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EFFECT OF COMPUTER-BASED LEARNING VERSUS TRADITIONAL METHODS ON PEDIATRIC NURSING STUDENTS' PERFORMANCE REGARDING CARDIOPULMONARY RESUSCITATION

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Abstract

Background: Learning using computer can boost motivation during the learning process, provide students with direct feedback, and allow them to accept and solve difficulties individually. Additionally, students will engage in real-world learning, which will improve their educational process. Aim: This study aims to evaluate the effect of computer based learning versus traditional methods on pediatric nursing students' performance regarding cardiopulmonary resuscitation. Design: An experimental design. Sample: A purposive sample included 62 third-year nursing students. Setting: The study was carried out in the pediatric clinical skill laboratory and computer laboratory at Abo- Homos Technical Nursing School. Tools: Tool I: A pre-designed questionnaire sheet to assess student's characteristics and assess their knowledge regarding pediatric cardiopulmonary resuscitation (pre/post) using computer-based learning versus traditional methods, Tool II: Observational Checklists (post/follow up) used to assess the pediatric nursing students' practices toward applying the steps of cardiopulmonary resuscitation. Results: This study revealed that more than three- quarters and less than three-quarters of students had poor total knowledge pre-using computer learning versus traditional method, while most of and more than two-thirds of students had good total knowledge post-using computer-based learning versus traditional method with statistically significant differences, and indicated that the majority and more than two thirds of students had competent total score level of practices post and follow up using computer-based learning versus traditional methods with statistical significant differences . Conclusion: The present study concluded that computer-based learning is more effective than traditional teaching methods on pediatric nursing students' performance regarding cardiopulmonary resuscitation. Recommendation: Continuous training program for pediatric nursing students to acquire computer – based learning as a learning strategy in their education and computer based learning should be incorporated as a method of teaching in nursing education.

Keywords: Cardiopulmonary resuscitation, Computer-based learning, Traditional method, pediatric nursing, Students performance.

Introduction

The hallmark of pediatric cardiac arrest is an abrupt stop to cardiac activity, which is defined by the cessation of cardiac activity. It causes unresponsiveness, including irregular breathing and lack of circulatory signals. In most cases, cardiac arrest results in death in a matter of minutes. Children are less likely to experience cardiopulmonary arrest as their primary cardiac event. The most common cause of cardiac arrest in children is respiratory failure or apnea, which results in bradycardia and pulseless electrical activity. (Priscilla et al., 2020).

A serious public health concern, in-hospital cardiac arrest nearly results in a child's death. Although the prevalence of In-Hospital Cardiac Arrest (IHCA) is not well known worldwide, the United States and Europe record close to a million cases of pediatric cardiac arrest annually. Similar estimates place the number of infants who suffer cardiac arrest at 2– 6% of those admitted to Pediatric Intensive Care Units (PICUs). Younger children or newborns account for about 60% of cardiac arrest cases in the pediatric population (Morgan et al., 2022).

Diverse treatment strategies are used globally to reactivate heart activity and raise the likelihood of survival for children experiencing cardiac arrest. One strategy that was put into practice in 1966 with clear, documented procedural guidelines is cardiopulmonary resuscitation (CPR), which consists of chest compressions, artificial ventilation, and basic airway management with the goal of supplying oxygen and nutrients to the heart, brain, and lungs— the body's three main organs (Herce et al., 2022).

In order for nursing students (NSs) to be capable of practicing independently as nurses, they must possess the cognitive, emotional, psychomotor, and confidence levels that come with nursing education. This is also a

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prerequisite for getting nurses with the appropriate degree of competency in nursing practice standards to provide safer and higher – quality patient care in light of evolving health care needs (Grizioti & Kynigos, 2020).
As computers have been more widely available and the internet has become more easily accessible. Computer-Based Learning (CBL) has gained popularity as a valid teaching strategy and is gradually displacing more conventional teaching strategies like lectures and textbooks. With the use of computers and other electronic devices, CBL was created to deliver educational content through the use of information and communication technologies. This includes anything from the simple display of lecture slides to the integration of content into virtual learning environments (Sun et al., 2022).

