ORIGINAL RESEARCH

Enhancing empathy and positive attitude among nursing undergraduates via an in-class virtual reality-based simulation relating to mental illness

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ABSTRACT

Objective: The study aims to examine the impact of virtual reality simulation that simulates the experience of psychiatric symptomology associated with mental illness in mental health nursing education.

Methods: A total of 159 nursing students being exposed to an in-class VR simulation completed pre-test measures about empathy and positive attitudes towards mental illness. Narrative feedback was collected to explore the students' perceptions of the VR simulation.

Results: The results indicated a significant increase in the overall empathy and positive attitudes towards mental illness after participating in the in-class VR simulation related to mental illness. Students had a clearer understanding of the patient's experience and difficulties from VR simulation.

Conclusions: In-class VR simulation may play a significant role in enhancing empathetic understanding and positive attitudes towards individuals diagnosed with mental illness.

Key Words: Nursing undergraduate, VR simulation, Mental illness, Empathy and positive attitude

1. BACKGROUND

Empathetic understanding and attitudes toward patients with mental illnesses are two fundamental ingredients that influence the therapeutic alliance in nurse-patient relationships.[1,2] Healthcare professionals are not immune to social prejudices, sometimes share the general public's attitude towards people with mental illness. Studies revealed that undergraduate nursing students had a shortcoming in knowledge about mental illness.[3,4] Nursing students are likely to report fear, anxiety and dread in anticipation of encountering a mentally ill patient.[5] The perception may hinder the patient-nurse relationship and the quality of care in their future practice.[6,7]

Clinical skills learning tends to focus heavily on the cognitive and psychomotor domains of learning, while paying limited attention to the affective domain. Affective learning refers to the type of learning that relates the students' emotional and belief system with the establishment of attitude and professional value.[8] In mental health nursing education, it is necessary to consider the affective domain to develop the students' empathic understanding and positive attitude towards mentally ill patients.[9] Experiential learning including simulations and the role-playing scenarios have been frequently applied to change students' stigmatized attitudes.[10,11] Studies demonstrated with role-play scenarios of hearing simulated voices provided students with

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greater empathetic understanding of patients with hallucinations.[10, 12, 13]

In the recent decade, the proliferation of Virtual Reality (VR)-based tools adoption in the field of health professions education. Virtual reality is defined as the use of three-dimensional, immersive computer technology to replicate real-life situations.[14] It has expanded exponentially in healthcare education, and may provide a way to simulate a patient's psychological experience into a simulated experience that others can share.[15–21] VR simulation provides an experiential learning for students to better understand how mental health disorders can be and allow them to enter figuratively into the shoes of an individual's experience from mental illness. This learner-centred approach functions on the same basis as the constructivist learning theory which emphasizes one's understanding and knowledge of the world, through experiencing things and reflecting on those experience.[22] Recent VR studies demonstrated that simulating the experience of psychiatric symptoms significantly enhanced the participants' attitudes and empathy towards individuals diagnosed with psychotic disorders and dementia.[22] A literature review on VR simulation in mental health education indicated the potential effectiveness of improving positive attitude and positive learning experience in participants with healthcare backgrounds.[23]

The project aims to examine the impact of a virtual reality-based simulation imitating psychiatric experience to be used in the classroom to enhance undergraduate nursing students' empathy, knowledge and positive attitudes towards mental illness. This study hypothesised that there would be an increase in positive attitudes and empathy towards mental illness after the in-class VR simulation.

2. METHODS

2.1 Setting and sample

A non-probability convenience sample was used. The study was conducted as part of the pre-licensure baccalaureate nursing program at a university in Hong Kong during 2018-2019 semester. Approval was obtained from the university's Institutional Review Board (UW 18-332). The inclusion criteria for the study were (1) participants must be fourth year nursing students who were enrolled in the course Mental Health Nursing, which is a compulsory subject for the pre-licensure baccalaureate nursing program, (2) willingness to participate in the simulation test.

Recruitment occurred during the first week of the course. The course coordinator explained the purpose of the study and that participation was voluntary. A written information sheet was distributed to supplement the information of VR simulation. No penalty was given to the students who did not wish to participate in the study; nor was any compensation provided to those who participated. A total of 159 students consented to participate in this study from the class with 208 students. The participation rate was 76.4%.

