Effectiveness of Simulation Versus Electronic Training Regarding Pediatric Tracheostomy Care on Nursing Students' Knowledge, Skills and Self-efficacy

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Abstract:

Background: Pediatric tracheostomy care requires effective training and specific technical skills and knowledge to ensure child's safety and prevent complications. **Aim:** Evaluate the effectiveness of simulation versus electronic training regarding pediatric tracheostomy care on nursing students' knowledge, skills and self-efficacy. **Subjects:** A convenience sampling of 200 pediatric nursing students. **Setting:** Pediatric Clinical Skills Lab, Faculty of Nursing, Tanta University. **Tools:** Tool (I) Students' Knowledge questionnaire about Tracheostomy. Tool (II) Observational Checklists of Tracheostomy Care. Tool (III) Learning Self-Efficacy Scale. **Results**: No statistically significant difference in students' knowledge was found between simulation and E-training groups at pretest, immediate posttest and one month later. Statistically significant differences were found in the mean scores regarding students' skills and self-efficacy between both groups immediately posttest and after one month. **Conclusion:** Simulation and E-training were effective strategies in improving students' knowledge regarding pediatric tracheostomy care. Simulation is more powerful than E-training in improving nursing students' skills and self-efficacy regarding pediatric tracheostomy care. **Recommendation**: Integration of E-learning with simulation training as a complementary modality, but not as a substitute.

Keywords: Electronic training, Knowledge, Nursing students, Pediatric tracheostomy care, Self-efficacy, Simulation, Skills.

Introduction:

One of the fundamental needs of healthcare systems is to fulfill the needs of pediatric nursing through employing of highly skilled nurses. Thus, the essential roles of nursing education programs are delivering high quality education to nursing students and training proficient nurses who are able to give high quality and safe care for children in the future **(Ghasemi, Moonaghi, Heydari, 2020)**.

In nursing education, creative teaching and learning approaches enable nursing

students to engage in self-regulated learning actively. This can transform conventional one-way education to student-centered learning and teaching style. The innovative approaches support the development of evidence-based healthcare, health informatics, teamwork, communication, introspection, cultural sensitivity as well as critical thinking. **(An, Oh, Park, 2022)**.

Simulation is one of innovative and technologically advanced approaches in nursing education. It helps students develop their clinical competency, confidence, analytical thinking skills and minimizes the errors before working in a real clinical setting. Numerous simulation modalities are used in medical education including full and partial body models with low and high fidelity capabilities, standardized patients and computer-based programs **(Koukourikos, Tsaloglidou, Kourkouta et al., 2021)**.

Teaching through simulation has many advantages but can also present a few challenges in preparing nursing graduates for the future. It allows nursing students to develop skills without risk to patient. It also increases students' self-confidence, lessen anxiety in the real patient care setting, enables them to critically evaluate their own actions, reflect on their skills and criticize the clinical decisions of others **(Baykara & Eyikara, 2018)**.

Nursing education is a significantly impacted by the advancements in information technology. Electronic learning has expanded and currently included into nursing education and training. Electronic learning is a nontraditional method of providing online education and correlates to virtual learning environments using electronic devices to deliver educational course outside of the conventional classroom. It encompasses wide range of online technologies including web-based courses, multimedia resources, virtual classrooms and mobile applications **(Bond, Buntins, Bedenlier et al., 2020).**

The role of instructor in an online environment is different than in a traditional classroom. The emphasize has shifted from imparting knowledge to facilitate and stimulate the learning process. This transition from teacher-centered instruction to learner-centered facilitation needs pedagogical skills as predicting learners' needs, managing interactions, coordinating resources and mastering technologies **(Rose, Ishak, Hamidun et al., 2024).**

Tracheostomy is a life-saving procedure. In children, the indications for it involve congenital anomalies of upper respiratory tract, inflammatory diseases and medical conditions that need prolonged intubation. Nevertheless, there is a significant risk of morbidity and mortality with pediatric tracheostomy **(Kang, Lin, Lee et al., 2022)**. Over 100,000 tracheostomies are now performed annually, including 4,000 in pediatric patients **(Duymaz, Yılmaz, Önder et al., 2021, Watters, 2017)**.

