**Abstract**

Empathy is significant in nursing and showing empathy toward a patient positively impacts a patient's health. Learning empathy through immersive simulations is effective. Immersion is an essential factor in virtual reality. This study aimed to describe nursing students' experiences of empathy in a virtual reality simulation game. Data were collected from nursing students (n=20) from May 2021 to January 2022. Data collection included individual semi-structured interviews; before the interviews, the virtual reality gaming procedure was conducted. Inductive content analysis was used. Nursing students experienced compassion and a feeling of concern in the virtual reality simulation game. Students were willing to help the virtual patient, and they recognized the virtual patient's emotions using methods such as listening and imagining. Students felt the need to improve the patient's condition, and they responded to the virtual patient's emotions with the help of nonverbal and verbal communication and helping methods. Empathy is possible to experience by playing virtual reality simulation games, but it demands technique practicing before entering virtual reality simulation game.

KEYWORDS: Education, Nursing; Empathy; Learning; Virtual Reality; Emotions

## Introduction

Empathy is critical in nursing. Nurse-expressed empathy has been found to decrease patient distress,[1] and increase patient satisfaction.[2] Overall, healthcare professionals' empathy has been shown to predict better patient outcomes.[3] Nursing students' empathic tendency has, however, been found to decline at the end of nursing studies.[4]

Empathy is defined through affective and cognitive components.[5] The affective component includes emotions as a reaction to another person's emotions.[5,6] Empathy is an emotion,[7] and its central part, empathic concern, is formed of compassion and concern for the well-being of others.[8] The cognitive component of empathy includes perspective taking which means ability to understand and predict another person's feelings and thoughts.[5,8]

The worldwide pandemic crisis of Covid -19 has showed that it is crucial that nursing curriculum contains education of empathy for its significance in enhancing the well-being and resilience of nursing students.[9] Practicing empathy within nursing education is essential for various compelling reasons related to the nursing profession, and it can be learned through experiential learning and humanistic learning.[10] Experiential empathy learning methods, including simulations, roleplaying, scenarios,[10] and immersive simulations,[11] have been found to be effective. Immersion is one of the key components in virtual reality (VR),[12] and within immersive experiences in VR the participant feels like they are a part of the situation through their own individual cognitive process.[13]

Virtual reality (VR) technology can be categorized into non-immersive desktop VR systems, semi-immersive VR systems and immersive systems. [12] Immersive VR systems, as one form of simulation game, imitates elements of the real world, [14] by utilizing game features such as interactive 3D environments, realistic animations and graphics, progress tracking and scores, and visual- and text-based feedback to enhance learning. [15] VR simulation achieved through a computer-generated 3D environment where the virtual world is projected onto a Head-Mounted Display (HMD), enables the user to be fully immersed in this digital world. [12]

Immersive VR systems can be enhanced by audio, sensory, and haptic devices,[12] where haptic devices transfer the technology-generated sense of touch to the user as forces, motions, or vibrations.[16] VR simulations through a HMD possess opportunities for more immersive quality compared with computer simulations.[17]

Enhanced immersive VR is considered to be an effective learning method among nursing students,[18] and it has become a growing interest within nursing education.[19] VR as a pedagogical tool has clear benefits compared to less immersive learning approaches especially regarding abstract, logical or emphasized procedural skills.[20] While there has been a growing number of studies exploring empathy through the use of VR,[21] there is a limited body of research in the context of nursing education. Notable examples include studies conducted by Adefila et al., [22] Hannans et al.,[23] and Ma et al. [24] In the studies conducted by Adefila et al.,[22] and Hannans et al.,[23] empathy was found to increase after a VR experience. The present study aims to address this gap in empathy research by focusing on nursing students' experiences of empathy by playing VR simulation games.

**Study purpose**

The purpose of the present study was to describe nursing students' experiences of empathy by playing a VR simulation game. In the current study, empathy and empathizing are referred to as self-motivational recognition of emotions of others and responding to said emotions with an appropriate affect.[5] The study was part of a larger research project aiming to develop immersive technology for nursing education and explore its effect on students' learning. The affective and cognitive components of empathy guided the research questions. Emotions are strongly intertwined with research questions due to their connection to the affective and cognitive components of empathy. The research questions were as follows:

1. What kind of emotions do nursing students experience in the VR simulation game?
2. How do nursing students experience recognizing the patient's emotions in the VR simulation game?
3. How do nursing students experience responding to the patient's emotions in the VR simulation game?