2.2 Development of VR simulation

Three VR simulation videos were developed to replicate the lived-experience of patients with psychosis, anxiety disorder, and mood disorder, respectively. Each VR simulation lasted for 5 to 7 minutes. Throughout the VR simulation, the students would experience what the patient sees, thinks, and hears with psychiatric symptoms filled life. The simulation also revealed the unseen difficulties of the clients, such as misunderstanding and stigma from society. All simulation videos were created with the following components to achieve the learning experiences:

- Realistic living environment
- Sensory simulation imitating symptomology of the mental illnesses, such as hallucination, delusion or sensory overload
- Perception, thoughts and feelings as the first person
- The known stigma from society

Two experienced psychiatric nurses designed the video vignettes based on the information from case reports and literature. These psychiatric nurses interviewed patients with psychotic disorder, depression and anxiety disorder to inform the symptoms and experiences presented in the virtual reality simulation. Patients' and mental health expert's opinions developed and revised the drama scripts to more clearly reflect the real status of patient's experiences.

The teaching team also worked with e-learning technology experts from Technology-Enriched Learning Initiative (TELI) to figure out the best way to simulate the experiences that the clients would struggle with. The team used 360 degree VR video shooting to film a number of scenes to explore the standardized patient's life in school, in the restaurant, and at home. A basic VR cardboard, which is a simple affordable paper-made headset for the immersive experience, was used to create the VR environment in a large class.

2.3 Procedure

The VR simulation was integrated into the class of Mental Health Nursing which contained three lectures about psychosis, anxiety disorder, and mood disorder, respectively. Commencing, the students received an hour lecture which provided an overview on various forms of mental illness and relevant information such as signs and symptoms, causes and risk factors. After the theoretic input, the students were engaged in the in-class VR simulation. The students were expected to identify the clinical presentation, perception and

daily difficulties associated with individuals with these disorders. After the exposure to each VR simulation, there was a 15-minute debriefing that focused on discussion and reflection about the experience that the patient encountered, and the student's personal experience towards mental illnesses (see Figure 1). Online discussion platform Mentimeter and the Gibbs reflective cycle were adopted to facilitate the discussion about the feelings and thoughts related to the learning experience, and what they would do differently in caring for these patients in the future.[24]

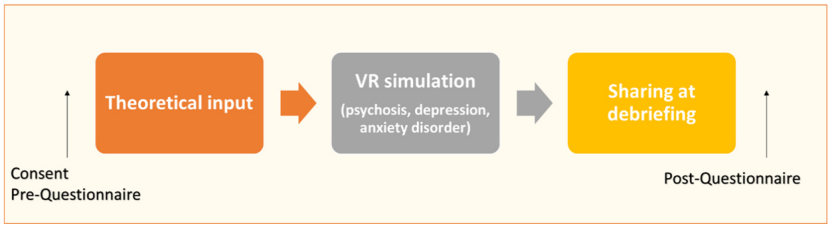

Figure 1. Procedure of VR simulation

2.4 Measures

For standard demographic information, specific characteristics of participants including previous experience of close contact with mental health patients, and receiving relevant mental health training, were collected.

2.4.1 *Chinese-language Empathy Scale in Patient Care (ES-PC)*

The ES-PC is a 23-item questionnaire that measures the level of empathy with three subscale: intellectual empathy (7 items; 5.71% of total variance), affective empathy (7 items; 10.99%), behavioural empathy (9 items; 44.73%). Intellectual empathy describes an individual's capacity to understand another person's feelings and emotions.[25,26] Affective empathy describes an individual affectively feels and internalizes the emotion experienced by another person.[25,26] Following that, behavioural empathy involves the outward expression of understanding the other person's feeling by observable gestures.[25,26] The questionnaire is a 9-point Likert scale, ranging from 9 (Totally agree) to 1 (Totally disagree). The study indicated a good internal consistency with the Cronbach's α coefficients value for the 3 subscales, and the overall scale ranged from .87 to .94. Evidence of concurrent validity also showed a good external validity with test–retest correlation coefficient for the entire scale r = .89.[25]