Aim Of The Study

This study aims to evaluate the effect of computer based learning versus traditional methods on pediatric nursing students' performance regarding cardiopulmonary resuscitation.

SUBJECTS & METHODS

I. Technical Design: Design:
An experimental research design.

Setting:
The study was carried out in the pediatric clinical skill laboratory and computer laboratory at Abo-Homos Technical Nursing School, affiliated to the Ministry of Health.

Subjects:
A purposive sample included 62 third-year nursing students enrolled in pediatric nursing during the second semester of the academic year 2022-2023, divided randomly and equally into two groups over a 6-month period.

Tools of data collection:
Tool I - Pre-designed Questionnaire sheet: It was designed by the researcher after reviewing the related literature and reviewed by supervisors. It included the following parts:
Part 1: Students' Characteristics: Such as age and residence.
Part 2: Students' knowledge: Regarding pediatric CPR (pre/post) using CBL versus traditional methods. It was comprised 47 questions in the form of six main groups of questions namely; pediatrics cardiac arrest (9 item), pediatrics CPR (8 items), assessing pulse and breathing (7 items), ventilation and rescue breaths (3 items), chest compression and external defibrillator device (14 items) and nursing care during CPR (6 items)

Scoring system:
The students' knowledge was checked with model key answer; the correct answer was scored one mark to each question and the incorrect answer was scored zero. In this respect the total score of student knowledge was 47 mark which equals 100%. Accordingly, these scores were summed and converted into a percent score as the following categories:

- Good level of knowledge if the score ≥75%,
- Average level of knowledge if the score from 60 - < 75%,
- Poor level of knowledge if the score < 60%.

Tool II: Observational Checklists (post/follow up)
It was adopted from American Heart Association, (2020), to assess the pediatric nursing students' practices toward applying the steps of CPR. It was contained seventy-six (76) steps, which divided into nine main procedures. These nine main procedures namely: before performing pediatric CPR (9 steps), during performing CPR for children (12 steps), during performing CPR for infant (12 steps), after performing CPR (4 steps), emergency automated external defibrillator (16 steps), choking relief for a responsive child (4 steps), choking relief for an unresponsive child (5 steps), choking relief for a responsive infant (9 steps) and choking relief for an unresponsive infant (5 steps).

Scoring system:
The scoring system of the student's response. Two marks if the step done correctly, one mark if the step done incorrectly, and zero if the step not done. The total score of students practices was 152 marks which equals 100%. these scores were summed and converted into a percent score and clarified as the following:

- Competent practice, if the score ≥85%.
- Incompetent practices if the score < 85%.

Operational Design:

Preparatory Phase:

This phase included reviewing the available literature and different studies related to pediatric CPR and theoretical knowledge of various aspects of the study, using textbooks, evidence- based articles, websites, periodicals, and journals to prepare the tools for this study.

Content Validity:

Tools of data collection were tested and evaluated for their content validity by a panel of three experts from pediatric nursing staff from the Faculty of Nursing /Ain Shams University. Their opinion was elicited regarding the format, layout, clarity, relevance, comprehensiveness, applicability, and relevancy of study tools. Accordingly, the required corrections and modifications were performed.

Reliability:

Internal consistency reliability of all items of the tools was measured using Cronbach's alpha coefficient. It was 0.929 for the knowledge questionnaire sheet and 0.937 for observational checklists. These indicate a high degree of reliability for the study tools.

Ethical Considerations:

Ethical approval of the study was obtained from the Scientific Research Ethical Committee of the Faculty of Nursing /Ain Shams University. An oral consent was obtained from pediatric nursing students, explaining the aim of the study to the students to take their permission to do the study and ensure each participant approved to be involved in the study.

Pilot Study:

A pilot study was conducted to test the clarity and applicability of the study tools and to estimate the time needed for each tool, it was done on 10% (6 students) of the total pediatric nursing students. Pediatric nursing students included in the pilot study were later excluded from the main study sample to avoid sample bias and contamination.