Care of tracheostomy requires a multidisciplinary strategy, especially including nursing healthcare. Proper tracheostomy care requires frequent suctioning, stoma cleaning, periodic tracheostomy tube change, nutrition, and speech therapy. The insertion and

management of tracheostomy are becoming prevalent in critical care units as well as general wards **(Pereira, Silva, Vaz et al., 2020)**.

Innovative teaching learning strategies have a positive effect on students' performance, achievement and self-efficacy. Nursing self-efficacy has been described as the expectations of acquiring the knowledge base and performing the different skills required for education. So, self-efficacy for nurses is crucial to provide quality care, develop their professional identities and improve their performance **(Abusubhiah, Walshe, Creedon et al., 2023)**.

Significance of the study

Pediatric tracheostomy care is an important procedure in pediatric nursing education as proper care reduces the risk of complications which can be life threatening. Therefore, undergraduate nurses should be familiar with the tracheostomy care. This can be achieved by using different modern educational strategies as simulation and E-training those makes the learning experience more effective and help students to be more qualified at real situations.

Aim of the study:

Evaluate the effectiveness of simulation versus electronic training regarding pediatric tracheostomy care on nursing students' knowledge, skills and self-efficacy.

Research hypothesis:

H_1: Simulation training is expected to be more effective in improving nursing students' knowledge and skills regarding pediatric tracheostomy care more than electronic training.

H_2: Students' self-efficacy is expected to be improved after training program using both simulation and electronic training of pediatric tracheostomy care.

Subjects and Method:

Research design: A quasi-experimental research design was employed in this study.

Setting: The study was conducted at the Pediatric Clinical Skills Lab, Faculty of Nursing, Tanta University, a Ministry of Higher Education and Scientific Research affiliated institution.

Subjects: The study included a convenience sampling of 200 Pediatric Nursing students in the third year who was enrolled in the pediatric nursing course from 1/10/2023 to 1/1/2024. The total number of third year students during this period was 530 students so, to ensure adequate statistical power, the sample size was calculated using Epi-info software. The calculation was based on a 95% confidence level, a 5% margin of error, and a 50% estimated population proportion. This resulted in a sample size of 200 students. The recruited sample was then classified as follows:

Group (1): Simulation training group that was consisted of 100 students. They received tracheostomy care training in the Pediatric Skill Laboratory using simulation training on Tracheostomy manikin.

Group (2): Electronic training group was consisted of 100 students. They received tracheostomy care training using electronic application and on-line training using computers. Students were assigned to either the simulation or E-training group via systematic random sampling.

Tools of data collection:

Three data collection tools were used in this study.

Tool I: Students' Knowledge questionnaire about Tracheostomy:

It was developed by researcher to assess students' sociodemographic characteristics and their knowledge about tracheostomy. This questionnaire was comprised of two parts as follow:

Part (1): Students' Sociodemographic characteristics: It encompassed students' age, sex, past experience and previous training related to trachoestomy care.

Part (2): Students' knowledge about tracheostomy: The researcher developed it after reviewing literatures **(Erturgul, Kesici, Bayrakci et al., 2016, Hussein, 2022).** It was used to assess students' knowledge pre and post training course.

It included data about anatomy and physiology of respiratory system, trachea, tracheostomy (definition, indications, and parts of tracheostomy tube), tracheostomy care, and stoma cleaning procedure, appropriate pressure, and duration of tracheostomy suction and best position for tracheostomy tube change.

Students' knowledge scoring system:

-Correct & complete answer was scored (2).

-Correct & incomplete was scored (1).

-Incorrect or don't know was scored (0).

Total score of students' knowledge was calculated and categorized as follow:

- High knowledge level :> 80%.
- Moderate knowledge level: 60% - 80%.
- Low knowledge level :< 60%.

Tool (II): Observational Checklists of Tracheostomy Care:

The researcher developed it after a literature review. **(Qawala, 2017, Bowden & Greenberg, 2016)**. It was used to assess students' practice regarding tracheostomy after training course, it included the following skills: preparation of the equipment & children, tracheostomy suctioning, cleaning tracheostomy opening, changing tracheostomy ties and changing tracheostomy tube.

Scoring system of students' practice:

- Done step scored (1).
- Note done or incorrect step scored (0).

Total score of students' skills was calculated as follow:

- Unsatisfactory practice < 80 %.
- Satisfactory practice ≥ 80 %.