## Methods

### *Design*

A descriptive qualitative design was conducted using individual semi-structured interviews to describe nursing students' experiences of empathy in a VR simulation game. The Standards for Reporting Qualitative Research (SRQR),[25] was followed when preparing the manuscript.

## Participants

Nurses' general care training last for at least three years of study, as regulated by the directive 2013/55/EU of the European Parliament and of the Council.[26] In Finland it takes three and a half years to get a bachelor's degree in nursing. In the present study, a convenience sample of undergraduate nursing students in their final academic year from three universities of applied sciences on the southern, west, and southwest coasts of Finland were recruited.

## Data collection

After study approval, the researcher contacted people in every university of applied sciences to inform the nursing students about the study, giving the researcher's contact information to agree on a time for data collection. Data collection was carried out from May 2021 to January 2022. Students' background information was collected with an electronic questionnaire about background including questions about age, gender and working experience within the social and health care sector. Previous research on 3D simulation games, including background information such as age, work experience in social and health services, and gender, has been found to be important to report. [27,28]

After gaming, the students were interviewed. The VR simulation game session consisted of approximately 30-45 minutes of individual gaming. Students received brief information verbally before playing the VR simulation storyline, on how to move and grab things in the virtual world using hand controllers, and how to wear an HMD. When the participant was immersed within the virtual world by wearing an HMD the researcher verbally instructed on technical issues regarding the VR simulation game if the student had any problems.

In addition, the students had the opportunity to freely express their feelings regarding the virtual scenario during the VR simulation gaming. Thus, it was seen as important to create an atmosphere where students felt safe and encouraged to convey themselves.

The gaming was included as part of one nursing course at one university of applied sciences. The VR simulation gaming and interviews were held individually in a classroom where only the researcher and student were present at one time. The interviews focused on three themes based on the research questions (Table 1). The themes were formed based on Baron-Cohen and Wheelwright's,[5] definitions of empathy regarding emotion recognizing and responding to these emotions. During the interview, when related to the interview themes, the researcher also asked for clarifications of the students' thoughts, which had been prompted within the VR simulation game session. This included, for example, if the student did convey thoughts about wanting to ask about a virtual patient's possible pain while gaming. The duration of interviews was 6-17 minutes per student. The interviews were audio recorded.

**Virtual reality simulation game**

The VR simulation game used in the present study was further developed from a computer-based simulation game for learning clinical reasoning, [15] to a HMD virtual reality version with audio-visual adjustments in a multi professional collaboration project within university of applied sciences (UAS) in Finland. Several studies have been published on the computer-based version and it has been proved to be effective learning method. [27–29] The clinical content of the scenarios was created by experienced nurse educators and medical doctor. Game elements, including graphics, animations and interactions between the player and the game environment, were developed by game designers and developers. The game was created with Unity development platform and was specifically designed for Oculus Quest devices. This allows players to interact with the game world using VR controllers and move around virtual hospital environment. The game is presented in a first-person view. In this single-player game the user functions in the role of a nurse taking care of a virtual patient with a deteriorating condition involving pneumonia. In the simulation scenario, the virtual patient (a 59-year-old man with no previous illnesses) is transferred from the emergency room to the department of inner-medicine, and the user must assess the patient's clinical condition. The patient lies on the

hospital bed answering questions verbally, with a moaning tone of voice. The virtual patient's appearance reflects an unwell state, with a slightly wrinkled forehead and twisted mouth. The user wears Oculus Quest HMD and with hand controllers, the user can make a clinical observation and alleviate the symptoms patient has regarding their condition (Figure 1., Figure 2.). In addition, there is a menu making it possible for the user to interact with the patient by choosing a question or request for the patient to respond hence offering the user multisensory feedback (audio, visual and physical). The user can view 360- degrees and move around the virtual hospital room by natural walking or teleporting. Here teleportation is a technique that allow a user to navigate in a virtual environment by using a handheld controller.[30] There is no time limit to perform the scenario in the VR simulation game and the game automatically provides feedback on performance to the user after completion of the scenario. The actions taken by the students in the game included asking questions from the patient, assessing the patient's clinical condition, and implementing nursing interventions. During playing, the students' performance in relation to the learning goals were measured with scores. Students received scores for choices they made in the game, indicating their performance in the scenario. Points were earned for correct choices and lost for incorrect ones. The learning goals of the game were as follows: Student should be able to assess the patient's clinical state using the ABCDE approach, identify the NEWS criteria, and make decision necessary for the patient's clinical condition.

