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Perceived Effectiveness of High-Fidelity Simulation in the Acquisition of Cognitive, Psychomotor, and Affective Learning in a Department of Nursing in South Korea

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Abstract

This descriptive-correlative study determined students' perception of the effectiveness of High-Fidelity Simulation (HFS) used as a teaching strategy in the acquisition of cognitive, psychomotor, and affective domains of learning at a nursing department in the Republic of South Korea during the Fall and Spring Semesters, Academic Year 2016-2018. Data were statistically treated using frequency and percentage distribution, weighted mean, Cramer's V, and Pearson's Moment of Correlation. The findings of the study revealed that the respondents perceived the use of simulation as highly effective in the acquisition of learning in the learning domains. Moreover, a marked significant relationship existed between the student's perception of the effectiveness of HFS and their year level in the cognitive and affective domains of learning, but not in the psychomotor domain. On the other hand, no significant relationship existed between the student's perception of HFS effectiveness in the three domains of learning and their gender variable, hence, acceptance of the null hypothesis.

Keywords: *High-fidelity simulation, Perceived effectiveness, Acquisition of learning, Cognitive, Psychomotor and Affective learning*

1. Introduction

With the emergence and existence of the global pandemic at this time, coupled with the challenges of nursing shortages, an aging workforce, and increasing patient understanding, particularly in the United States of America [1], the public can be confronted over these hoisted concerns in the delivery of safe and quality health care services. It was also disclosed that in American health care, there has been a significant increase in patient safety alarms, with experts estimating 98,000 deaths each year among hospitalized patients due to medical errors [2]. In the field of nursing education, related safety concerns may also be attributed to the diminishing number and availability of clinical sites [3, 4, 5], the decreasing number of qualified faculty available to educate new nurses [4], and critical reviews of studies (n=26) reported that new graduates having lack of competence on the area of communication, critical thinking and stress management [1]. With this premise, students' learning may be compromised, knowledge and skills may not be guaranteed, and their related clinical learning experiences (RCLE) may be questioned. In this light, researchers in nursing education have observed this gap in the challenges in this field and believe that simulation-based learning as

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a teaching methodology can be a powerful tool. This potential was tested in this research study, for it is apparent that the simulated – teaching platform works well in this regard. Specifically, this study determined the effectiveness of HFS as a teaching strategy for nursing students' domains of learning acquisition among junior and senior nursing students. Assessment of their perception of the efficacy of HFS in the learning acquisition of nursing students in terms of the cognitive, psychomotor, and affective domains was noted, and a significant relationship between the student's perceived effectiveness of HFS and their profile variables was established and tested at 0.01 level of significance.

2. Methods

2.1. Research participants

A total of 124 respondents were randomly chosen out of 166 nursing students who belonged to the Level III & IV students in the Department of Nursing. Locally and globally, nursing remains a female-dominated profession where participants are represented.

2.2. Research instrument

The primary instrument used in data gathering is a content-validated questionnaire with a five-point scale. Students' demographic profiles and 30 behavioral indicators were the major components of the study tool. The domains of learning were divided into three categories with specific examples of behavioral indicators represented, namely: cognitive (12), psychomotor (9), and affective (9) domains of learning.

2.3. Data analysis method

Data were encoded and tabulated using the Statistical Package for the Social Sciences (SPSS) software to analyze and interpret the data quantitatively. The demographic profile was subjected to frequency and percentage distribution. A weighted mean was utilized to assess respondents' perception of HFS effectiveness in the three domains of learning. Lastly, to establish a significant relationship between the students' perceived efficacy and their profile, Cramer's V and Pearson correlation was used.

2.4. Ethical considerations

The Institutional Ethical Review Board (IERB) and the University Research Center (URC) 's permission was sought to conduct this study. Once approval was granted, the researcher asked permission from the departmental head and distributed the questionnaires during their respective class schedules. Clarifications among the participants were addressed accordingly, and their anonymity was assured for the study's purpose.