Filed Work:

The process of data collection was carried out through six academic months which extend from January until July 2023 for third-year pediatric nursing students. A random sample of 62 students was selected by posting the inclusion criteria (third-year pediatric nursing students, who don't have previous experience with pediatric CPR, have computer skills, and have smartphones). Then 62 students were equally randomly assigned to either the study group that received the computer-based learning method and the control group that received the traditional learning method.

1: Preparation Phase:

Content: Theoretical content for CPR was selected and organized guided by the pediatric Nursing Procedures Manual& Book.

The theoretical content of the CBL module was identical to that of the traditional teaching method.

The scientific content regarding CPR was converted into a PowerPoint data show and accompanied by a summative text, static pictures, and 3D video, which was uploaded to the website, this formed the basis of web-based education procedures, to stimulate interest and promote learner's engagement.

The CBL module was composed of a pediatric CPR demonstration video, PowerPoint presentation, and checklists. Two instructional resources were developed, aimed to fulfill the CBL module.

Environment: The study was conducted in two settings:

A. the pediatric clinical skill laboratory contains; a pediatric CPR mannequin, equipment, and supplies.

B. Computer laboratory; the computers were checked for their efficiency, adequate numbers, and application of the CPR module.

Students: The researcher was available at Abo–Homos Technical Nursing School four days/ weeks from Sunday to Wednesday according to their academic schedule from 8:00 AM and extended to 3:00 PM. At the beginning of the interview; the researcher welcomed available students, explained the purpose, duration, and activity of the study, and took their oral approval to participate in the study before data collection. Then the researcher assessed the pediatric nursing student's level of knowledge and practices.

2: Implementation Phase

The implementation phase was achieved through eight sessions over five weeks, each session started with a summary of the previous session and the objective of the new one. These sessions were repeated for each group. (four days for one group) and finish two groups every week. Each group of studied students was divided into 3 subgroups; each group consisted of 10 -11 students.

3: Evaluation Phase

Knowledge related to CPR was evaluated for all students in both groups over four weeks. A posttest was used to evaluate the students following the teaching sessions. Practices related to CPR were evaluated for all students in both groups immediately after the implementation, and follow up after three months. The comparison between the two groups was done to evaluate the effect of computer-based learning versus traditional methods on pediatric nursing students' performance regarding CPR.

Administrative design:

An official letter was taken from the Dean of the Faculty of Nursing, Ain Shams University to the director of Abo–Homos Technical Nursing School. A clear explanation was given about the nature, aims, importance, and expected outcomes of the study.

Statistical analysis:

The collected data were organized, coded, computerized, tabulated, and analyzed by using the Statistical Package for Social Science (SPSS) version (28). Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage. The following tests were done: The Chi-square, Paired t-test, and Pearson's correlation coefficient (r) test. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant.

Results

Figure (1): Percentage distribution of the studied students using computer -based learning method and traditional method according to their age.