**Ethical considerations**

The present study was carried out according to the responsible conduct of research and ethical principles of research.[31] The students had the opportunity to compensate for a course assignment in two universities of applied sciences assigned by their nursing educator by volunteering for the present study. The participants were informed of the study both written and verbally. Information given included that participating in the study was voluntary and that participating or not participating would not influence the participants' grades or academic evaluation. The participants were also informed about anonymity regarding their responses. Students who provided written informed consent were included. The approval of the audio recording of the interviews was individually requested from the participants. Data anonymity was secured. Ethical approval was obtained from the Human Sciences Ethics Committee of the Helsinki Region Universities of Applied Sciences.

## Data analysis

Data analysis was performed using inductive content analysis,[32] in four phases:1) After reading the transcribed interviews several times, words or sentences related to each other was considered a meaning unit of analysis according to research questions.[33] 2) Condensed meaning units were grouped into subcategories according to similarities. 3) Those subcategories with common characteristics were abstracted into categories. The research group strived for the categories to be more general than subcategories. 4) Categories were turned into main categories so that all the data fit only into one subcategory and category.[33] To strive for transparency the research group has included examples of meaning units, condensed meaning units, subcategories and category turned into one of the three main categories (Table 2). The research group discussed every phase of the analysis to reach a consensus.

## Results

Most (95%) of the 20 students were women and aged between 21 and 25 years (35%) and 26 and 30 years (35%). Most of the students (40%) had working experience in the social and health sectors for one to five years.

Three main categories of 1) Nursing students' emotions experienced in the VR simulation game, 2) Nursing students' experiences of patient's emotion recognition in the VR simulation game, and 3) Nursing students' experiences of responding to the patient's emotions in the VR simulation game were derived from eight categories, as shown in Figure 3. The eight categories consisted of subcategories signifying the unifying factors discovered in the narratives of the nursing students.

### *Nursing students' emotions experienced in the VR simulation game*

**Scenario induced emotions** consisted of three subcategories: *compassion, the feeling of concern, and self-confidence*.

C*ompassion* consisted of feelings of sympathy, empathy, and sense of humanity. The virtual patient's poor condition was described as causing discomfort in the student. In addition, seeing the virtual patient as a sympathetic being and the situation as a real patient situation, where the patient is not feeling well, evoked an emotion of compassion.

> "When the patient didn't feel well, it caused the feeling of not feeling well myself."

> "After you got the chance to ask a few questions from the patient, you got these empathy feelings."

*Feeling of concern* consisted of feelings of panic, distress, tenseness, and insecurity that the patient's situation caused. The virtual patient's authentic deteriorating condition with breathing problems and abnormal vital signs where the nurse had to act quickly brought about feelings of concern within the nursing students. Feelings of concern were also shown through questioning one's own competence to treat the virtual patient.

> "In a certain way maybe concerned, like it would have been real…and the tenseness…you thought that the situation was real, that something would happen to it if you don't react fast enough."

> "I took the situation like seriously."

*Self-confidence* consisted of experience with professionalism, succeeding, and feelings of decisiveness. Acting alone in the virtual patient room, taking the role of a nurse, taking measurements, and conducting patient interviews affected their emotions. Self-confidence was also exemplified in the students' descriptions of their own calm behavior because of the calmness and consciousness of the patient.

> "I felt professional because I was basically alone in the room or like… I had much more power to make decisions, so I was a real nurse, not just a half of a nurse."

> "I got the feeling of decisiveness when immediately placed like into nurse's role, like 'Okay, I am responsible for him and I have to do my job'… and then, I have to make those decisions, like in what kind of order to do the measurements and what to do with those test results."