3. Results

3.1. Overall summary of students' perceived effectiveness of high-fidelity simulation (HFS) in the learning domains

It can be gleaned from the study's findings [Table 1] that nursing students perceived HFS as highly effective in acquiring learning, with the affective domain of knowledge being the highest. This can be attributed to the fact that student respondents can relate better to this

domain in appreciation of their future roles and responsibilities as professional nurses. There is also an extensive share of the early research regarding simulations that focused on the affective domain of the respondents to the pedagogy. Most of the primary research was supported by the meta-analysis of 93 studies conducted between 1969 and 1980, as cited by S. De Young, revealing no significant difference between cognitive gains from simulations compared to other teaching methods but found substantial gains in desired attitudes [6]. Similar results of the meta-analysis of forty (40) quantitative studies by J. H. Kim et al. (2016) showed that high-fidelity simulation and standardized patients had the most significant effect sizes in terms of the affective outcome and cognitive domains of learning [7]. For the other domains of learning, Cant and Cooper's (2017) systematic reviews of simulation-based learning in undergraduate nursing education further supported that simulation improved students' knowledge acquisition, enhancing scores on knowledge and skills examinations [8]. Specifically, nursing students benefitted from HFS in increasing their critical thinking skills and level of confidence after the simulation education [8]. Added to this, Ilgen, J. et al. (2013) systematic synthesis of related studies and evidence regarding technology-enhanced simulation, which included robotic and static mannequins, cadavers, partial task trainers, live animals or animal parts, and computer-based virtual reality simulators, but excluding human standardized patients yielded favorable effects of simulation to outcomes of knowledge, process skills, products, time, learner behavior and patient outcomes [9]. However, these findings of related studies may require further research to determine specific and measurable indicators for the improvement of knowledge and communication skills. This has been included in the recommendations of J. Lee and P. J. Oh (2015) extracted a meta-analysis in a review of 26 controlled studies up to 2014 to determine the effectiveness of high-fidelity human simulation (HFHS) as an educational strategy on the cognitive, affective, and psychomotor outcomes of learning [10].

Table 1. Overall summary of students' perceived effectiveness of high-fidelity

Domains of Learning		Mean	Interpretation	Rank
1	Cognitive Domain of Learning	4.26	HE	3
2	Psychomotor Domain of Learning	4.31	HE	2
3	Affective Domain of Learning	4.36	HE	1
Over-All Mean		4.31	HE	

3.2. Students' perceived effectiveness of HFS on the cognitive domain of learning

Of the 12 behavioral indicators listed in the Cognitive Domain of Learning, the top three highest-ranked items represented the basic foundations of those thinking skills that students can achieve. Students noted this can help them remember and retain previously discussed concepts by their professors and signify their learning in a skill performance. However, among the other listed items, the last two behavioral indicators ranked as the lowest reflected the higher levels of the taxonomy by Benjamin Bloom that involves prioritizing/explaining problems and actions, analyzing, applying, synthesizing, and evaluating decision-making skills [11]. These lowest to highest-ranking items differentiated the levels of cognitive domain learning gains. However, they may be achieved but must be clearly specified and objectively measured in various evidentiary simulation-based research studies that were gathered and mentioned among succeeding research studies.

The following related studies have extended into measuring what was learned from partaking in a simulation. Systematic reviews conducted by R. P. Cant, S. J. Cooper (2017), and S. Lapkin et al. (2010) illustrated that simulation-based learning improved knowledge acquisition, critical thinking skills, level of confidence, and the ability to determine or assess a deteriorating patient [8, 12]. M. H. C. V. Presado et al. (2018) also added to the simulation literature that learning with HFS in Portugal supports this study. This has shown students' competencies in recognizing signs and symptoms but has yet to improve the development of critical thinking with the ability to review, mobilize, and consolidate knowledge to structure clinical reasoning and make decisions for patient care [13]. Moreover, in a quasi-experimental study investigated by E. D. Curl et al. (2016), study results showed that HFS is an effective educational strategy and can be used instead of 50 percent of traditional clinical experiences in the areas of obstetrics, pediatrics, critical care, and mental health nursing [14]. Also, M. S. D'Souza et al. (2017) reported that students in a public university in Oman perceived higher satisfaction and self-confidence in a controlled environment, improving knowledge and performance among critical care nursing students using HFS compared to video [15]. P. Jeffries (2012) further emphasized in this scholarly edition of her book the value of simulation as one of the most effective strategies utilized in academic and service settings [16]. Numerous research studies, systematic reviews, and meta-analyses were cited in her books, with advantages, challenges, and multiple issues of simulation-based learning. They supported evidence on selected learning outcomes of knowledge or skills acquisition, clinical decision-making, teamwork, and confidence in the role of health care professionals.