2.4.2 *Chinese-version Attitudes toward Mental Illness (CAMI)*

CAMI is an 11-item self-report scale questionnaire which examines the negative attitudes and recovery outcomes towards mental illness. The items are scored on a 5-point Likert's scale ranging from 5 (strongly agree) to 1 (strongly disagree), with higher score indicating a more positive attitude towards mental illness. The scorings on item 1-4 are reversed to avoid a response bias. The Cronbach's α coefficients indicated a good internal consistency (coefficient α: .75-.81), and appropriate construct validity and cross validity (χ^2 = 105.31, GFI = .92, IFI = .91, CFI = .91).[27,28]

2.4.3 *Chinese-version Mental Health Knowledge Questionnaire (MHKQ)*

MHKQ is a 20-item self-report true and false questionnaire. The first 16 questions assess the individual basic knowledge of mental health and the remaining items assess the awareness of mental health promotion issues. One point is given for each correct answer. The total score ranges from 0 to 20, with higher scores implying a higher 'mental health literacy'. The psychometric testing showed that the internal consistency of the Cronbach's α coefficients ranges from 0.62 to 0.73.[29,30] The exploratory factor analysis yielded a three-factor solution and covers three aspects of mental health knowledge, including the characteristics of mental health and mental disorders, the epidemiology of mental disorders, and awareness of mental health promotion has Cronbach's α coefficients ranging from 0.62 to 0.67.[29]

2.4.4 *Satisfaction survey*

At post VR simulation, students were served with a satisfactory questionnaire containing six 5-point Likert scale questions and three narrative questions to collect their opinion and feedback to VR simulation. The questions covered a wide range of judgements related to effectiveness of VR simulation education, including learning needs, learning outcomes, resources support, the logistic arrangement, the satisfaction, strength, and weakness of the VR simulation, and the suggestions for improvement.

2.5 Data Analysis

Quantitative data analysis was performed using SPSS version 25. Descriptive statistics were used to provide information about the demographic characteristics of the participants. A series of paired *t*-test was used to explore the change between the baseline and post-test on each dependent variable (empathy, attitude and knowledge) in overall participants

and participants with specific characteristics (close contact with mental health patients, and receiving mental health relevant training). The reliability of the instruments has also been assessed through Cronbach's Alpha to determine the internal consistency. Cronbach (1951) suggested that a Cronbach's Alpha ranges between 0.6-0.7 indicates a fair internal consistency reliability, 0.7 and 0.8 indicates an acceptable reliability coefficient, ranged between 0.8 and 0.9 indicates a good reliability coefficient, and Cronbach's Alpha larger than 0.9 indicates an excellent reliability coefficient.[31]

The narrative feedback collected in the evaluation survey was qualitatively analyzed as outlined by Miles et al.[32] to draw new insight into students' opinion about the VR simulation. All narrative feedbacks were directly entered into the computer. The researcher read and re-read the feedback to gain a sense of wholeness, and thereafter, there would be a line-by-line coding of text according to its meaning and content. The research team then discussed and verified the coding again to ensure it truly reflect the key themes of the responses. The frequency of codes was then counted to identify the most frequently reoccurring themes.

3. RESULT

One hundred and fifty-nine fourth year nursing students taking the course Mental Health Nursing were enrolled in the study of the in-class VR simulation. The students average age was 21.57 (SD 1.12, range 20-29) and the population was female-dominated (69.8%). Thirty-nine percent of the participants had attended mental health-related courses before their participation, and 28.9% of them had close contact with people with mental illness (see Table 1).

Table 1. Demographic characteristics of the participants (n = 159)

Characteristic	Mean (SD)
Age (years)	21.57 (1.12)
Gender	
Male	48 (30.2)
Female	111 (69.8)
Attended mental health related course	
Yes	63 (39.6)
No	96 (60.4)
Close contact with MI	
Yes	46 (28.9)
No	113 (71.1)

The results demonstrated that there was a significant increase in the overall empathy, both behavioral and intellectual empathy after participating in the in-class VR simulation (see Table 2). Moreover, affective empathy displayed no significant difference before and after the in-class VR simulation. The subgroup results also revealed that there was a significant empathy increase in all students regardless of previously attending mental illness training (see Table 3). The subgroup results also revealed that there was a significant empathy increase in the students who had no close contact with mental illness (see Table 4). The ES-PC demonstrated strong internal consistency reliability in total score (α = .92-.94), behavioral subscales (α = .93), affective subscale (α = .92-.93) and intellectual subscale (α = .89-.91) in this study.

