

Effect of Computer Mediated Instruction Technique on Knowledge and Practice of Critical Care Nursing Students

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Abstract

Background Computer mediated instruction is a technique that offers a plenty arrangement of apparatuses that can be utilized to help an assortment of learning encounters, so the teacher isn't restricted to one lot of administrations or instruments yet can use a few to set up a learning climate which will best suit their understudies' adapting needs. CMI denotes to combination of email, text, audio or video conferencing, instant messaging, list-servers, bulletin boards, and multi-player video games. **Settings**; this study was carried out at Critical Care and Emergency Nursing Department, Faculty of Nursing- Alexandria University. **Method**: A quasi experimental research design was used to conduct this study "Tool one: Computer Mediated Instruction Critical Nursing Knowledge test" and "Computer Mediated Critical Nursing Practice checklist". **Results**: There were statistical significant differences between both groups of students in the favor of study group in relation to nursing knowledge and practice also within the study group after the application of CMI ($p < .001$). **Conclusion**: The current study findings concluded that; critical care nursing students who were subjected to computer mediated instruction technique had better knowledge scores and practice performance than those of the control group. **Recommendations**: it can be recommended that CMI technique should be incorporated in nursing theory and clinical education to improve the level of students' knowledge and clinical practice.

Keywords: computer mediated instruction, knowledge, practice, nursing students.

Introduction

Advancements in innovation have made new stations for personnel understudy association as learners are getting progressively dependent on online innovation as an asset for correspondence and go about as instruments that help students in information revelation and as courses for cooperation. Through the Internet, students can work intuitively to find rich assets that empower them to tackle issues or develop information. Beyond that, computer mediated technique interceded, guidance encourages understudy cooperation and gives new pathways to student correspondence and communication. It permits students to find information at

their own movement and thought about an exploratory type of learning as it permitting students to look, recover, and assess data (Kumar, Natarajan, & Acharaya, 2017, Ally, M. (2004), & Ammar, & Bukharaev, 2017).

Computer mediated communication has made a significant move in how instructors and students consider educating and learning by permitting understudies to learn in more helpful areas and regularly at more advantageous occasions. It empowers more students to broaden their training into a deep-rooted learning measure. Computer interceded guidance offers a plenty arrangement of apparatuses that can be utilized to help an assortment of learning encounters, so the teacher isn't

restricted to one lot of administrations or instruments yet can use a few to set up a learning climate which will best suit their understudies' adapting needs (Dhull 2017, Mahmud Hassan 2018, & Nguyen, 2015).

Moore and Kearsley (2017) defined **Computer Mediated Instruction (CMI)** as a wide variety of communication forms between two or more persons who may interact, affect, and/or influence each other through different computers that does not encompass the methods by which these computers communicate, but mainly focus on how persons communicate using computers. Furthermore, CMI denotes to combination of email, text, audio or video conferencing, instant messaging, list-servers, bulletin boards, and multi-player video games. There are two approaches of CMI; Synchronous and asynchronous. Synchronous interaction requires the student and instructor being on the web and impart together. It permits students to get ongoing, intuitive feedback, explanation of realities. While, asynchronous is the ideal delivery modes for learners in diversity of geographic locations and time zones, or for part-time learners whose work schedules have limited them (Moore , Kearsley 2017, Darrell, Paul 2018 & Metz, 2015).

Tools for computer mediated instruction

There are many tools include *Web 2.0*, which is social and participatory stage to improve the capacity of the end client to alter or make data gave by another client. *Webinar*, which describes the use of online seminars to improve learning experience by attended the lectures and ask questions and answer the instructor's questions. *Real simple syndication* is a technical tool to get news and commentary from teachers directly to

students. *Edmodo* where the teacher can create a class, post an announcement, share a few files, engage and communicate with learners and create the quiz (Duval, Sharples, & Sutherland, 2017, & Kelsey, & St Amant, 2018). As well, *Kidblog* is platform had the capability to enclosure any multimedia into a post, permitting endless opportunities for impost. *TED's* platform includes original lessons, created by teachers through scaffolding of watch, think, and dig. *NeoK12* encompasses educational videos, games, puzzles, and quizzes (Parke, Marsden, & Connolly, 2017, Riva, & Galimberti, 1998, & Walther, 2012).

