The Effect of Using Virtual Reality in Urinary Catheter Insertion Procedures on Nursing Students' Self-Efficacy

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Abstract

Self-efficacy is a person's belief or confidence in doing something. Self-perception related to confidence in the learning process or learning strategy is often called "learning self-efficacy" where it reflects how confident a learner is in achieving certain learning objectives in the context of performing clinical skills of urinary catheterization. In developed countries, virtual reality is proven to be able to increase student self-efficacy but in developing countries there is still limited research. The purpose of this study was to see the effect of virtual reality learning media on the self-efficacy of nursing students in the learning process in Indonesia as a developing country. This research design is a quantitative study with a pre-experiment research design with one intervention group with a pre-test post-test design approach. The sampling technique used was purposive sampling with 49 nursing students of the Faculty of Nursing, Universitas Padjadjaran as samples. The instrument used in this study was the Learning Self Efficacy Scale (L-SES) for Clinical Skills questionnaire consisting of 12 question items. Data analysis was carried out univariately and bivariately using the dependent t-test because the data were normally distributed. The results showed that there was a significant difference between the pre-test and post-test which showed an average increase of 13.65 points. The use of VR learning media in the act of urinary catheterization and static results show a value of $p = 0.001 < 0.05$ it means significantly increase learning self-efficacy. So it can be concluded that virtual reality learning media in catheterization actions have an effect on increasing the self-efficacy of nursing students in Indonesia as a developing country.

Keywords: Nursing students, self-efficacy, urinary catheterization action, virtual reality

Introduction

According to Bandura self-efficacy is a person's belief about his ability to overcome various situations that arise in his life. Self-efficacy is also related to the environment and cognitive conditions that cause one individual's behaviour to be different from another individual (Drama et al., 2020). Self-efficacy can be obtained and learned from several factors including past success experiences, which means that learning results and achievements can determine a person to be able to accept new knowledge, experiences of success achieved by others, in this case the experience of observing others in carrying out an activity, verbal persuasion that comes from the teacher, is rich in knowledge and can be relied upon as information, psychological states and reactions, which means that the feeling of anxiety or calmness that is felt can cause a symptom and affect self-efficacy (Lesmana, 2019). Self-efficacy is one of the most significant supporting aspects in the learning process because it will affect the achievement of learning outcomes (Ningsih & Hayati, 2020). Self-perception related to confidence in the learning process or learning strategy is often called "learning self-efficacy" where it reflects how confident a learner is in achieving certain learning goals in the context, process and strategy (Kang et al., 2019).

The achievement of learning objectives is closely related to Bloom's taxonomy. In this hierarchical structure there are three domains, namely cognitive, affective and psychomotor. The cognitive domain is about mental skills including knowledge and the development of intellectual skills (Handayani, 2020). The affective domain is related to emotions, feelings, and their development. In this domain, Bloom's taxonomy focuses on how people handle it emotionally especially in learning activities (Kang et al., 2019). Then, the psychomotor domain is related to physical skills and their development (Netriwati, 2018). In this case, the self-efficacy measured is self-efficacy in the learning process, especially when performing clinical skills. In practical education, Bloom's taxonomy should be considered as a goal-setting framework for teaching and learning in the education system.

Nursing is part of the national higher education system which aims to produce nursing personnel who are competent in providing health services (Uli & Putra, 2018). On its way, it will be influenced by various demographic diversity systems and accelerative technological developments (Komarudin, 2018). Technological developments will also certainly affect the education system where the system is effective and affects the learning process if it pays attention to the development of health development services and programs in line with the development of Science and Technology in the health sector (Jamun, 2018). Virtual reality (VR) technology has gained significant attention in the healthcare industry and medical education around the world in recently years (Rushton et al., 2020). The field of VR training in healthcare is growing and provides several advantages (Parham et al., 2019). The advantages of this technology are supported by studies stating that VR has been successfully used for the medical field, namely procedural training and team crisis response by surgeons, surgical residents, and military medical trainees (McGrath et al., 2018).

Simulation with VR will provide active learning opportunities by mimicking modern nursing actions that help nursing students gain clinical experience efficiently and develop higher-order thinking skills (Franklin et al, 2020). Research related to VR which is able to increase self-efficacy in students has been carried out in developed countries, but researchers have not found sufficient studies in developing countries including Indonesia, which use VR especially in the world of health education and are proven to be able to increase self-efficacy in nursing students. Developed countries and developing countries have different characteristics (Putri, 2019). The use of VR in Indonesia is still low especially for increasing self-efficacy of nursing students. Based on this phenomenon, researchers are interested in examining the effect of using VR on the self-efficacy of nursing students in the learning process, especially when performing clinical skills related to the installation of urinary catheterization.