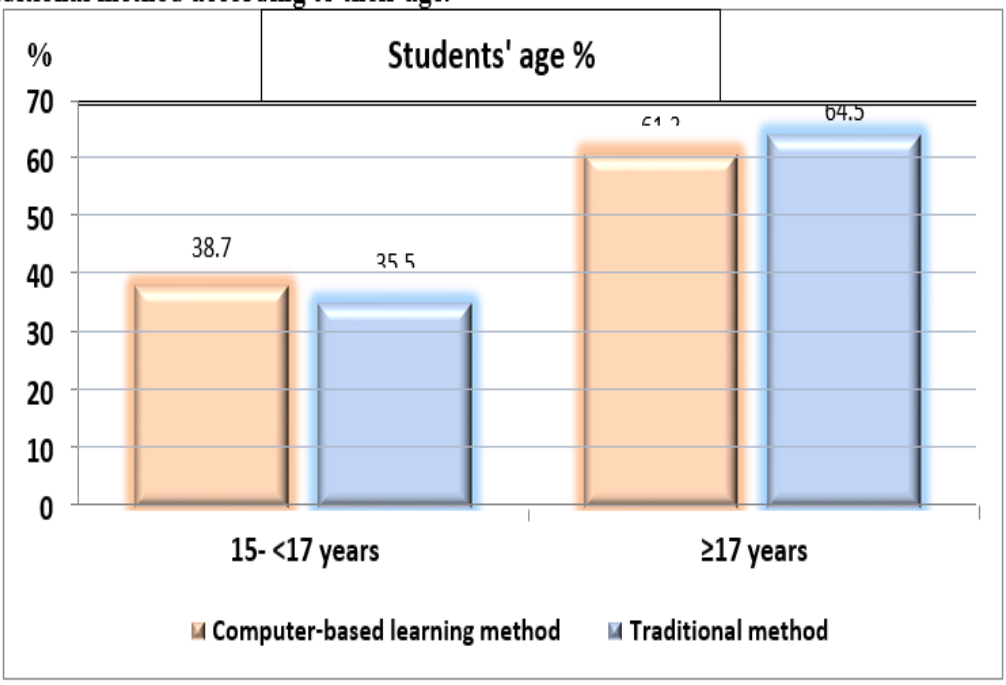

Figure (1): This figure showed that 61.3% -64.5% of students using computer – based learning versus traditional method were aged ≥ 17 years, with mean 17.06+0.929 and 16.77+0.669 years, respectively.

Figure (2): Percentage distribution of the studied students using computer -based learning method and traditional method regarding their residence.

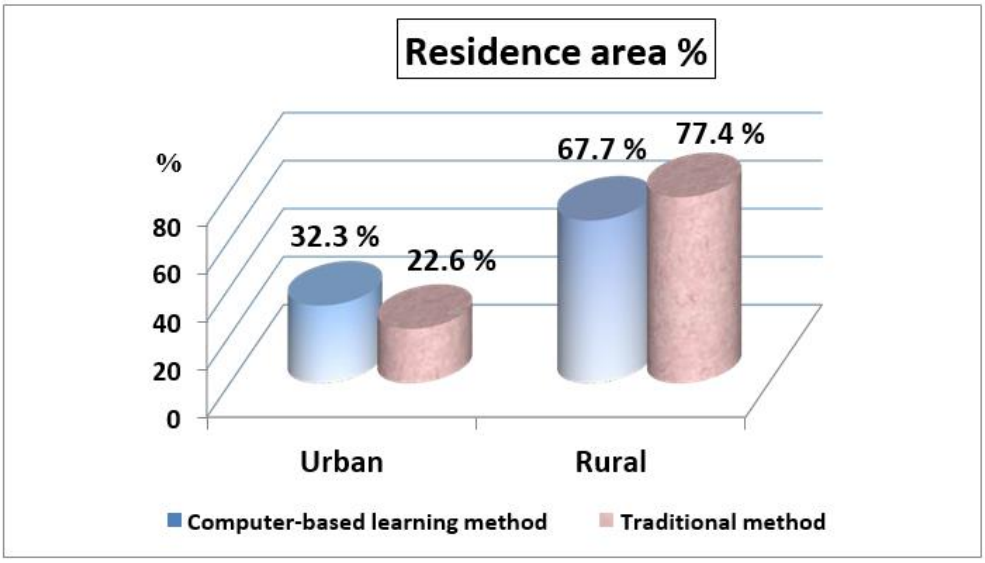

Figure (2): This figure revealed that 67.7% &77.4% of all students using computer – based learning versus traditional method residing in rural areas.

Figure (3): Comparison between the students' total score level of knowledge about pediatric CPR pre/post using computer -based learning method versus traditional method.