Table 2. Mean score of outcome measures (n = 159)

	Pre	Post	*t*	*p*-value	
	Mean (SD)				
Overall ES-PC	150.71 (18.44)	155.31 (17.70)	3.449	.001	***
Behavioral empathy	66.2 (7.81)	69.30 (7.74)	4.274	< .001	***
Affective empathy	43.58 (9.12)	43.54 (9.55)	-0.056	.96	
Intellectual empathy	40.84 (6.17)	42.48 (5.28)	3.556	< .001	***
Attitudes Towards Mental Illness (CAMI) scale	38.10 (4.18)	38.81 (4.01)	1.954	.052	^
Mental Health Knowledge	15.52 (2.40)	16.35 (2.39)	3.633	< .001	***

^$p \approx .05$, *$p < .05$, **$p < .01$, ***$p < .001$

Table 3. Mean score of subgroup: Previous experience in receiving mental health training

	Attended training related to mental illness			
	Yes (n = 63)		No (n = 96)	
	Pre	Post	Pre	Post
	Mean (SD)		Mean (SD)	
Overall ES-PC	151.03 (19.44)	156.22 ** (16.79)	150.50 (17.85)	154.72* (18.33)
Attitudes Towards Mental Illness (CAMI) scale	38.18 (4.5)	38.81 (4.53)	38.04 (3.97)	38.80 (3.66)
Mental Health Knowledge	15.98 (2.43)	16.40 (2.59)	15.21 (2.39)	16.32*** (2.26)

*$p < .05$, **$p < .01$, ***$p < .001$

Regarding attitudes towards mental illness, there was a marginal increase in the improvement on attitudes after the participation in the in-class VR simulation (see Table 2). Interestingly, the students who had previous close contact with mental illness demonstrated a significant increase in attitudes towards mental illness (MD = 1.33, p = .048), while there was no significant increase in the attitude of students who had no previous close contact with mentally ill individuals (p = .295) (see Table 4). The CAMI adopted in the study demonstrated a fair internal consistency reliability (α = .61-.69).

Overall, the result demonstrated that there was a significant increase in mental health knowledge after the students' participation in VR mental health simulation (see Tables 2 & 4).

Table 4. Mean score of subgroup: Close contact with mental health patients

	Close contact with mental patients			
	Yes (n = 46)		**No (n = 113)**	
	Pre	**Post**	**Pre**	**Post**
	Mean (SD)		**Mean (SD)**	
Overall ES-PC	154.65 (20.43)	157.39 (18.59)	149.11 (17.41)	154.47 ** (17.33)
Attitudes Towards Mental Illness (CAMI) scale	37.54 (4.43)	38.87* (3.96)	38.32 (4.07)	38.78 (4.05)
Mental Health Knowledge	15.54 (2.81)	16.22 (2.41)	15.50 (2.23)	16.41*** (2.39)

*p < .05, **p < .01, ***p < .001

The satisfaction questionnaires showed that over 65% of the respondents agreed that the in-class VR simulation was an appropriate pedagogy that met the training needs, and was able to enhance their understanding and attitude towards mental illness. 76% of the respondents expressed satisfaction towards the VR simulation (see Figure 2).

