features can foster both fidelity and students’ experience of authenticity.^[46] Another important point to be considered is the idea that authenticity is not something that takes place in the learner, in a task to be learnt, or in the environment. Instead, authenticity is born in the dynamic interaction or flow that occurs between all these elements.^[47]

3. RESEARCH PURPOSE AND AIM

The purpose of this study is to describe final-year nursing students’ experiences of simulation authenticity and to present development needs proposed by the students. The study aims at producing knowledge that can be used by educators and technology specialists to develop simulation pedagogy for acute nursing.

In this study, nursing students are seen as users involved in the development of a learning environment. User-oriented or user-centered design/development starts with the end users’ needs, wishes and experiences. It is inspired by the users, and its purpose is to ensure that the end product is as useful and authentic as possible from the user perspective.^[48] The

students had over 3 years' experience of simulation pedagogy.

The research question is: What kind of experiences do final-year nursing students have of simulation authenticity and what development needs do they propose?

4. RESEARCH METHODS

This is a qualitative study in which nursing students close to graduation were requested to respond to four open questions. The responses were analyzed using inductive content analysis.

4.1 Participants and data collection

The target group consisted of eleven final year nursing students specializing in acute nursing (intensive care and in- and out-of-hospital emergency care). National ethical principles and guidelines on good scientific practice were observed^[49] The research was conducted at a University of Applied Sciences in Finland, where study permission was granted by the Research and Innovation Director. Verbal and written information about the voluntary and anonymous nature of the study was provided before written consent was requested.^[50] Eleven students, all female, volunteered to participate. They responded to a questionnaire with four open questions during their last acute nursing class in December 2019. The questions concerned the experienced authenticity of the simulation-based teaching, experiences of preparing for the simulations, and students' opinions of the simulators and audiovisual equipment used in the simulated scenarios. The same group of nursing students also contributes to the user perspective in a pilot study, which is part of the Product Validation in Health Project (2017-2020) funded by the European Union's Interreg Baltic Sea Region Program. The purpose of the Project has been to promote cooperation among health laboratories, which test new products and technologies in real-life contexts.^[7] The pilot study was conducted in collaboration between a Finnish university telemedicine center and a Swedish technology company specialized in developing augmented reality (AR) software and glasses for training triage and emergency nursing. Besides education, the results of the study will thus be useful for product development as well.

The eleven participants had just completed a simulation-based acute nursing course, but they had also participated in several other simulation-based courses earlier during their studies. The students responded after completing 8 hours of simulation workshops and 2 × 8 hours of full scale simulations concentrating on acute nursing situations. Each session had involved 15 minutes for preparation (learning objectives and familiarization with the instruments and equipment); 15-

20 minutes for the actual simulated situation, and 45 minutes for a feedback discussion. Each time, 2-4 nurse students had acted out the scenarios, while the other students had observed them through video.

The topics in the scenarios had involved advanced life support (including defibrillation, drug therapy and intubation), the care pathway of trauma patients, and acute atrial fibrillation, chest pain and stroke treatment. A computer-aided manikin, but also teachers in patient roles, had been used in the simulated scenarios. The scenarios had taken place in simulation classrooms representing in- or out-of-hospital emergency care, coronary care and intensive care, with real instruments and equipment for nursing, observation and examination tasks. In addition, images, videos and light/sound effects from computers had been used to represent weather conditions.

4.2 Data analysis

Inductive content analysis was used to analyze the transcribed data. Clauses, sentences and phrases that could be seen to answer the research question were selected as a unit of analysis and picked out into separate files. They were reduced into more succinct expressions, which were then used to create categories and subcategories characterizing the content. The investigator who conducted the analysis returned repeatedly to the original material to ensure that the interpretation was true to the data.^[51]

4.3 Trustworthiness

The investigators in this study were experienced educators with pre-understanding of simulation-based education. This knowledge facilitated the analysis, but it may also have been a source of bias. Special attention was therefore paid to reflexivity – the effect of the investigators – by seeking to keep the analysis as data-driven as possible.^[52] The actual analysis was conducted by one researcher, but all research team members read through the original material and provided comments on the results of the analysis. The team members agreed that the results reflected the views of the nursing students. The participants' responses to the open questions are believed to represent their lived experience, and direct quotations are presented in the results section to support the analysis. An effort was made to construct a theoretical background, which supports the analysis and understanding of the phenomenon. Since this is a qualitative study with a limited number of participants, there is no discussion on the generalizability of the results. Instead, the investigators believe that professionals in similar educational settings and developers of new simulation technology can decide, based on the research report, to what extent the results could be

transferable to their work.^[52]

5. RESULTS

The results section starts with general observations concerning students' experiences of the challenges encountered in simulation-based education. They are followed by two categories describing elements that are relevant from the perspective of authenticity: preparing for a simulated learning situation and need to develop the authenticity of simulation-based learning.