Research Methods

This type of research is quantitative research with a pre-experiment approach to determine the effect of VR on learning self-efficacy. Overall this research was conducted from October-December while data collection for this study was carried out in December 2022 for two weeks starting from December 12, 2022 to December 23, 2022. Sample calculation using Windows G*Power 3.1.9.7 to get a minimum sample of 0.5 effect size, 5% probability error, and 0.9 for 1-β probability error. So that the results obtained 44 people for each group. To anticipate the dropout rate, the researcher will add 10% of the total minimum sample so that the total sample for the intervention group is 49 nursing students selected using purposive sampling method, meaning that the sample is selected with certain criteria. The selected sample has received practicum on urinary catheterization, does not have a tendency to experience motion sickness or vertigo. The sample was second to fourth year nursing students because they had learned the installation of urinary catheterization. it was an action that was tested in VR so it didn't take too long for orientation related to the action. The sampling technique used proportional purposive sampling consisting of 49 respondents. Each level chooses a different number of students, so that it is evenly distributed, it is taken according to the percentage of each generation and the results obtained from the Class of 2019 are 14 samples, from the Class of 2020 there are 17 samples and from the Class of 2021 there are 18 samples.

Then students who match the criteria are selected to try using VR and are invited to fill out the Learning Self-Efficacy Scale (LSES) questionnaire for clinical skills adapted from (Kang et al, 2019). This instrument has been proven to be valid and efficient for measuring learning self efficacy. The researcher did a back to back translation in Indonesian to the language center. this instrument consists of 12 questions classified in three domains of cognitive, affective, and psychomotor. The overall score ranges from 12 to 60. the score is obtained from 5 ranges with details of 1 strongly disagree, 2 disagree, 3 less agree, 4 agree, and 5 strongly agree. The higher the score the higher one's learning self-efficacy. The advantage of the LSES for clinical skills is that it has very high validity and reliability (0.91 from Cronbach's alpha (0.7)). But one disadvantage is that it needs guidance for the respondents to fill out the questionnaire correctly. Previous researchers have tested the validity and reliability of this questionnaire.

The researcher gives permission to each classes to join the whatsapp group then the researcher explains the objectives and benefits, research procedures and sends information files related to the consent that must be signed. Then the researcher also provides a gsheet link to make it easier for respondents to fill in the schedule to try VR. Then the respondent will be contacted according to the filled schedule. The respondent came to the virtual lab in the Faculty of Nursing, Universitas Padjadjaran. After that the respondent was given user information, before using VR the respondent filled out a pre-test first and measured his vital signs and then tried VR with the direction of the researcher assisted by one researcher friend. After trying VR the respondent filled out the post-test and measured his vital signs again. The respondent is entitled to a souvenir from the researcher.

As a pre-requisite test, a normality test was carried out to determine the distribution of data using the Kolmogorov-Smirnov test. After the test, it was found that the data was normally distributed where $Sig. > 0.05$ so that the data was analyzed with a parametric test, namely the dependent t-test. Researchers conducted validity and reliability tests on 20 nursing students who were not included in the research sample. After getting that all question items were valid, the researchers conducted data collection. Data collection was carried out for two weeks starting Monday-Friday. The results showed that there was a significant difference between the pre-test and post-test which showed an average increase of 13.65 points. The use of VR learning media in the act of urinary catheterization and static results show a value of $p = 0.001 < 0.05$ it means significantly increase learning self-efficacy.

This study has obtained a letter of ethical review from the Ethics Committee of the

Faculty of Nursing, Padjadjaran University with registration number No. 1005/UN6.KEP/EC/2022.

Results

Characteristics of Participants

Based on table 1, it can be seen that most of the respondents are female, totaling 45 (91.8%). The age of respondents is mostly in the range of 20 years with a total of 19 (38.8%). Most respondents do not have experience using virtual reality, namely. The most common visual impairment suffered by respondents was myopia as many as 24 (49%). Most respondents did not have a previous history of illness. All respondents had no complaints when trying to use virtual reality. A total of 39 (79.6%) of them had psychological disorders such as stress, anxiety, depression or others.

Table. 1 Demographic Characteristics of Respondents

Characteristics of Participant	Frequency (n)	Percentage (%)
Gender		
Female	**45**	**91.8**
Male	**4**	**8.2**
Age		
18	**2**	**4.1**
19	**14**	**28.6**
20	**19**	**38.8**
21	**9**	**18.4**
22	**5**	**10.2**
VR Usage Experience		
Yes, ever	**13**	**26.5**
Never	**36**	**73.5**
Having Vision Impairment		
Myopia	**24**	**49**
Hypermetropia	**1**	**2**
Astigmatism	**3**	**6.1**
None	**21**	**42.9**
Has a history of previous illness		
There is	**8**	**16.3**
None	**41**	**83.7**
Have complaints when trying Virtual Reality		
Yes	**0**	**-**
No	**49**	**100**
Having psychological disorders such as stress, anxiety, depression and others		
Yes	**10**	**20.4**
No	**39**	**79.6**

Study Outcome

Based on table 2, it can be seen that the average (mean) of nursing student self-efficacy pre-test is 36.3265 and has increased in the post-test with a value of 49.9796. The lowest score on the pre-test was 12 and the highest score was 50. While the lowest score on the post-test was 36 and the highest score was 60.