Tool (III): Learning Self-Efficacy Scale (L-SES)

It was developed by **Kang, Chang, Kao et al., (2019)** based on the framework of Bloom's taxonomy to collect data related to students' self-efficacy before and after training course. The items of the scale were answered and completed by the students using a five-point Likert scale ranging from "strongly disagree" to "strongly agree". The scale assessed self-efficacy across three domains: cognitive, affective and psychomotor.

Scoring system of students' self-efficacy:

1 = Strongly disagree.

2 = Disagree.

3 =Undecided – Neither agree nor disagree.

4 = Agree with the statement.

5 = Strongly agree with the statement.

The total scores of students' self-efficacy was calculated and classified into

- High self-efficacy from 60% and more of the total score.
- Low self-efficacy less than 60%.

Method

The study was accomplished through the following steps.

1. **Administrative process:**

Formal permission to collect data was granted by the Dean of the Faculty of Nursing, Tanta University before the study began.

Ethical and legal considerations: -

- Ethical approval was obtained from the Scientific Research Ethical Committee of the Faculty of Nursing, Tanta University. (code no.161-12-2022).
- The study involved no risk of harm or pain to the entire sample.
- Confidentiality and privacy were strictly maintained throughout the data collection and analysis phases.
- All participated nursing students provided informed consent after detailed explanation of the study aim and assured that their participation was voluntary and would not affect their grades. The students were free to withdraw from the study at any time without explanation.

Tools development:

Three tools were utilized for data collection.

Content validity:

The study tools were reviewed for content validity and clarity by a jury of five experts in the field of Pediatric Nursing before conducting the study.

Reliability of tools:

The reliability of data collection tools was assessed using Cronbach's alpha. The resulting coefficients were 0.827 for knowledge and 0.721 for practice, indicating a high degree of reliability.

A Pilot study:

It was conducted on 20 students (10%) of the study sample. Pilot study was excluded from the study because some modifications were done.

Phases of the study: The study was conducted through four phases:

1-Assessment phase:

This phase involved orienting both study groups to the study aim and collecting baseline data, including pre-training assessments of tracheostomy care knowledge and self-efficacy using the study tools (I & III).

2-Planning Phase:

A- Setting of the training course objectives.

B- Preparation phase:

1. Preparation of educational materials for theoretical and practical training in pediatric tracheostomy care.

2. Preparation of the environment. The study was conducted across two distinct modalities: a physical setting (pediatric skills laboratory) and a virtual setting (Microsoft Teams).

3. Preparation of the teaching and training methods. Booklet and pediatric trachoestomy simulator were prepared for simulation group while PowerPoint presentation included combination of text, high quality pictures and videos created by the researcher for electronic training group using Microsoft Teams application.

3-Implementation phase:

Simulation group:

- The researcher divided simulation group (100) students into 5 subgroups. Each subgroup consisted of 20 students**.** The theoretical and practical explanation related to pediatric

trachoestomy care was carried out through 4 sessions for each subgroup of students two sessions / week. Each practical training session was lasting approximately 50 minutes in which the researcher demonstrated tracheostomy care procedure on a manikin and then the students re-demonstrated the procedure steps while, being observed by the researcher.

Electronic training group:

- The researcher divided E- training group (100) students into 5 subgroups. Each subgroup consisted of 20 students. The researcher presented the tracheostomy care training course for each subgroup separately through 4 sessions, two sessions / week. The training sessions was implemented twice / week. The time of each session was about 50 minutes using different methods of teaching as: Power Point presentation contained combination of text and high-quality pictures for theoretical content and videos for practical content that were shared and presented to students for 35 minutes. The researcher allowed discussion and asking questions for 15 minutes at the end of each session.

Teaching sessions for both study groups were as follow:

First educational session: A theoretical session; it focused on anatomy and physiology of respiratory system, trachea, definition, indications and complications of tracheostomy.

Second educational session: A theoretical session that focused on definition, types and basic parts of pediatric tracheostomy tube and caring for a child with a tracheostomy.

Third session: A practical session that started by demonstrating skills including suctioning and cleaning of the tracheostomy.

Fourth session: A practical session that was concentrated on changing tracheostomy ties and changing tracheostomy tube.