**Emotions regarding technique and virtual environment** consisted of three subcategories: *insecure, frustration toward technology, and interest*.

*Insecurity* consisted of confusion, astonishment, tenseness, and anxiety. The emotion of insecurity was affiliated with technical problems with the hand controllers and the virtual world as a new nongenuine environment, where the equipment was not real and future

incidents in the game were not given. In addition, the virtual patient's graphic features were seen as scary.

> "It causes confusion and insecurity because the situation was like new and different…these equipment weren't familiar."

> "I kind of think that it was a bit scary looking when staring all the time with the same look really close and not moving at all."

Some *frustration toward technology* was experienced because of the problems with hand controllers. Nursing students considered that they couldn't use or didn't understand how to use the technology. The problems with technology made moving and gripping things difficult in the virtual environment.

> "Frustration, because I couldn't use the technic."

> "Maybe at first frustration, that I didn't first get it, how the hand controllers work and how I get from place to place and how can I grab it."

*Interest* was described in the function of the game and the VR HMD as a novel medium. Gaming was considered an immersive, fun, exciting, interesting, and educative experience. Interest also appeared as a desire to experience different kinds of nursing situations after having familiarity with the technology also outside the classroom.

> "It swept me away."

> "I think it was fun and exciting and interesting to test that…just like the new practice, you haven't done before. It would be fun and nice if you could practice on your own and not always somewhere in school simulation."

***Nursing students' experiences of patient's emotion recognition in the VR-simulation game***

**Motivation to recognize the patient`s emotions** consisted of two subcategories: *the need to find out the patient's emotions* and *the willingness to help.*

*The need to find out the patient's emotions* consisted of a drive to solve the patient's condition and the obligation of the role of a nurse. The understanding of the patient's emotions motivated them to help better, and the importance of emotion recognition was

described as being emphasized when the patient is distressed. The authenticity of the patient was also a motivating factor.

> "I thought that I have to find out soon his condition."

> "A part of the motivation comes because of your role in it…It comes somehow automatic, that well yeah, I will take care of it because it has to be done."

*The willingness to help* consisted of a need to help the patient in that certain situation as an existing or easily emerging characteristic, and as an awareness that the patient had to be helped.

> "You want to help the patient in that situation."

> "I guess I'm that kind of a human that I always think others more than myself, so I get very easily this willingness to help."

**Collecting information to recognize the patient's emotions** consisted of three subcategories: *observation, interviewing, and listening*.

Students used *observation* to recognize the virtual patient's emotions by observing, watching, and listening to the virtual patient's voice, tone of voice, facial expressions, gestures, movements, and nonverbal communication.

> "Facial expressions did check a lot…of course by observing…maybe the way how he spoke."

> "Observation, like watching the man, facial expressions and gestures, that nonverbal communication."

Students used also *interviewing* as a mean to recognize the virtual patient's emotions. Interviewing was asking about the virtual patient's condition with extra questions. Asking questions was considered a good way to reach the bottom of the cause.

> "Speaking or asking questions about how he is feeling"

> "Asking like how are you feeling so it goes quite well to the points"

The students also used *listening* as a means to recognize the virtual patient's emotions. Listening was stopping to hear the patient's answers and making eye contact. In addition, listening appeared physically as getting closer to the virtual patient.

> "You listened to the patient and based on that you started to help him."

> "Got near to the patient when asking something and waited for the response and took eye contact at that point."

**Reasoning in the patient`s emotion recognition** consisted of two subcategories: *interpreting* and *imagining*.

*Interpreting* involved analyzing, making presumptions, guessing, and inferring. Interpretations were made based on the virtual patient's status, body gestures, vitals, movement, patient charts, patient answers, and NEWS scores.

> "How he responses to those questions, out of these you can, of course, infer the mood."

> "Of course, some hint you may get from vitals, those might also be connected to that distress and feeling of stress, that you can infer also out of those things."

*Imagining* was getting oneself involved in and imagining the real situation with the help of previous experiences about how the pain manifested in the patient. Putting oneself in another's position was also mentioned and the virtual patient's tone of voice, coughing, and humanlike voice made it easier to immerse oneself in the situation.

