

Effectiveness of Virtual Simulation on Self-Efficacy, Learning and Self-Confidence among Nursing Students in North India - A Randomised Control Trial

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Abstract

Though use of virtual simulation in nursing started during 2020 due to Covid pandemic, virtual simulation is burgeoning which demands for evidence for its effectiveness. A randomised control trial was conducted among nursing students to study the effectiveness of virtual simulation on self-efficacy, learning, and confidence. Multicentre, randomisation with balanced allocation [1:1], parallel-group study was conducted with 140 students from 2 institutions which were selected by using computer-generated random tables. After pre-test, virtual simulation on Myocardial Infarction Management Bundle (MIMB) was given to experimental group. Post-test was conducted on 32 and 62 of pre-test using self-efficacy scale and modified learning and self-confidence scale. The study findings showed that virtual simulation was more effective in improving self-efficacy ($F=44.591$, $p<0.001$ and $F=111.20$, $p<0.001$) and learning and self-confidence ($f=37.011$, $p<0.001$, $F=104.244$, $p<0.001$) than traditional teaching method.

Key words: Virtual simulation, Myocardial Infarction Management Bundle (MIMB)

The Government, health educators, health managers and the students are always facing challenges in nursing education to ensure the quality and safety of learning and clinical practice. Usage of information and communication technologies (ICT) on day-to-day basis has significantly grown up among students. Professors and managers should remember that these students are able to access information in real time, to use parallel processes and do multitasking. In addition, they prefer graphics to text, function best while networking and need instant gratification and frequent rewards (José M P, 2019).

The students' ICT skills and fast development of technology demands innovation in pedagogical strategies in nursing education (José et al, 2019, Foronda et al, 2020). Today, nursing Professors play the role of learning facilitators rather than lecturers and face students as active learners who are capable of ascribing individual meanings to their own experiences and developing their own knowledge over time (José et al, 2019).

Innovation in simulation is becoming increasingly an essential and desired part of the training of healthcare professionals. Simulation is now

acknowledged in nursing for its potential to support the development of competency in the domains of knowledge, skill acquisition/retention, cue recognition, clinical judgment, and for its potential value related to evaluation and competency testing (Bradley, 2006).

Self-efficacy can be a useful indicator of the performance of nursing students in the clinical setting. Self-efficacy refers to the belief in the capacity of an individual to take appropriate actions to handle a situation in the future. The sense that "I can do" gives the person control over the environment. A rise in self-efficacy can increase self-confidence and independence. Research suggests that satisfaction with work and the intention to continue in a field are enhanced by a solid belief in the self-efficacy of one's practice.

The nursing curriculum helps the student to execute the clinical tasks confidently and effectively within the clinical setting. Hagbagheri et al (2004) have stated that self-confidence and competence are the primary elements that allow students to make informed decisions when it comes to the field of patient treatment. As professors in the field of nursing, we are concerned about influence of newer technologies ie virtual simulation in health field and its impact on students' learning. Thus, a study was conducted on effectiveness of virtual simulation on self-efficacy, learning, and confidence among nursing students in North India.

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Objectives

The study was set with two objectives.

1. To determine the effectiveness of virtual Simulation teaching method on self-efficacy, among Nursing students; and
2. To find out the effectiveness of virtual Simulation teaching method on learning and self-confidence among Nursing students.

Materials and Methods

Trial design was adopted and multicentre, randomisation with balanced allocation [1:1], parallel-group study was conducted among pre-final and final year students from two nursing institutions in northern states of India. The investigators used the computer-generated random number table built by (Haahr, 1998) for selection of states and colleges. Virtual simulation or traditional teaching methods were randomly assigned to the colleges by using lottery method.

A total of each 70 students in virtual simulation group and traditional teaching group were selected using the computer-generated random number table built by (Haahr, 1998).

After getting ethical clearance and informed consent, the pre-test data was collected from eligible nursing students who met selection criteria by using baseline tool, universal self-efficacy scale, modified Chamberlain Learning and Self-Confidence tool. Next day, students in experimental group were assigned to web-based virtual simulation (V Sim) software on Myocardial Infarction Management Bundle (MIMB) developed by Laerdal Medical and Wolters Kluwer, USA, which allows students to

interact with patients in a safe, realistic online environment. The virtual simulation on MIMB was divided into three sessions namely pre-briefing, simulation scenario and debriefing.