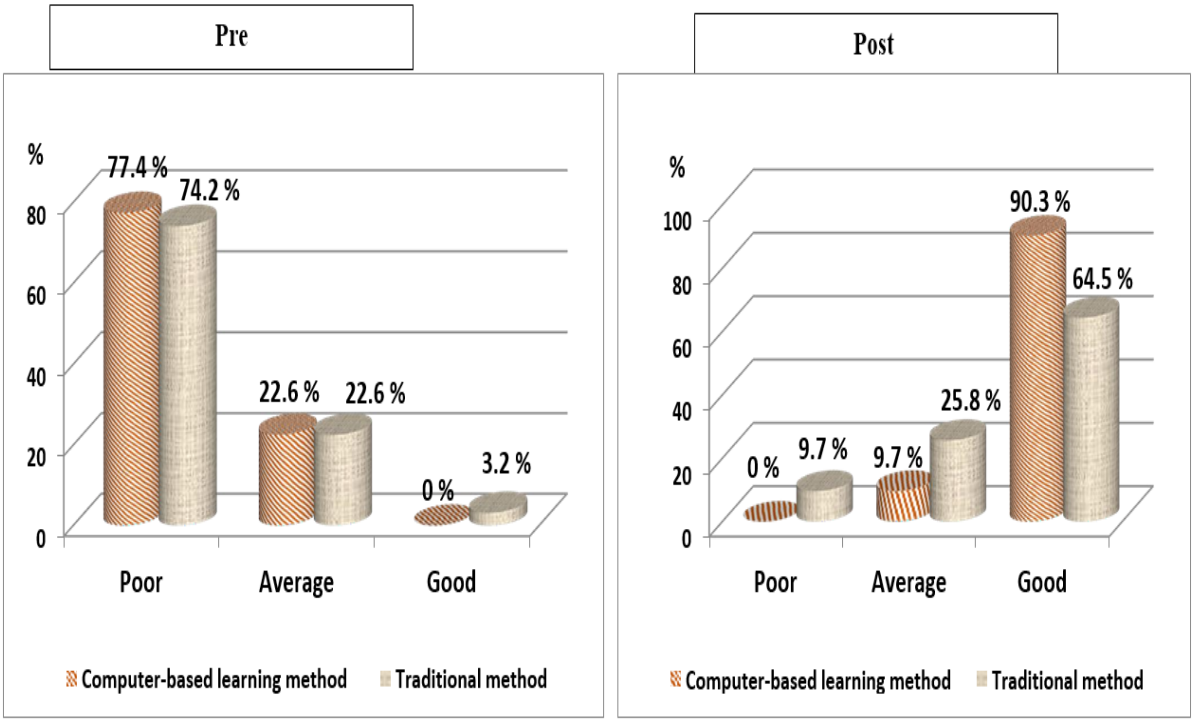

Figure (3): showed that, pre using computer-based learning versus traditional method, 77.4% of students and 74.2% of students using the traditional method had poor total score levels of knowledge about pediatric CPR with statistically insignificant differences (X2 (1) = 3.927, P = 0.140). In contrast, 90.3% of students using computer-based learning and 64.5% of students using traditional method had good total scores level of knowledge post-using computer-based learning versus traditional methods, which reflected statistically significant differences (X2 (2) = 6.212, P = 0.045). method versus traditional method (n=62).

Figure (4): Comparison between the student's total score level of practices about pediatric CPR post/follow up using computer -based learning method versus traditional method (n=62).