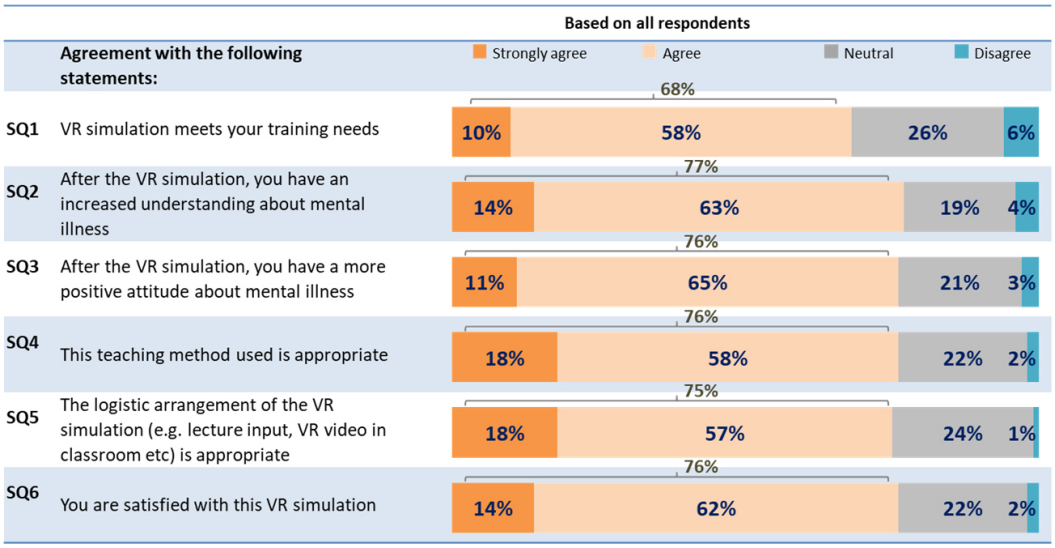

Figure 2. Satisfactory questionnaire

3.1 Narrative feedback

Thirty-five students provided narrative feedback for the in-class VR simulation. The identified themes from the written reflections and the frequency of the most common themes are reported in Table 5.

One predominant theme that emerged was that students found the in-class VR simulation to be interesting and good learning experiences (n = 17). The students' expressions captured are 'very interesting' and 'it made the class more interesting and interactive'.

The second predominant theme was 'get a real understanding of the patient's experience and difficulties' (n = 8). Students reported the in-class VR simulation helped them to gain more understanding of the patient's viewpoint and situation.

One student reported that it is 'good to experience the feelings/thoughts of the patients'. Another student also made a similar statement, 'able to put ourselves into patient's perspectives, knowing and feeling how the signs and symptoms are like'.

Table 5. Identified Themes and Frequency from Written feedback (n = 35)

• Interesting and Good learning experience (n = 17)
• Get a real understanding of patients' experience and difficulties (n = 8)
• Facilitate the learning process (n = 2)
• Consider VR as the future of education (n = 1)
• Technical problems (n = 6)
• Physical discomfort (n = 3)
• Unpleasant experience (n = 3)
• Same as watching a video (n = 3)
• Adding therapeutic communication in VR to equip the communication skill (n = 1)

Two students found that in-class VR simulation facilitated their learning process. They reflected that they found it easy to remember the characteristics, signs and symptoms of the mental illness, as well as understanding how they appeared in reality. One student expressed the importance of VR technology in education, and 'considers VR as the future of education, especially in the medical and nursing discipline'.

On the other hand, there were negative comments received. The predominant theme emerged was technical problems. Students complained that the video took too long to load, and the quality of the video was not good enough. The other theme that emerged was physical discomfort. Three students reported feeling dizzy after the VR simulation. Three students expressed unpleasant experiences including time-wasting and annoying experience to explore VR under the stressful classroom environment. Another three students expressed that the experience was similar to watching the video without VR platform. One student suggested further development in using VR to equip the therapeutic communication skill.

4. Discussion

The current study examined the effectiveness of using in-class VR simulation in mental health education to improve empathetic understanding, and positive attitudes of pre-licensure baccalaureate nursing students. The results demonstrated that the participants endorsed significantly higher scores on overall empathy and attitudes after exposing VR simulation in the classroom. The results supported our study's hypothesis and is consistent with previous research investigating the effect of VR simulation in enhancing empathy and attitudes towards mental illness in health professionals training.[22,23,33] The students also demonstrated significant improvement in the empathy subscales including intellectual and behavioral empathy after the in-class VR simulation. The results reflect that in-class VR simulation might enhance the student's capability into the patient's internal world and affirm their feelings and willingness to employ the behavioural skills, or observable gestures, to demonstrate their empathetic understanding to patients. The qualitative results also echoed the students' engagement in putting themselves into the patient's experiences. These findings support that in-class VR simulation in mental health education might establish student's affective elements related to quality nursing care such as empathy, attitudes and professional value towards mental illness.