In the pre-briefing phase investigators reviewed scenario with students on different aspects of myocardial infarction management bundle. To promote fidelity and clarify expectations, the investigators oriented students to the virtual simulation room prior to the simulation. In the virtual simulation scenario phase the investigator simulated scenes on cardiovascular assessment, monitoring of patient with myocardial infarction, ECG identification of myocardial infarction, laboratory investigations, medical and nursing management of patients diagnosed with myocardial infarction. In debriefing phase investigators help the students to connect actions taken during scenario with the learning outcomes and all 3 sessions lasted for 4 hours.

Students assigned to the traditional method received regular teaching on various aspects of myocardial infarction and its management on the next day of pre-test. Post-test data was collected on day 32 and 62 using the tool from both groups.

Results

Out of 140 nursing students, nearly half of the students (57.1%) were female in virtual simulation group and in traditional teaching, 51.4 percent; gender ratio was nearly equal in both the groups. The average age of students in virtual simulation group 21.36 ± 1.272 years and in traditional teaching group it was 21.30 ± 1.068 years. The academic performance in both was good in previous semester (68.6% & 64.3%) respectively.

Table 1: Mean and SD scores of Self-Efficacy on myocardial infarction management bundle in pre-test (SE1), post-test one (SE2) and post-test two (SE3) among nursing students in both virtual simulation and traditional teaching group through repeated measure ANOVA [n=140 (70+70)]

Self efficacy observation	Virtual simulation group				Traditional teaching group			
	Mean	SD	f value	p value	Mean	SD	f value	p value
SE ₁	31.26	8.651	75.308	0.000 ***	30.57	8.690	1.289	0.279
SE ₂	41.06	8.290			31.04	9.419		
SE ₃	51.90	11.488			32.97	9.673		

Table 2: Comparison of Self-Efficacy mean scores on myocardial infarction management bundle in pre-test (SE1) and post-tests (SE2 & SE3) among nursing students between virtual simulation and traditional teaching group through ANOVA [n=140 (70+70)]

Observation		Mean difference	SE	f value	p value
Virtual Simulation Group	Traditional Teaching Group				
SE ₁	SE ₁	0.686	1.466	0.219	0.641
SE ₂	SE ₂	10.014	1.500	44.591	0.000***
SE ₃	SE ₃	18.929	1.795	111.20	0.000 ***

Table 3: Mean and SD scores of Learning and Self-confidence on myocardial infarction management bundle in pre-test (LSC1) and post-tests (LSC2 & LSC3) among nursing students in both virtual simulation and traditional teaching group through repeated measure ANOVA [n=140 (70+70)]

Learning and self confidence observations	Virtual Simulation Group				Traditional Teaching Group			
	Mean	SD	f value	p value	Mean	SD	f value	p value
LSC ₁	31.33	8.921	63.834	0.000***	31.51	8.686	0.893	0.412
LSC ₂	41.40	9.204			32.10	8.881		
LSC ₃	52.49	12.236			33.41	9.721		

Table 4: Comparison of Learning and Self-confidence mean scores on myocardial infarction management bundle in pre-test (LSC1) and post-tests (LSC2 & LSC3) among nursing students between virtual simulation and traditional teaching group through ANOVA [n=140 (70+70)]

Learning and Self confidence		Mean difference	SE	f value	p value
Virtual simulation group	Traditional teaching group				
LSC ₁	LSC ₁	0.186	1.488	0.016	0.901
LSC ₂	LSC ₂	9.300	1.529	37.011	0.000***
LSC ₃	LSC ₃	19.071	1.868	104.244	0.000***