Table 2. Average Score of Nursing Student Self-Efficacy Before and After Intervention

Variables	Mean	SD
Pre-test	36.3265	7.86180
Post-test	49.9796	6.30307

The results of the calculations that have been carried out show that the variables in this study meet the asymp. sig value> 0.05. In the pre-test of the intervention group the asymp. sig value is 0.218 and the post-test in the intervention group the asymp. sig value is 0.154. So it can be concluded that the data in this study are normally distributed. So that the test that can be used in this study is the dependent parametric t-test.

Table 3. Normality Test

	Kolmogorov-Smirnov			
Group	Variables	Statistics	df	Sig.
Intervention	Pre-test	0.080	49	0.218
	Post-test	0.092	49	0.154

Based on the data analysis table above, the paired sample t-test or dependent t-test statistical test was obtained with an asymp. sig value of 0.001. That is, this value> 0.05 so it can be concluded that there is an effect of increasing the self-efficacy of nursing students after being given a learning media intervention using virtual reality in the act of urinary catheterization.

Table 4. Parametric Test of Dependent T-Test

Group	Variables	Asymp.Sig. (2-tailed)
Intervention	Pre-test and Post-test Learning Self-Efficacy	0.001

Discussion

This study was conducted to determine the effect of virtual reality learning media in urinary catheterization on nursing students' self-efficacy. The results of the analysis show that the use of virtual reality learning media in the act of urinary catheterization is proven to be able to increase the self-efficacy of nursing students. Education is a process of the younger generation to be able to run life and fulfill their life goals (Lenggono, 2021). Nursing education is considered an institution that has a major role in creating and developing the professionalism process of nursing personnel. In the context of education, self-efficacy refers to the perceived ability to learn or perform activities at a certain level (Lin & Wang, 2021). Learning self-efficacy was assessed using a modified version of the self-efficacy measure used in a previous simulation study of medical students which included three domains namely cognitive (4 items), affective (4 items), and psychomotor (4 items) (Kang et al., 2019). These three domains are very important in determining the ability of nursing students to become professional nurses in the future. Students who believe in their abilities, they believe they will be able to organize the next steps to achieve learning goals (Siregar & Putri, 2020). Students' perceptions of their abilities that are not enough will lead to a high sense of desire to learn and have a desire to improve their learning process (Sanjaya et al., 2018).

The development of science and

technology that is currently rampant is one of the learning media in nursing education. One of the learning media used in educational institutions is VR for clinical skills. In this study, implementing a VR simulation program designed to assist nursing education in students due to practical restrictions. The action used in VR is the installation of urinary catheterization. Based on the results in table 2, it is known there is an increase in the average before and after the intervention.

In table 4, a t-test was conducted to see the effect of using VR in the act of urinary catheterization on the self-efficacy of nursing students, the results obtained an asymp. sig value of 0.001. That is, the value > 0.05 so it can be concluded that there is an effect of increasing the self-efficacy of nursing students after being given a learning media intervention using VR in the act of urinary catheterization. The results showed that self-efficacy in the learning process, especially in performing clinical skills for urinary catheterization, increased significantly after receiving VR learning interventions.

The results of the study, in line with three previous studies, that learning using VR is able to increase self-efficacy or self-efficacy compared to traditional methods using phantoms (Francis et al., 2020). The use of VR affects student learning achievement so that it affects theoretical knowledge, and skills (Sirakaya & Cakmak, 2018). New challenges in nursing education have encouraged nurses to look for alternative educational modalities such as virtual reality simulations which have been shown to increase student confidence and ability (Rushton et al., 2020).

Experiental learning allows students to develop clinical reasoning through practice with simulation which is recommended in nursing education as preparation for new graduates. Repeated practice on patients in a safe environment is encapsulated in learning using simulation. Deliberate practice can improve the ability of new graduates to recognize emergency clinical patterns in patients and respond to them. This level of deliberate practice is difficult to achieve in high fidelity simulation laboratories due to constraints related to faculty and laboratory availability.

VR simulation offers a solution as students can engage in deliberate practice, increase self-efficacy through cognitive abilities, and experience nursing in a safe environment. VR simulation then contributes to students being more fully engaged in high-fidelity simulation, which incorporates components of teamwork, collaboration, delegation, communication, and clinical skills.

Conclusion

This study shows that VR as learning media in the act of installing urinary catheterization has an effect on increasing the self-efficacy of nursing students. Self-efficacy is very important for nursing students because it affects learning achievement. Students who have good learning achievements will produce competent and professional nurse candidates. Therefore, innovation in the field of nursing education needs to be continuously improved.

Limitation

In this study, of course, there are several limitations, including when filling out the pre-test questionnaire, there were several respondents who were less focused because they were distracted by the crowded virtual laboratory environment because they were waiting in line to try VR. VR that can be used is only 2 pieces while other researchers will also use it so they have to wait and take turns to try it. The virtual reality used occasionally experienced errors, so that respondents had to repeat the action from the beginning and when they were about to start a new action it had to be restarted so that it took a long time. The schedule arrangement when testing virtual reality is irregular, there are days where respondents accumulate in number and there are also days where there are only a few respondents. This is because the respondents' schedules often clash so that rescheduling must be done.

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