4-Evaluation phase:

Students' knowledge related to trachoestomy care and self-efficacy were evaluated three times, pre training, immediately after training and one month after implementation of the training course. Students' skills related to tracheostomy care were evaluated immediately and one month after training. Both groups were evaluated in the pediatric clinical lab using same instruments.

- The collection of data was carried out within 3 months starting from 1-10-2023 and ending at 1-1-2024.

Statistical analysis:

Data were organized, tabulated and analyzed using IBM SPSS software. Qualitative data were presented as numbers& percentages and quantitative as means and standard deviations. Statistical tests included Chi-square test to compare between different groups. ANOVA test to compare between more than two periods. Friedman test to compare between more than two periods. Student t-test to compare between two studied groups. Pearson coefficient to correlate between two normally distributed quantitative variables. Statistical significance was defined at $P<0.05$ (*) and highly significant at $P<0.01$ (**).

Results:

Table (1): illustrates socio-demographic characteristics of the students. The mean age was 21.12 ± 0.48 years in simulation group and

21.15 ± 0.56 years in E-training group. Regarding students' sex, it was evident that nearly two thirds of students (63%) in simulation group and nearly three quarters (72%) in E-training group are female. Most of the students (89% & 92%) didn't have past experience about trachoestomy care in simulation and E-training groups respectively. Also, the majority of the students (91% & 95%) didn't attend any previous training related to tracheostomy care in simulation and E-training groups respectively.

Table (2): represents students' total knowledge regarding pediatric tracheostomy. At pre-test all simulation students had low knowledge level. Following training program ,100% of these students demonstrated high knowledge immediately post-test, which slightly decreased to 96% after one month ($p<0.001$).

Concerning E-training group, it was noticed that 95% of the students had low level of knowledge pretest compared to 96% and 89% had high level of knowledge immediately posttest and after one month from implementation of training program respectively with a high statistically significant difference ($p<0.001$). There was no statistically significant difference between simulation and E-training group pretest, immediately posttest and one month later.

Table (3): illustrates students' total practice regarding pediatric tracheostomy care. It was noticed that, all of students (100%) and 89% of simulation group compared to more than three quarters (87 % & 77%) of E-training group had satisfactory practice immediately posttest and one month after training respectively.

There was high statistically significant difference within the simulation group immediately post training and one month later ($p<0.001$) while there was no significant difference within the E-training group ($p=0.058$). Also, there was statistically significant difference between both groups immediately posttest ($p <0.001$) and after one month ($p=0.024$).

Table (4) represents students' total score of self-efficacy. It was observed that, all of the students (100%) in simulation group had high self-efficacy compared to 96% and 92% of E-training group immediately after and one month after training respectively.

Moreover, there was high statistically significant difference related to self-efficacy within the simulation and the E-training groups ($p <0.001$). Also, there were high statistically significant differences in the mean of total score of self-efficacy between both groups immediately after training and one month later ($p<0.001$).

Table (5) clarifies the correlation between total knowledge and total practice scores related to pediatric tracheostomy care in simulation and E-training groups. A highly statistically significant positive correlation was found in simulation group immediately after training ($p<0.001$) and one month later ($p=0.003$). Also, statistically positive correlation was observed in E-training group immediately after and one month after training ($p=0.024$) ($p=0.002$) respectively.

Table (1): Percentage Distribution of the Studied Students According to Sociodemographic Characteristics (n=200).

Socio demographic characteristics	Simulation group (n =100)	E-Training group (n =100)
Age		
Mean ± SD.	21.12 ± 0.48	21.15 ± 0.56
	%	**%**
Sex		
Male	37	28
Female	63	72
Past experience about trachoestomy care		
Yes	11	8
No	89	92
Previous training related to trachoestomy care		
Yes	9	5
No	91	95

Table (2): Total Scores of the Studied Students' Knowledge Regarding Pediatric Tracheostomy

Total score of students' knowledge about tracheostomy	Simulation group (n =100)				E-Training group (n =100)				Pretest	Immediately posttest	1 month posttest
	Pretest	Immediately posttest	1 month posttest	Test of sig. (p_0)	Pretest	Immediately posttest	1 month posttest	Test of sig. (p_0)	χ^2 (p_1)	χ^2 (p_2)	χ^2 (p_3)
	%	%	%		%	%	%				
Low (<60 %.)	100	0	0	**Fr.=197.474 (<0.001**)**	95	0	0	**Fr.=193.241 (<0.001**)**	**5.128 (0.059)**	**4.082 (0.121)**	**3.532 (0.060)**
Moderate (60% - 80 %.)	0	0	4		5	4	11				
High (> 80%.)	0	100	96		0	96	89				
Mean ± SD	15.54 ± 3.42	34.64± 1.27	33.21 ± 2.07	**F=2173.15 (<0.001**)**	15.39 ±3.23	33.94± 2.08	32.23± 2.59	**F=1796.678 (<0.001**)**			