5.1 Challenges in simulations

To start with, the students in this study found simulation-based learning an important part of their acute nursing studies. They expressed the wish to have more simulations concentrating on the care of trauma and multiple injury patients. Accidents and emergencies involving children were also mentioned in this context.

All simulated situations involved challenges; the students pointed out that having still limited experience of nursing practice, mainly based on practical training and summer jobs, it was not easy to take on the various nursing roles assigned to them. They also found it difficult to imagine how a patient might feel in an acute situation.

The most demanding simulations mentioned by the students involved accidents, trauma patients and multiple patient incidents, which required triage and simultaneous assessment of several patients. Other challenging patient groups for simulations included choking and unconscious patients and children. According to the students, it was not possible to easily experience difficult weather conditions, for example the cold and dark, in a simulation. Neither was it easy to simulate encounters with aggressive behavior or other risk situations. Consequently, it was at times challenging for the students to identify with their role or with the situation.

5.2 Preparing for a simulated learning situation

The students were asked to describe their experiences of preparing for the simulated scenarios. The following subcategories evolved in the analysis: Clear instructions from teachers; personal preparations for simulated scenarios, and spontaneous participation in simulated scenarios.

According to the students, clear instructions from teachers concerning the learning objectives, context, and actor and observer roles made it easier for them to prepare for the simulated learning situation, and also made the situation feel more authentic. The students mostly found that preparing for the simulation had been very successful. The teachers were considered to be experts, who were committed to maintaining their competence, and who knew how to provide

comprehensible feedback on students' success and development needs. To quote the students: "Properly going through all the things and teaching are important before the simulation"... "Assigning roles to students before the simulation, and giving all the information about the initial situation".

Secondly, personal preparations for simulated scenarios were considered as important, because in addition to their own learning, the students felt responsible for the learning results of their peers. Many students felt that the preparation time was too short, and many of them found it necessary to revise various nursing protocols before taking part in the simulated scenarios. All students stressed the importance of learning about the equipment beforehand. They said, for example: "Taking on a role is challenging, more time is needed"... "Orientation to the phenomenon to be simulated and to the equipment beforehand"... "they should tell about the topic beforehand and tell students to read about how to cope with the situation etc."

The third subcategory, spontaneous participation in simulated scenarios, means that part of the students were pleased with the fact that some of the simulations were arranged without any opportunity to prepare for them in advance. These simulations resembled real-life clinical nursing, where unexpected acute situations required rapid assessment and consistent action. Coping with unexpected situations in simulations was found to increase self-confidence. In the students' own words, "Simulations are about practicing what we have learnt, as in a real situation"... "It's good that we don't know what is coming"... "Sometimes we are just blindly thrown into the situation".

5.3 Need to develop the authenticity of simulation-based learning

The students in this study suggested several improvements to improve the authenticity of simulation-based learning. The suggestions are presented under four subcategories: More realistic situations; challenges in environmental conditions; make-up and visualization options, and real equipment.

The students wished for more realistic situations and contexts. It was suggested that instead of having a teacher or one of the students assume the patient's role, real patients or unfamiliar persons should be used in the scenarios to increase realism. The students said, for example, "Real patients"... "Unfamiliar actors and colleagues, if it's just our group, we tend to start playing around, giggling". The students also proposed that all nursing procedures should be actually carried out. That would allow consolidating concrete, technical skills, which, in addition to non-technical skills, were an important part of clinical competence. In

the students' own words, "We should really do the things, not just quickly say that now something has been done"... "We should have a chance to complete all the procedures in a situation, although it takes some time, e.g. cannulation, taking blood pressure etc."