> "Based on previous experiences you could little imagine how pain really appears to the nurse."

> "There was a tone of voice within the words, coughing, and like that, so it made easier to get oneself into that situation."

**The recognized emotions of virtual patient** consisted of four subcategories: *fear, frustration, powerlessness, and calmness*.

*Fear* consisted of feelings of insecurity, worry, confusion, and distress. Fear was recognized through tone of voice, facial expression, respiration rate, movement, the patient's sayings, the look of feeling not well, and imagining a real patient situation. Presumed uncertainty about the future was also considered as causing fear.

> "At least fear showed in the face somehow or distress."

> "That anguish or something like that through movement, like those toes, were moving all the time and he held his hands on the stomach."

*Frustration* was recognized as imagining the real patient situation and it was connected to nursing students' thoughts about functioning slowly in the situation.

> "Frustration and like, that you would want to improve faster his condition, so I would imagine if I would think the real patient situation."

> "Maybe my functioning brought this feeling that he is frustrated because I work so slowly and vague in that moment."

*Powerlessness* was recognized in the virtual patient's feeling of tiredness, melancholy, pain, as well as a poor and unpleasant condition by the tone of the voice, facial expressions, gestures, answers, and imagining a real patient situation. Painfulness was thought to be reflected in the vitals.

> "He kind of looked away, so that made me think that he doesn't feel well."

> "I guess it was because of the poor condition which somehow transferred to me as like kind of tiredness."

C*almness* was recognized in the virtual patient's peacefulness, tolerable condition, and warm gestalt. The characteristics of calmness consisted of virtual patient's structured answers, small movements, posture, and eye contact, which symbolized warmth when touching virtual hands.

> "He answered anyway completely full sentences, so that would tell that he was quite calm."

> "Pretty calm gestalt he had, that he didn`t move that much there."

## Nursing students' experiences of responding to the patient's emotions in the VR simulation game

**Motivation to respond to the patient's emotions** consisted of two subcategories: *the need to improve the patient's condition* and *the need to calm down the patient verbally.*

*The need to improve the patient's condition* consisted of a desire to relieve the patient's poor condition, a willingness to make the patient feel better, and a need to alleviate the patient`s symptoms. The condition that the patient had motivated the nurse to act quickly, and the feeling of being rushed was also associated with the need to get things resolved. The need to

alleviate the patient's symptoms emerged through a wish for a blanket to cover the patient. Improving the patient's condition through mental well-being was considered to also affect the patient's physical well-being.

> "You got this feeling of, that you want to help and make it feeling better, that old man."
>
> "The desire to make the other one feel better."

The students also described *the need to calm down the patient verbally* as a desire to soothe the patient with a different phrase. The patient's weak condition motivated them to answer a loud even though they were aware of the simulation.

> "The patient didn't feel well and that motivated to answer that doctor is on its way here and things are proceeding."
>
> "Even though it was a simulation you got first this, that I wish I could say, that take it easy, and everything is fine."

**Responding with the help of nonverbal and verbal communication and helping methods** consisted of three subcategories: *soothing, responding with measurements and examination,* and *treating symptoms.*

*Soothing* through the students' calm behavior, body language, and speaking was one method to respond to the patient`s emotions.

> "With calmness, I responded."
>
> "I experienced that I was quite calm, and I wasn't in a panic, so that transferred kind of trust to the patient"

The students *responded with measurements and examinations* of the patient's distress and helplessness nonverbally, and in this way the patient was described as being heard, and not left alone. The patient was described as being more tranquil when examined.

> "Even though not verbally, but as he said about breathing you can respond to it with measurements, like kind of you hear what he says."
>
> "There when you examined the patient, the look was more peaceful."

*Treating symptoms* was also one method to respond to the patient's emotions by lifting the upper bed and putting the breathing mask on, which was thought to alleviate patient's

distress. In addition, methods that had been noticed working in real life were described as useful when helping the virtual patient.

> "When you lifted the bed, he looked like it relieved him at that situation."

> "Maybe you tried mostly with those physical helping methods to alleviate his condition and consequently that distress."