Table 2. Perceived effectiveness of high-fidelity simulation used in learning acquisition of student nurses in terms of the cognitive domain

Cognitive Domain of Learning		Mean	Interpretation	Rank
1	Recall theories and concepts that provide a basis for skill performance	4.33	HE	1.5
2	Recognize signs and symptoms	4.36	HE	1
3	Interpret assessment and diagnostic data	4.17	E	11
4	Distinguish cause and effect in the performance of skills	4.31	HE	4
5	Recall the rationale for the performance of skills	4.25	HE	7
6	Explain the indication for performance skills	4.28	HE	6
7	Formulate solutions to problems	4.23	HE	9.5
8	Verbalize steps in decision-making to troubleshoot problems	4.15	E	12
9	Prioritize problems and actions	4.30	HE	5
10	Verbalize complications resulting from skill not performed	4.33	HE	1.5
11	Asks relevant questions	4.23	HE	9.5
12	Differentiate ideal conditions from actual situations	4.24	HE	8
General Weighted Mean		4.26	HE	

Legend: 4.20-5.00 Highly Effective (HE); 3.40-4.19 Effective (E); 2.60-3.39 Moderately Effective (ME); 1.80-2.59 Slightly Effective (SE); 1.00-1.79 Not Effective (NE).

3.3. Students' perceived effectiveness of HFS on the psychomotor domain of learning

The top three behavioral indicators, as shown [Table 3], were ranked as the highest, demonstrating the students' preparedness in responding to the given scenarios while performing and communicating with other members of the team. This is supported by systematic reviews conducted by B. N. Harder (2010), wherein most of the studies examined would reveal an improvement in healthcare students' skills with simulation compared to other

teaching methodologies [17]. Also, a meta-analysis of forty (40) quantitative studies by J. Kim et al. (2016) showed that simulation-based nursing educational interventions have strong educational effects, particularly in the psychomotor domains of learning [7], as it requires clinicians to solve problems, work as a team, communicate effectively with their peers and other providers [6], [17], [18]. On the other hand, the ones ranked lowest by the student respondents yielded a lower degree of demonstrating self-confidence and performing skills independently and with proper sequencing in their skill performance. These findings do not conform with M. H. C. V. Presado et al. (2018) study, where students reported their learning experience improved their self-criticism, self-confidence, and valuing communication with the client as a dimension of care [13]. Another recent study in Norway by C. Ollaussen et al. (2019) indicated that active learning increased student satisfaction with the learning activity and self-confidence in managing the simulated patient situation [19].

Table 3. Perceived effectiveness of high-fidelity simulation used in learning acquisition of student nurses in terms of the psychomotor domain

Psychomotor Domain of Learning		Mean	Interpretation	Rank
1	Return demonstrate properly	4.31	HE	5.5
2	Perform skills independently	4.24	HE	9
3	Perform skills with proper sequencing	4.27	HE	7
4	Perform skills on time	4.36	HE	1.5
5	Perform skills in a safe manner	4.36	HE	1.5
6	Perform skills concurrently with interpersonal and communication skills	4.39	HE	1
7	Participate in activities as expected	4.34	HE	4
8	Demonstrate a definite preference for performing the skill correctly	4.31	HE	5.5
9	Display a high degree of confidence and certainty when performing skill	4.25	HE	8
General Weighted Mean		4.31	HE	

Legend: 4.20-5.00 Highly Effective (HE); 3.40-4.19 Effective (E); 2.60-3.39 Moderately Effective (ME); 1.80-2.59 Slightly Effective (SE); 1.00-1.79 Not Effective (NE).

3.4. Students' perceived effectiveness of HFS on the affective domain of learning

As gleaned from [Table 4], aspects with highest weighted mean scores reflected nursing students' appreciation of their future roles as professional nurses. This has been supported by M. H. C. V. Presado et al. (2018) study that enabled students to developto develop and refine behaviors and attitudes and become closer to the responsibilities and values inherent to the profession in the care management [13]. On the other hand, the ones ranked lowest by the respondents may be attributed to limitations on students' learning opportunities in a hospital environment. This may be evident depending on their clinical areas of exposure, wherein there are patient's conditions and significant others who would not allow active interaction with the students [3], where innovations in simulation strategies can be utilized for students enrolled in the Nursing programs [5].

Table 4. Perceived effectiveness of high-fidelity simulation used in learning acquisition of student nurses in terms of the affective domain

Affective Domain of Learning		Mean	Interpretation	Rank
1	Exhibit respect for the dignity of patients	4.31	HE	8
2	Verbalize appreciation for the role of the nurse	4.49	HE	1.5
3	Recognize your own strengths and limitations	4.49	HE	1.5
4	Perform their share in group activities	4.37	HE	4.5
5	Critique positively own performance	4.33	HE	6
6	Critique positively others performance	4.37	HE	4.5
7	Accept feedback on performance in a positive manner	4.40	HE	3
8	Demonstrate resourcefulness & creativity in skill performance	4.30	HE	9
9	Express ideas, thoughts, and beliefs freely	4.32	HE	7
General Weighted Mean		4.36	HE	

Legend: 4.20-5.00 Highly Effective (HE); 3.40-4.19 Effective (E); 2.60-3.39 Moderately Effective (ME); 1.80-2.59 Slightly Effective (SE); 1.00-1.79 Not Effective (NE).