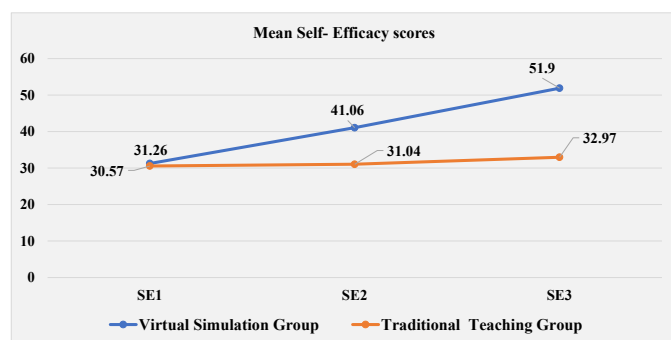


Fig 1: Mean self-efficacy scores of pre- and consequent post-tests of virtual simulation and traditional teaching groups.

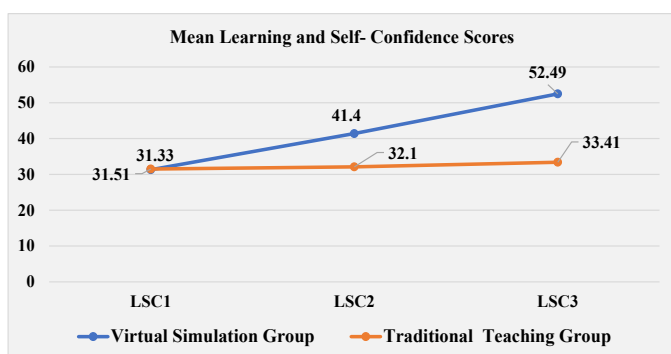


Fig 2: Mean learning and self-confidence scores of pre- and consequent post-tests of virtual simulation and traditional teaching groups.

The results of repeated measure ANOVA (Table 1) revealed that there was significant difference in self-efficacy scores of pre-test (SE₁) and post-test (SE₂, SE₃) self-efficacy scores ($f=75.308$, $p=0.000$) in virtual simulation group whereas no significant difference in self-efficacy scores of pre-test

(SE₁) and post-test (SE₂, SE₃) self-efficacy scores ($f=1.289$, $p=0.279$) in traditional teaching group.

Table 2 revealed that virtual simulation ($f=44.591$ and 111.20 respectively) was more effective in improving the self-efficacy on myocardial infarction management bundle than traditional teaching method at $p<0.001$ level of significance. Hence, virtual simulation was more effective in improving self-efficacy on myocardial infarction management bundle than traditional teaching method.

The results of repeated measure ANOVA (Table 3) revealed that there was significant difference in learning and self-confidence scores of pre-test (SE₁) and post-test (SE₂, SE₃) self-efficacy scores ($F=63.834$, $p=0.000$) in virtual simulation group whereas no significant difference in learning and self-confidence scores of pre-test (SE₁) and post-test (SE₂, SE₃) self-efficacy scores ($f=0.893$, $p=0.412$) in traditional teaching group.

Virtual simulation ($f=37.011$, 104.244 respectively) was more effective in improving learning and self-confidence on myocardial infarction management bundle than traditional teaching method at $p<0.001$ level of significance (Table 4). Hence, virtual simulation was more effective in improving the learning and self-confidence on myocardial infarction management bundle than traditional teaching method.

Discussion

The virtual simulation and traditional teaching approaches are useful tools in teaching learning process. Our results revealed that virtual simulation is more effective in improving self-efficacy, learning

and self-confidence among nursing students than traditional teaching method.

The average age of nursing students in virtual simulation group was 21.36 ± 1.272 and in traditional teaching group it was 21.30 ± 1.068 . Similar findings were found in the study conducted by Salameh (2019) in which majority of the participants were in age range 21-22 years (58.6%). However, present study findings were contradictory to the study conducted by Joseph et al (2015) who reported majority of the participants in the age range between 20 -21 years (40.8%).

This study findings show that majority of the nursing students (57.1%) were female in virtual simulation group and in traditional teaching (51.4%). Salameh (2019) reported similar findings i.e. that majority of the participants were female (53.6%). However, present study findings were contrary to the study conducted by Joseph et al (2015) who reported majority of the participants to be male (55.4%).