**Discussion**

The purpose of the present study was to describe nursing students' experiences of empathy by playing a VR simulation game. The main results of this descriptive qualitative study were that nursing students experienced compassion and feelings of concern, hence forming an empathic concern, as defined by Morse et al.[8] In addition, nursing students recognized virtual patient's emotions and responded to those emotions with gestures and behavior indicating experienced empathy.

Our findings showed that nursing students` experienced compassion and feelings of concern in the role of a nurse was related to the experienced authenticity of the patient situation, which was affiliated with a patient in deteriorating condition. Previous studies on experienced empathy through immersive VR have shown similar results, even though these studies have been experienced from the perspective of a patient.[22,23] In our study, the nursing students also experienced self-confidence, which is also in line with a previous VR study where nursing students' growth of self-confidence was reported.[23]

As for experienced emotions regarding technique and virtual environment, which emerged spontaneously when asking about induced emotions in the patient situation, our findings showed that nursing students experienced insecurity regarding difficulties with hand controllers and moving around in the virtual world, which is in line with a previous study.[34] Nursing students also experienced insecurity and anxiety, which can stem from skepticism about VR. Being skeptical about VR can hinder positive experiences. However, studies have shown that initial skepticism towards VR technology doesn't necessarily prevent a positive rating of VR.[35] In this study nursing students also experienced an interest in the VR simulation game and described it as an educative learning method. Also, in previous studies, VR has been experienced as an entertaining,[36–38] and satisfying[39] medium according to nursing students.

The feature of a willingness to help as an inherent characteristic is something that is desired for a nurse treating a patient. What makes it surprising in our study, however, is that the same feature also seemed to occur when encountering a virtual patient. Our findings showed that virtual patients' emotions were recognized when using versatile methods such as listening and imagining especially regarding the methods indicating compassion toward the virtual patient. The four emotions recognized for the virtual patient were fear, frustration, powerlessness, and calmness; these emotions resemble those experienced within the simulated role of a patient dependent on a nursing care in a study by Vanlaere et al.[40] However, it is worth considering that people's own experiences can shape empathic understanding, and it is important to be aware of them to avoid incorrect interpretations based on personal presumptions. [41]

Finally, our findings showed that the nursing students responded to virtual patient's emotions with calm gestures and behavior that transmitted their calmness to the virtual patient. The VR simulation game did not enable speaking to the patient, and some students felt the need to soothe the patient with spoken words; some communicated verbally to the patient. This desire to communicate and the actual verbal communication revealed the possible true motivation experienced to help the patient, even if just, a virtual patient. VR simulation game enabled mostly nonverbal communication, which, together with verbal communication, is a means to express your understanding of the other's perspective.[8] All in all, these gestures and behavior and the expressed need to improve the patient's condition indicates compassionate care offered to the virtual patient.

**Strengths and Limitations**

The strength of current study is in creating an atmosphere of safety that can enable individual playing and game instruction during data collection, which potentially strengthened the nursing students' experiences within the VR simulation game by diminishing stress, leading to sharing thoughts truthfully about their experiences. However, some limitations can be identified. The durations of the interviews were short, which manifested in some of the nursing students' answers being superficial. Hence, this has affected the difficulties in analyzing the data, revealing partly inadequacies regarding in -depth analysis. Despite the challenges of analyzing, the collected data are rich in their entirety.

## Conclusion

The present study implies that empathy is possible to experience by playing VR simulation game; this can encourage nurse educators to process their pedagogical approaches within empathy learning. In a post-Covid-19 world where learning continues to occur in a hybrid environment, VR represents a usable resource that can be utilized in teaching and learning empathy, demanding however technique practicing before VR practice. What this means for nursing education is that nurse educators must be prepared to guide students in operating technically correctly within VR environment. For further research the role of empathy's components in empathy learning within nursing education utilizing VR simulation games needs to be evaluated.

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*Table 1. Interview themes and research questions*

*Table 2. Example of main category of nursing students' emotions experienced in the VR simulation game.*

*Figure 1. Screenshot of the VR simulation game*

*Figure 2. Student measuring the heart rate of the virtual patient.*

*Figure 3. Nursing students' experiences of empathy in VR simulation game*