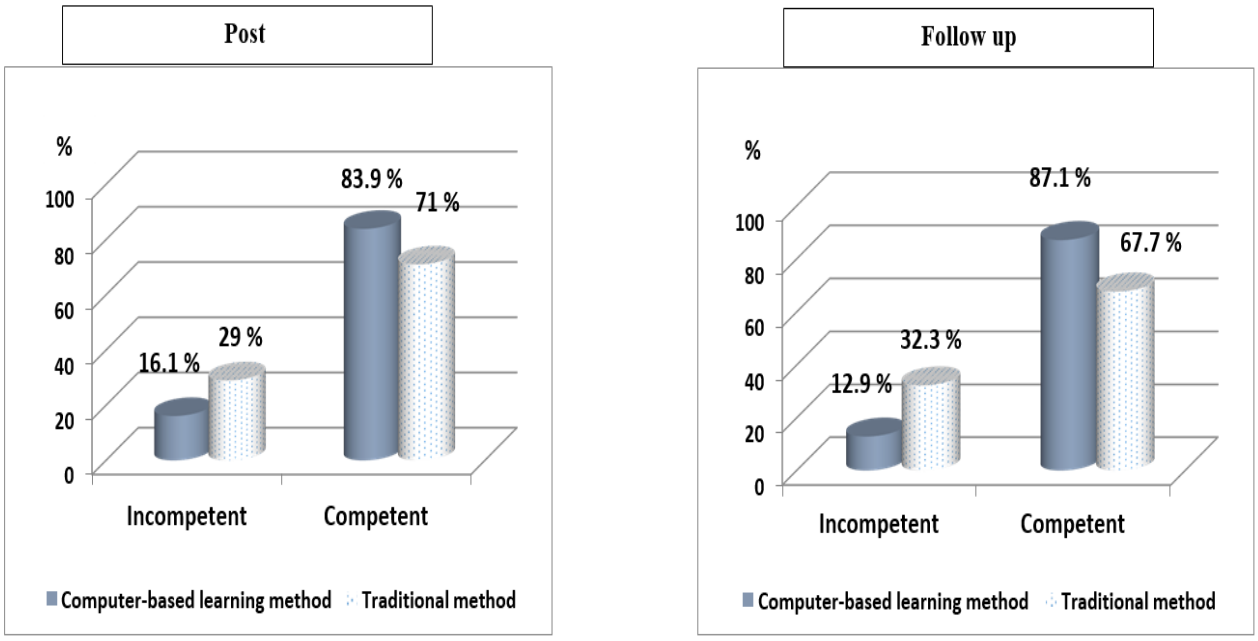

Figure (4): Indicated that 83.9% & 71.0% of student's post using computer – based learning versus traditional method as well as, 87.1% & 67.7% of students follow up using computer – based learning versus traditional method had competent total score level of practices with statistical significant differences (X2 (1) = 14.573, P = 0.001, X2 (2) = 9.644, P =0.001& 0.007).

Table (1): Correlation between students total score level of knowledge regarding pediatric CPR pre and post using computer- based learning method versus traditional method (n=62).

Items	Total score level of knowledge			
	Pre		Post	
	Computer- based learning method			
	r	P value	R	P value
Traditional method	0.292	0.111	0.435	**0.015***

* Statistically significance p≤ 0.05. Statistically insignificance p>0. 05.

Table (1): This table showed a statistically insignificant negative correlation (r = 0.292, P = 0.111) between student's total score level of knowledge pre using computer-based learning versus traditional method. compared with a statistically significant positive correlation (r = 0.435, P = 0.015) between student's total score level of knowledge post using computer-based learning versus traditional methods that reflected a positive correlation.

Table (2): Correlation between students total score level of practices regarding pediatric CPR post and follow up using computer- based learning method versus traditional method (n=62).

Items	Total score level of practices			
	Post		Follow up	
	Computer- based learning method			
	R	P value	r	P value
Traditional method	0.686	**0.000***	0.558	**0.000***

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Table (2): This table clarified that, there was a statistically significant positive correlation between student's total score level of practices post using computer- based learning versus traditional methods with (r = 0.686, P = 0.000). As well as, there was a statistically significant positive correlation between student's total score level of practices follow- up using computer- based learning versus traditional methods with (r = 0.558, P = 0.000) that reflected a positive correlation.

Table (3): Correlation between students total score level of knowledge and total score level of practices regarding pediatric CPR post using computer- based learning method versus traditional method.

Items	Total score level of practices			
	Computer- based learning method		Traditional method	
	R	P value	r	P value
Student's total score level of knowledge	0.450	**0.011***	0.635	**0.000***

Table (3): This table demonstrated that, there was a statistically significant positive correlation between student's total score level of practices and total score level of their knowledge post using computer- based learning versus traditional methods with (r = 0.450, P = 0.011 & r = 0.635, p = 0.000) that reflected a positive correlation.