Our study also shows that virtual simulation, a pedagogical strategy, combined with other strategies such as pre-briefing, simulation and debriefing, was more effective in improving the self-efficacy ($f=44.591$, $p<0.001$, $f=111.20$, $p<0.001$) and learning and self confidence ($f=37.011$, $p<0.001$, $f=104.244$, $p<0.001$) among nursing students than traditional teaching method both initially and over time. The present study findings were parallel to the many studies conducted by self-efficacy outcomes using a two-group, pre-test and post-test design (Alfes, 2011; Andrighetti et al, 2012; Blum et al, 2010; Brannan et al, 2008; Dykes, 2011; LeFlore et al, 2007; Liaw et al, 2012; Rockstraw, 2006). In all studies simulation group gained more self-efficacy than the control group. Also, present study findings are consistent with the findings reported in previous literature where the self-efficacy of the nursing students improved after the simulation experience (Bowling & Underwood, 2016; Cummings and Connelly, 2016; Mano et al, 2019; Press & Prytula, 2018).

Similar results were found in the study conducted by Chamberlain (2017) who reported significant differences in overall simulation effectiveness, which were significantly higher ($p = 0.000$) with the use of pre-briefing activities compared to no pre-briefing and overall learning were significantly higher ($p = 0.000$) with the use of pre-briefing activities compared to no pre-briefing. Overall confidence were significantly higher ($p = 0.000$) with the use of pre-briefing activities compared to no pre-briefing. The present study is also consistent with several previous studies which reported that simulation improves students' level

of self-confidence and satisfaction with their training (Agha et al, 2015; Omar, 2015; Kim, 2016). The present study is also consistent with study conducted by (Yilmaz & Sari, 2021) in which the mean self-confidence score in the experimental group was significantly higher than that in the control group ($t = 3.741$, $p = 0.001$).

Recommendation

This study recommends that virtual simulation as a pedagogical strategy should be integrated and coordinated with other pedagogical strategies in classes and high-, medium- and low-tech simulators in use in our simulation labs to maximise the development of cognitive, affective, and psychomotor skills as well as self-confidence in nursing students.

Nursing Implications

Virtual simulation is an effective pedagogical strategy in nursing education to improve the acquisition of knowledge, critical thinking, self-confidence and learning in nursing students.

Conclusion

Virtual simulation is a pedagogical strategy that contributes to improve self efficacy and learning and self confidence among nursing students initially and over time. This paper reveals that the impact of virtual simulation use in nursing education, and helps the professor of next generation in nursing to be aware of its pedagogical utility and appropriateness

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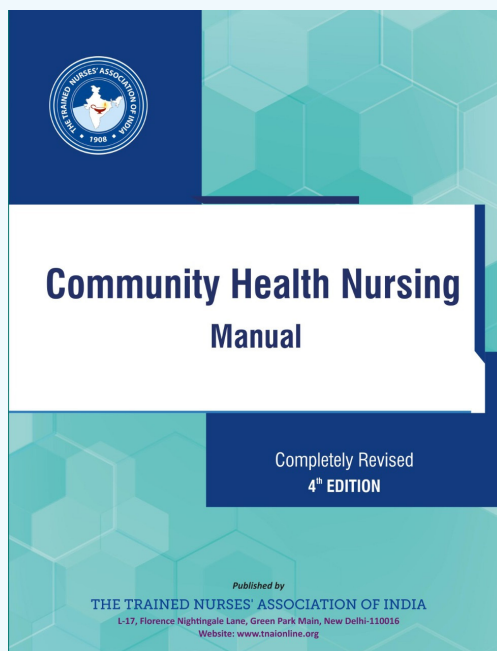
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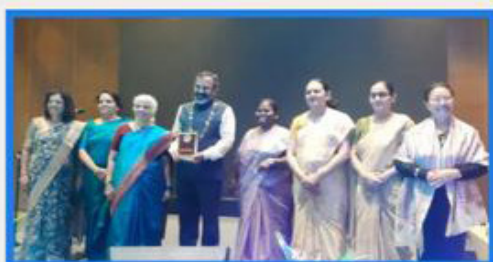
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