A variety of cues were used in the simulation classroom to reproduce acute nursing situations in emergency care, coronary care and intensive care. The students observed that it was challenging to exemplify the environmental conditions in a classroom simulation. For example, it was difficult to set up disasters or accidents, severed limbs or suffocation. The students wondered about the possibility to reproduce various contexts and cues for weather conditions, passing cars, the color and smell of smoke, or a radioactive environment, for example. Indicating broken equipment was also mentioned. The students gave examples, "Creating smoke for a fire scenario"... "Chemical accidents, smells, earthquakes".

Third, the students found that treating injuries would seem more authentic with more investment on the patient make-up and visualization. It was not easy for the students to gain a realistic conception of the severity of the situation, if they were expected to imagine parts of the scenario. According to the students, "You don't get a realistic idea about the injuries if it's just fake bleeding"... "The props and the make-up, more realistic wounds. Real bleeding." The students suggested using audiovisual effects – sounds, images, lighting- to increase authenticity. They said, for example, "Background noise, flashing lights in the dark"... "Blocked airways, agonal breathing, skin color".

Finally, the students would appreciate the use of real equipment in the simulated scenario. The equipment should be similar to that used in the regional emergency medical services and care facilities, so that students would find the transition to clinical placements easier. "A real defib, like we use in the field".

6. DISCUSSION

This study presents final year nursing students' experiences and perceptions of self-defined authenticity of simulated acute nursing scenarios. Based on the students' feedback, it seems that the students' own preparations and living into the nursing role, together with proper briefing from an expert teacher or facilitator before the simulation activity were essential for the authenticity of the situations. These points were stressed more than the technical replication of context. Careful planning of the simulation activities and inclusion of specific tasks or issues have been emphasized in earlier research as well.^[53] The facilitator's role has been found essential, not only as a provider of information, but in motivating

and engaging students.^[54] Another way how the teachers' contribution is important is that their earlier experiences of real patient situations can be almost identically copied and used in simulation.^[55,56] It is the teachers' responsibility to ensure that students are fully aware of the objectives of the learning experiences. It has also been pointed out that, in addition to presenting clearly defined objectives and roles, logistic details about the session should be given, and what many investigators call a fiction contract should be discussed to ensure that students are aware of the limitations of the simulated situation.^[57] Given that the teacher's role is essential, it may be a challenge if the teachers themselves mainly work in universities, removed from the practice they are teaching about.^[22]

Another commonly acknowledged challenge, evident in this study as well, is that mimicking real-world activities in a classroom may feel forced or awkward.^[22] The students in this study would appreciate a more realistic representation of the setting and patient using real equipment, real (unfamiliar) actors and multisensory cues. Research has indicated that increasing contextualization- equipment, physical resemblance and other environmental fidelity- affects immersion and learning positively,^[18] although some investigators remind us that the level of fidelity should depend on the student's level and type of task.^[58] The more experienced the learner, the more important it probably becomes to include elements that bring out the unpredictable nature of the real setting.^[59] It has been pointed out that instead of striving for faithful replication of reality, it may be possible to reach simulation fidelity by a carefully selected set of accurately represented cues and stimuli.^[12] Here, VR and AR applications can come in useful. As much as possible, the development of the technologies should be informed by users and current learning theories.

To sum up, according to this study, students' subjective experience of authenticity depends on many factors; preparation, awareness of objectives, support from the facilitator and the level of environmental fidelity. Simulations, which reach a reasonable degree of authenticity in the students' experience, can be considered an effective form of authentic learning. Simulation sessions, including the preparation and feedback, include many elements attributed to authentic learning, for example interaction, collaboration, dialogue, reflection and the integration of theory and practice; all of them features that should be considered when planning authentic, high-fidelity simulations for healthcare education. The extensive scoping review mentioned previously in this article (2.5.) also reminds us that besides cuing and a credible environment, many other features, such as content drawn from real life, interaction and feedback, are required to produce authentic high-fidelity scenarios.^[46] These elements should always

be included in discussions on the authenticity and fidelity of simulations.

7. CONCLUSIONS

Students' experience of authenticity in simulation-based education greatly depends on students' own preparations and living into the nursing role with help of clearly defined objec-

tives and proper briefing from an expert teacher, supported by environmental fidelity. The level of fidelity should depend on the student's level and type of task, and it can be reached by accurately represented cues and stimuli. Simulations can be considered an effective form of authentic learning.

CONFLICTS OF INTEREST DISCLOSURE

The authors declare they have no conflicts of interest.

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