Fr: Friedman test F test (ANOVA) with repeated measures
p_0: p value for comparing between the same group
p_1: p value for comparing between both groups pretest
p_2: p value for comparing between both groups immediately posttest
p_3: p value for comparing between both groups post 1 month
*: Statistically significant at $p < 0.05$
**: Highly Statistically significant at $p < 0.0001$

Table (3): Total score of the studied students' practice regarding pediatric tracheostomy care

Total score of students' practice	Simulation group (n =100)		E-Training group (n =100)		Immediately posttest	1 month posttest
	Immediately posttest	1 month posttest	Immediately posttest	1 month posttest	Test of sig. (p_1)	Test of sig. (p_2)
	%	%	%	%		
Unsatisfactory	0	11	13	23	χ^2= 13.904 (<0.001**)	χ^2= 5.103 (0.024*)
Satisfactory	100	89	87	77		
	McN= 11.640 (p_0 =0.001**)		McN= 8.028 (p_0 =0.052)			
Mean ± SD	100.6 ± 3.38	94.73 ± 6.85	92.51 ± 5.25	90.81 ± 8.08	t=12.883 (<0.001**)	t=3.702 (<0.001**)
	t2= 12.972 (p_0 <0.001**)		t2= 1.917 (p_0 =0.058)			

p_0: p value for comparing between Post immediately and Post 1 month in same group
p_1: p value for comparing between both groups immediately posttest
p_2: p value for comparing between both groups post 1 month
*: Statistically significant at $p \leq 0.05$
**: Highly Statistically significant at $p < 0.0001$

Table (4): Percentage Distribution of the Studied Students According to their Total Score of Self-Efficacy

Total score of Self-Efficacy	Simulation group (n =100)			E-Training group (n =100)			Pretest	Immediately posttest	1 month posttest
	Pretest	Immediately posttest	1 month posttest	Pretest	Immediately posttest	1 month posttest			
	%	%	%	%	%	%	Test of Sig. (p_1)	Test of Sig. (p_2)	Test of Sig. (p_3)
Low	100	0	0	100	4	8	–	χ^2=4.082 (0.121)	χ^2=8.333 (0.007**)
High	0	100	100	0	96	92	–		
	Fr.= **200.00** (p_0 <0.001**)			Fr.= **184.333** (p_0 <0.001**)					
(Mean ± SD.)	25.88 ±4.14	52.25 ± 3.11	50.88 ±3.01	25.57 ±3.62	47.55 ± 3.24	45.74 ±2.90	t= 0.564 (0.574)	t= 10.458 (<0.001**)	t= 12.297 (<0.001**)
	F= **2260.606** (p_0 <0.001**)			F= **1702.705** (p_0 <0.001**)					

p_0: p value for comparing between the studied periods in same group
p_1: p value for comparing between both groups **pretest**
p_2: p value for comparing between both groups **immediately posttest**
p_3: p value for comparing between both groups **post 1 month**
*: Statistically significant at $p \leq 0.05$
**: Highly Statistically significant at $p < 0.0001$

Table (5): Correlation between Total Knowledge and Total Practice scores Related to Pediatric Tracheostomy Care in Simulation and E-Training Groups.

		Post immediately	Post 1 month
		Total Practice	Total Practice
Simulation group			
Total knowledge	r	0.391	0.290
	p	<0.001**	0.003**
E-training group			
Total knowledge	r	0.226	0.309
	p	0.024*	0.002**

r: Pearson coefficient *: Statistically significant at $p \leq 0.05$
**: Highly Statistically significant at $p < 0.0001$

Discussion:

Tracheostomy is one of the oldest and most often performed surgical procedures on critically ill children. Proper tracheostomy care is crucial and nurses are the front-line healthcare providers in pediatric tracheostomy care. There is evidence suggesting that adequate students' training regarding management of tracheotomies can improve patient comfort, decrease the need for sedation, lower the risk of laryngeal injury, accelerate weaning from the ventilator and shorten hospital stay **(Hussein, Mahmoud, Abd El-Salam et al., 2022, Mosalli, Aboumoustafa, Khayyat et al., 2022)**.