Discussion

Resuscitation is an essential aspect of the nursing curriculum for pediatric patients, and nursing students learn it as a fundamental skill during their undergraduate education. However, the great majority of nursing students lack confidence in their ability to perform fundamental lifesaving techniques like resuscitation and are unprepared (Liaqat et al., 2021).

Innovative teaching strategies in nursing education are anticipated to support nursing students' skills to actively participate in self-regulating learning, transform traditional one- way knowledge delivery, and cultivate patient-centered learning. The material and instructional techniques determine how effective a course is in teaching pediatric cardiopulmonary resuscitation. Thus, in order to engage students in active learning and knowledge practice, it is essential to test different teaching approaches to see if they are more instructional (Ghasemi et al., 2020).

Regarding age of the studied students using computer-based learning method and traditional method (Figure, 1), the findings of the current study revealed that more than three fifths of them were in age group equal or less than 17 years old with mean 17.06+0.929 and 16.77+0.669 years, respectively. From the researcher points of view, this young age can be attributed to this study was conducted in nursing schools after completion of preparatory level of education.

This result was contradicted with study of Berga et al., (2021), entitled "Blended learning versus face-to-face learning in an undergraduate nursing health assessment course" who found that, most of the studied students were between the ages of 18 to 24

years old. These finding was in an agreement with a study carried out by Wong et al., (2021) entitled "Factors associated with self-directed learning among undergraduate nursing students" who reported that, most of the studied students were 18 - 21 years old.

Concerning residence of the studied students using computer-based learning method and traditional method (Figure, 2), the current study represented that more than two thirds and more than three quarters of students using computer–based learning and traditional method respectively were residing in rural areas. This result was in accordance with the finding of the study done by Putri & Sumartini, (2021) entitled "Integrating peer learning activities and problem-based learning in clinical nursing education" who found that the majority of the studied nurses were rural residents. In contrast, a study carried out by Vallée et al., (2020) entitled "Blended learning compared to traditional learning in medical education" who stated that, the highest percentage of the studied

participants were urban residents. From the researcher points of view, this contradiction may be related to the difference between study settings.

According to comparison between the students pre/post using computer based learning method versus traditional method regarding their total score level of knowledge about pediatric CPR (Figure,3), the results of the current study showed that, more than three quarters of computer based learning students, and almost three quarters of traditional method students had poor total knowledge score about pediatric CPR pre using computer based learning versus traditional method, while most of computer- based learning students and nearly two thirds of traditional method students had good total knowledge score post using computer based learning versus traditional method, with a statistical significant differences. From the researcher points of view, this could have something to do with how much computer-based instruction has affected nursing students' understanding of pediatric CPR.

Correspondingly, a study conducted by Mulyadi et al., (2021), entitled "The effectiveness of blended learning in basic life support training among nursing students" who found that there were signs of numerous improving outcomes, such as knowledge, and who came to the conclusion that BLS training should employ blended learning models by altering the infrastructure, facilities, and training modules. These findings were in contrast with a study conducted by Elsayed et al., (2022), entitled "E-Learning Strategy versus Traditional Learning Strategy on Pediatric Nursing Students' Knowledge, Engagement, and Clinical Performance during COVID 19" who stated that over the course of the study's three periods, a statistically significant difference was discovered between the two groups and that students who utilized traditional teaching methods retained more information than those who employed e-learning.

As regard the studied student's total score level of practices about pediatric CPR post/follow up using computer-based learning versus traditional method (Figure, 4), The results of the current study declared that, most of students had competent total score level of practices with a statistical significant differences post/follow up using computer- based learning versus traditional method, respectively. On the other hand, these results were disagreeing with a study performed by Özdemir et al., (2023), entitled "Comparison of video-assisted education and traditional classroom education in pediatric cardiopulmonary resuscitation education of nursing students" who found that there was no statistically significant difference between the study groups (conventional classroom education and video-assisted teaching) and came to the conclusion that both approaches successfully raise students' knowledge of pediatric CPR.