The results showed that the students did not change in affective empathy after receiving the in-class VR simulation. Affective empathy refers to emotional engagement, or affectively feeling the same emotions as the client (Williams et al., 2010). Healthcare professionals traditionally preserved affective empathy to avoid over-identification with patients/family, and blurring of the professional boundaries.[34] Recent studies also discovered that healthcare students decreased their affective empathy along the clinical training, so as to preserve their own emotional integrity and the finite cognitive resources required to manage new and complex clinical situations.[35,36] The affective empathy shifted to a greater capacity towards the utilization of cognitive empathy, and thus, the overall empathy declined.[35,36] Interestingly, the result in this study reflected that only students who had previous close contact to people with mental illness significantly improved in positive attitudes towards mental illness (p = .048), while the students who had no previous close contact to people with mental illness showed no improvement in their attitudes towards mental illness (p = .295). This result might indicate that the in-class VR simulation improved the attitudes of students who had pre-existing perception, or were even bias or prejudge towards people with mental illness. Mental illness is highly stigmatized in Hong Kong under the influence of Confucian culture.[37] Previous study found that people with close contact to these patients, such as the caregiver, held intense negative attitudes towards the disorder.[38] Caregivers perceived mentally ill people to be violent and dangerous, as a punishment for past behaviours of the family, or as a reflection of poor discipline in family.[38,39] Close companions were also distressed by patient's disturbing psychiatric disorder, lack of employment, poor treatment compliance, financial burden, and their interruption of social activities.[37,38] The result of this study demonstrates

that VR simulation imitating psychiatric symptoms might be helpful in building positive attitudes towards mental illness among the patient's close companions. Future studies may explore the role of VR simulation in promoting positive and satisfactory attitudes among patient's close companion, such as caregivers.

Students also indicated the negative experiences of VR simulation, which include technical problems and the physical discomfort symptoms, such as cybersickness, which was consistent with the prominent complaints in previous studies on VR education.[40–42] The common symptoms are general discomfort, nausea, vomiting, pallor, and drowsiness.[42] Technical problems and cybersickness hindered the knowledge and skill acquisition, as well as the learner's attitudes towards this technology. The negative aspects may even increase the dropout rate from the immersive learning activities.[42,43] Cybersickness is caused by a mismatch between the sensory systems involved in motion perception. A higher-resolution and high-performance head-mounted VR gear may minimise the cybersickness.[44] This study also revealed other unpleasant experiences during the exposure of VR simulation, such as time-wasting, annoying and disturbing. Students' negative experience was associated with feelings of strain and stress with the use of VR technologies.[45] Meanwhile, the 3D immersive learning environment have been found to be useful to promote better knowledge acquisition, motivation and active engaging in learning,[42,43,46] it is worthy to further explore the factors hindering the use of VR system, and the solutions to minimize the barriers of using VR in healthcare education.

Several limitations were noted in the current study. First, the study used non-controlled and non-randomised design which undermines the validity of the study result. Second, the results were influenced by many external factors; for example, the principal investigator was the teacher who led the in-class VR simulation, this instance might inflate the intervention effect. The attitudes of the faculty administering the in-class VR simulation might also influence the student's response. Third, the VR simulation was arranged after the theoretical input in the course 'Mental Health Nursing'. Thus, it is doubtful if the positive finding was purely the result of the VR simulation, the lecture input, or the interaction effect of the lecture and VR simulation. Fourth, the study did not conduct the usability testing of this newly developed virtual reality experience. The technology acceptance model should be adopted in the study to evaluate the students' perception in the usefulness and ease-of-use of this VR simulation. Future studies with full experimental design are needed to address these limitations.

5. Conclusion

In conclusion, this study suggests that the in-class VR simulation may play a role in enhancing empathetic understanding and positive attitudes towards individuals diagnosed with mental illness. The results suggest that the in-class VR simulation may help students to develop the core nursing competencies necessary to meet the needs of the care. The findings of the current study have significant implications for nursing educators who wish to promote student's affective dispositions with regard to high-quality care in a safe and practical way, as well as for nursing students who are preparing to establish therapeutic alliance and high-quality care in their future practice. The results also inform future research with direction for the development of VR in nursing education to cover the learning objectives in cognitive, affective and psychomotor domains.

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Conflicts of Interest Disclosure

The authors declare that there is no conflict of interest.

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