Concerning students' knowledge about tracheostomy, the results of the current study showed that students in both studied groups had low level of knowledge before training. There was no significant difference between the two groups before teaching interventions. It may be attributed to that the vast majority of the students didn't receive any training course about tracheostomy care before and hadn't any experience about trachoestomy care.

This result was matched with **Malk, Fahem, Soultan et al.**, (**2022)** who studied "effectiveness of training program regarding tracheostomy care on nurses' performance at intensive care unit" and clarified that majority of nurses in their study had unsatisfactory level of knowledge regarding tracheostomy care preprogram implementation.

The results of the present study demonstrated that there was significant improvement in the knowledge regarding tracheostomy in simulation group immediately after and one month post training course with a statistically significant difference within the group. This may be due to frequent students' interaction and repetition also immersing students in realistic contexts through simulation bridge the gap between theory and practice leading to more effective knowledge acquisition and long-term retention.

The result of the current study was in harmony with **Abdou & Abass (2021)** who studied " effect of high-fidelity simulation on nursing students' knowledge and skills regarding assessment and nursing intervention of acute coronary syndrome" and revealed that a statistically significant differences between the pretest and posttest in the level of knowledge of nursing students after application of high-fidelity simulation.

Also, **Parmar & Vaidya (2022)** agreed with the present study. They conducted "a comparative study of teaching approach nursing simulation vs group discussion on respiratory assessment in terms of knowledge and critical thinking abilities among nursing students of selected colleges of Kheda–Anand district" and showed that after implementation of simulation there was significant change in post-test knowledge and critical thinking abilities regarding respiratory assessment among the students.

The findings of the present study demonstrated that there was significant improvement in the knowledge regarding tracheostomy in E-training group immediately after training and one month after training course with a statistically significant difference within the group. This may be due to educational content was produced in small sections so, it is easier to memorize and could be easily saved on electronic devices and frequently repeated for refreshment of knowledge.

The current findings were consistent with **Shah & Stefaniak (2018)** who studied" A review of the effectiveness of e-learning on knowledge and skill acquisition in medical education" as they reported that there was a statistically significant effect of e-learning on the learners' knowledge.

Concerning total score of knowledge in simulation and E-training groups, the findings of the present study revealed that there was no significant difference existed between simulation and E-training groups immediately posttest and one month after teaching interventions. This can be attributed to the effectiveness of modern teaching methods in delivering knowledge easily and facilitating the process of storing information and preserve knowledge in long term memory.

This result was matched with **Moore (2016)** who studied "Interprofessional Patient Simulation Training Compared to Online Training for learning to use In-Line Speaking Valves" and showed that interprofessional teams in online and simulation training groups gained equivalent knowledge across time without group differences.

Regarding students' practice related to tracheostomy care in simulation group, the current study revealed that all of student had satisfactory practice regarding tracheostomy care immediately after teaching strategy. This may be due to the positive effect of simulation as a teaching method on students' practice as it offered a high level of realism and enabled students to develop technical skills, improve teamwork and enhance confidence in a safe and controlled environment.

These results were supported by **Shah, Cusumano, Ahmed et al. (2020)** who studied "in situ simulation to assess pediatric tracheostomy care safety: a novel multicenter quality improvement program" and founded that in situ simulation can be used to identify and reassess latent safety threats related to pediatric tracheostomy management and thereby support quality improvement and educational initiatives.

Regarding students' practice related to tracheostomy care in E-Training group, the current study revealed that more than three quarters of the students had satisfactory practice and less than one quarter had unsatisfactory practice of tracheostomy care immediately after teaching strategy. This may be due to students had the opportunities to access content frequently. This

continuous learning approach contributes to better skill retention. Also, the availability of videos demonstrating the procedures enable repeated playback and review of the procedure.

The result of the present study was matched with **Guy & Lownes-Jackson (2015)** who conducted a study entitled" The use of computer simulation to compare students' performance in traditional versus distance learning environments" and reported that the majority of students were able to demonstrate the competency of their abilities with more than half of the sample population recieved a grade average of C or better on each application.