3.5. Significant correlation between students' perceived effectiveness of high-fidelity simulation and their demographic profiles

As depicted in [Table 5], there was a significant relationship that existed between the student's perception of HFS effectiveness in learning acquisition and their year level in the cognitive and affective domains of learning, but no relationship in the psychomotor domain of learning, with the computed Pearson's coefficient r value and p-value. It may be more evident to have higher learning in these two domains among Senior nursing students because of their competitive advantage in terms of their academic learning opportunities and clinical exposures. Regarding the psychomotor domain, all students can be observed as equally engaged in the expected performance of skills and in maximizing their learning from the provided scenarios in this simulation class. On the other hand, [Table 6] did not reveal a significant relationship among gender variables, as correlated using p-value and Cramer's V. This study has shown that nursing students are equally competitive in skills acquisition with the given simulation scenarios and their performance and the three domains of learning regardless of their gender. This is especially true in health-related professions wherein critical skills are essential and expected to be learned and mastered to foster optimal patient care. Simulation of any type, from low-fidelity roleplay to higher mode computerized mannequins, allows students to be involved in a clinical situation that they may not be allowed to participate with actual patients, such as resuscitations or critical events like management of anaphylaxis or shock in an emergency or critical settings [16]. In another study conducted among novice senior pre-licensure nursing students by A. E. Franklin et al. (2015), multiple-patient simulation preparation in terms of expert modeling/intervention and voice-over PowerPoint/active control suggested more significant improvements in self-efficacy compared with traditional reading assignments/passive control but no relationship between change in competence and self-efficacy over a five-week intervention [18]. This is also in conformity with the C. Olaussen et al. study (2019), which provided insights to improve the use of simulation as a learning strategy wherein active learning was associated with satisfaction with the simulation activity, while clear objectives and active learning was associated with self-confidence in managing the simulated patient situation [19]. It can be an efficient learning approach if students actively participate, wherein the faculty members utilize varying methodologies to capture students' enthusiasm in experiencing simulation. B. Bye and J. Davis (2014) stressed that simulation has been concluded as a safe and efficient

teaching method involving active learning, allowing students to correlate theory to practice and vice versa and fostering knowledge synthesis while gaining confidence in clinical skills [20].

Table 5. Correlation between students' perceived effectiveness of high-fidelity simulation and their profile: Year level

Domains of Learning	Pearson's r	p-value	Decision on Ho	Interpretation
Cognitive	0.321	*0.000	Reject	Significant
Psychomotor	0.162	0.071	Accepted	Not Significant
Affective	0.322	*0.000	Reject	Significant
Over-all	0.300	*0.001	Reject	Significant

** Correlation is significant at the 0.01 level of significance*

Table 6. Correlation between students' perceived effectiveness of high-fidelity simulation and their profile: Gender

Domains of Learning	Cramer's V	p-value	Decision on Ho	Interpretation
Cognitive	1.108	0.487	Accepted	Not Significant
Psychomotor	0.047	0.874	Accepted	Not Significant
Affective	0.059	0.804	Accepted	Not Significant
Over-all	0.058	0.802	Accepted	Not Significant

** Correlation is significant at the 0.01 level of significance*

4. Conclusion

For this quantitative method of research, a correlational and descriptive type was utilized to assess behavioral indicators that would signify students' acquisition of learning in the learning domains. Based on the findings of the study, the majority of the female Senior Nursing students perceived the use of High-Fidelity Simulation (HFS) as a teaching strategy in the acquisition of their learning, with the affective domain ranked as the highest and cognitive as the lowest. A significant relationship existed between the student's perception of HFS effectiveness and their year level in the cognitive and affective domains of learning, but no significant relationship in the psychomotor domain. However, acceptance of the null hypothesis was noted on a significant relationship between the students' perceived effectiveness of HFS in learning acquisition on the learning domains and their gender variable. Though the data did not explicitly and comprehensively explain complex issues about the acquired learning of students from various simulation activities, this study may further explore a better understanding of the specific context of students' appreciation of the learning gains in the domains of learning and their learned insights as future professionals.

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