In contrast, this result was contradicted with a study finding by Chong et al., (2023), entitled "The effectiveness of online-only blended cardiopulmonary resuscitation training: static-group comparison study" who found that traditional learning methods and online-only blended learning produced similar research outcomes and that there was no statistically significant difference between the two circumstances.

Pertaining to correlation between studied students' total score level of knowledge regarding pediatric CPR pre and post using computer based learning versus traditional method (Table, 1), the results of the current study highlighted that, there was statistically insignificant correlation between student's total knowledge pre using computer based learning versus traditional method, while there was a statistically significant positive correlation between student's total knowledge post using computer based learning versus traditional method. From the researcher point of view, this can be interpreted as computer based and traditional learning methods had significant influence in improving the studied students' level of knowledge in both groups.

Consistently, this results were agreed with a study finding by Capelli et al., (2022), entitled "Self-directed video versus instructor-based neonatal resuscitation training" who reported that following the use of instructor-based and self-directed video approaches, there were statistically significant positive correlations between the studied students' level of knowledge. Also, these results are similar to the study findings by Singaram et al., (2022), entitled "Impact of e-learning vs traditional learning on student's performance and attitude" who stated that, following the intervention, there was a positive statistical correlation between the students' knowledge in traditional learning groups and e-learning groups.

Regarding correlation between studied students' total score level of practices regarding pediatric CPR post and follow up using computer based learning versus traditional method (Table, 2), The results of the current study represented that, there was a statistically significant positive correlation between student's total practices post and follow up using computer based learning versus traditional method. From the researcher point of view, this may demonstrate how traditional and computer-based learning methods have improved the practicing skills of the students in the study after post-implementation in both groups.

The current study findings go in the same line with that of a study conducted by Özdemir et al., (2023), entitled "Comparison of video-assisted education and traditional classroom education in pediatric cardiopulmonary resuscitation education of nursing students" whom findings showed a positive association between the post-implementation level of video-assisted education and traditional classroom education for the nursing students under study and their level of practice. In the same respect, this finding was in harmony with a study carried out by Szyld et al., (2021), entitled "Self-directed video versus instructor-based neonatal resuscitation training: a randomized controlled blinded non-inferiority multicenter international study" who found a correlation between the study participants' level of practice following instructor-based newborn resuscitation training and self-directed video.

In relation to correlation between studied students total score level of knowledge and total score level of practices regarding pediatric CPR post using computer based learning versus traditional method (Table,3), the results of the current study revealed that, there was a statistically significant positive correlation between student's total score level of practices and total score level of knowledge post using computer based learning versus traditional method. From the researcher point of view, this can be understood to mean that students who appear to have competent practice and a satisfactory level of knowledge. This outcome is logical given that the potential for applying any subject becomes higher with an increased understanding about it.

Consistently, this results were agreed with the study finding of Towfik et al., (2022), entitled "Effect of Self-Learning Package about Critical Thinking on Intern-Nurses' Knowledge, Disposition and Skills" who found statistically significant positive relationships between the investigated intern nurses' knowledge and skill levels. Likewise, these results were in accordance with Mohamed et al., (2023), entitled "The effect of implementing cardiopulmonary resuscitation video-based online learning in acquiring the knowledge and skills in the physical education students" who confirmed that after using a traditional learning technique and an online video-based cardiopulmonary resuscitation learning method, there was a positive association between the knowledge and skills of the studied students.

Recommendations

In view of the study findings, the following recommendations were suggested:

- Computer based learning should be incorporated as a method of teaching in nursing education.
- Continuous training program for pediatric nursing students to acquire computer – based learning as a learning strategy in their education.
- Distance learning and online courses should be applied in nursing education. In addition, interactive learning environment such as virtualization and simulation must be involved in clinical teaching to facilitate independence and self- directed learning.
- Encourage pediatric nursing students to develop their skills in electronic design, and Web applications that enable them to use a variety of integrated teaching strategies, and employ these learning tools in their pediatric nursing educational process.
- Further researches should be replicated on a larger probability sample in other different settings are highly recommended to ensure generalizable results.

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