The finding of the present study revealed that there was statistically significant difference between simulation and E-training groups regarding students' practice related to tracheostomy care. A possible explanation of this result is that students in the simulation group benefitted from face-to-face lectures, demonstrations and redemonstration with the researcher and also because of sharing discussion and peer support during clinical training. These different methods of communication aren't available in the E-learning method.

This result was supported by **Guy & Lownes-Jackson (2015)** who found that there were significant differences in student performance when comparing the traditional format with the fully online method of instruction using computer and showed that students in the online group did not perform as well as their counterparts in the traditional group. On the other hand, **Linder & Weissblueth (2023)** who studied " Impact of Simulation Training-Comparison Between Face-to-Face and Online Learning" weren't in the same line with the present study and founded that no significant differences were found in learning outcomes for face-to-face simulation and online simulation.

Concerning self-efficacy of students in simulation group the current study revealed that there was statistically significant improvement of students' self-efficacy in simulation group throughout immediate post and one month after training compared to pretraining phase. This explained as more knowledge and hands-on experience gained through simulation training contributed to skills proficiency and high self-efficacy.

This finding was supported with **Mohamed & Fashafsheh (2019)** who studied "the effect of simulation-based training on nursing students' communication skill, self-efficacy and clinical competence for nursing practice" and revealed that the mean scores on the self- efficacy scale were increased following the simulation in comparison to the baseline assessment.

On the other hand, **Karabacak, Unver, Ugur et al. (2019)** were contradicted with the present study as they conducted a study entitled " examining the effect of simulation-based learning on self-efficacy and performance of first-year nursing

students" and found that self-efficacy scores decreased in the post-simulation scenario and using standardized patients in simulation training enables new nursing students to meet a real patient and to identify their own true self-efficacy.

Concerning self-efficacy of students in E-training group the current study revealed that there was statistically significant difference improvement of students' self-efficacy in E-training group throughout immediate post and one month after training course compared with pre training phase. This result may be attributed to the possibility of repetition of the videos and electronic content that helps to acquire, revise and retraining that promote self-efficacy of the students.

This result was supported by **Delıta, Berutu, Nofrıon et al. (2022)** who studied" Online learning: The effects of using e-modules on self-efficacy, motivation and learning outcomes " and showed that the using of e-module in online learning resulted in significant increases in self-efficacy, motivation, and learning outcomes also, the e-modules with the collaborative learning option was most effective teaching method.

The present study showed that there was statistically significant difference in the mean scores related to self-efficacy between simulation and E-training groups immediately after and one month after training course. These results may be due to that simulation method provides immersive and hand on experiences that closely mimic real scenarios. This helps students develop confidence in their ability to perform task correctly. Unlike E-training which is often focused on theoretical knowledge and passive content delivery.

These results were in the same line with **Choi, Lee, Jeon et al. (2020)** who studied " efficacy of the computer simulation-based, interactive communication education program for nursing students" and revealed that the simulation-based education group significantly improved communication knowledge, learning self-efficacy, and communication efficacy compared to computer -based education and these effects were maintained at two weeks.

Regarding correlation between total knowledge and total practice related to tracheostomy care in both groups. The current study revealed that there was statistically positive correlation between total knowledge and total practice in both groups immediately and one month after training. It may be due to that simulation and E-training improved nursing students' knowledge and practice regarding trachoestomy care and promoted both knowledge retention and the practical application of skills.

A study of **Akl, Farrag, Gaber et al. (2023)** about "effectiveness of TRACHE care bundle implementation on the pediatric nurses' performance and improving pediatric tracheostomy management safety" were in the same line of the present study and found that a statistically significant positive

correlation between the total practice level and the overall degree of knowledge held by nurses.

Conclusion:

The study concluded that both simulation and electronic training effectively improve nursing students' knowledge and self-efficacy related to pediatric tracheostomy care. Simulation training was significantly more effective than E-training in improving students' skills.

Recommendations:

Based on the findings of the present study, the following recommendations are suggested:-

- Integration of E-learning with simulation training as a complementary modality, but not as a substitute.
- Simulation should be used as an evidence-based educational strategy to address and possibly reduce the theory practice gap for undergraduates during clinical practice.
- Establishing comprehensive staff development programs about simulation-based learning for students.

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