While, *Project Share* defined as numerous courses that are free of charge where educators can generate their private courses , quizzes , tests and exhibition the outcomes within the system . *Google Hangouts*, which permit learners to video chat with peers and teachers, display life stream so any person can contribute and videos saved to YouTube accounts, enabling the learners to revisit the hangouts later (Clarke III, Flaherty, & Mottner, 2016, Eady, & Lockyer, 2013, & Shahid, et al. 2019). On the same hand, *Easy Class* is a free e-learning platform support for the Arabic language and allows the teacher to create a virtual classroom to store lesson and materials on the Internet. *Google classroom*, which facilitates the teacher to create and organize assignments quickly, provide feedback and communicate with ease. *Adobe captivate* is an e-learning tool can be castoff to generate online demonstrations, software simulations, branched scenarios, and interactive quizzes (Thieman, 2018, Malik, & Agarwal, 2012, & Schindler, et al. 2017).

Hence, over the past two decades the CMI was established as the innovative

method to enhance learning and influence educational practices for a wide variety of subjects. Recently, nursing educators and researchers introduced CMI into nursing education. Despite the technology potential contribution on learners includes enhancing their; self-learning, critical thinking, reflective practice, meta-cognition, problem solving, as well as stimulating personal skills such as creativity, social interaction, and team work (Gungadeen, 2015). However, few researches were found as to the effect of CMI on students' academic performance in both theory and practical.

Aim of the study

Investigate the effect of computer mediated instruction technique on knowledge and practice of critical care nursing students

Research questions

The current study aimed to answer the subsequent research questions; (1) what is the effect of computer mediated instruction technique on students' knowledge? (2) What is the effect of computer mediated instruction technique on students' practice? Also (3) is there a relationship between critical care nursing students' knowledge and practice of computer mediated technique, and their characteristics including age, gender, academic achievement, English language skills, computer skills and previous qualifications?

Research hypothesis

Students who are exposed to computer mediated instruction technique get higher scores in knowledge test than students who don't expose to it.

Students who are exposed to computer mediated instruction technique

get higher scores in practice test than students who don't expose to it.

Materials and method

Materials

Research design; A quasi experimental research design was used to conduct this study.

Settings; this study was carried out at Critical Care and Emergency Nursing Department, Faculty of Nursing-Alexandria University.

Subjects; The subject of this study embraced 160 nursing students out of 200 undergraduate nursing students who were itemized in "Emergency Nursing course" throughout the first term of the academic year (2019-2020). The subjects were allocated randomly into two identical groups; study and control, 80 students for each.

Tools; Two tools were used for data collection

Tool one: Computer Mediated Instruction Critical Nursing Knowledge, test

The tool was established by the investigators after reviewing the literatures (Sole, Klein, & Moseley, 2013, Wiegand, 2016) to assess the critical care nurse students' knowledge about cardiovascular system and airway system. It was two tests; the first test was about the cardiovascular system and the second about airway system, each test consisted of 30 questions; 15 true/ false questions and 15 multiple choice questions. The total score was 30 grades for each test but the mean score was taken for both. The overall score deduced as; from 30 to 20 had high knowledge, from 19 to 10 had modest knowledge level and from less

than 10 had low knowledge level. The tool's reliability was deliberated using Cronbach's Alpha test, it was reliable and the test coefficient value was 0.82.

Tool two: Computer Mediated, Critical Nursing Practice checklist

This tool was developed by the critical care nursing department to assess nurse students' skills related to central venous pressure measurement (CVP) and oropharyngeal insertion (OPA) skills. It includes two checklists the first was CVP, which consisted of 31 points with a total score of fifty grades; the other was OPA which consisted of 20 points with a total score of twenty-two grades. The total score was 72 grades for the two checklists but the mean score for both were taken. The overall mean score deducted as; from 36 to 25 had excellent skills, from 24 to 13 had moderate skill level and from 12 to less had low skill level. The upper the score deliberates the upper skills. The tool's reliability was premeditated via Cronbach's alpha test, it was reliable and hence the test coefficient value was 0.831.

Method

Official permission to conduct the study was acquired from the Dean of the Faculty of Nursing; Alexandria University, the head of Critical Care & Emergency Nursing department afterwards elucidating the aim of the study. Written consent was attained from separately involved student afterwards an elucidation of the study's aim and reassurance about the privacy, anonymity, and confidentiality of the attained data. The right to refuse to join in the study was confirmed to students.

Tools' content validity was confirmed by a panel of judges of 5 experts in the related fields and moreover the needed modifications were completed.

Tools I, II was verified for their reliability and the tools were reliable. A pilot study was piloted on 10% of the sample size to inaugurate the clarity and applicability of the tools and recognize hitches, which will face the researchers thru data collection.

The students were distributed randomly as: Study group: it encompassed 80 emergency care nurse students; who received lectures and clinical sections by computer mediated instruction techniques. Control group: it comprised 80 emergency care nurse students who received lectures and clinical sections by the traditional way. Data collection was accomplished by the researchers throughout the first term of the academic year 2019-2020 beginning at September 2019 and ends by January 2020.

Data collection:

The study tools were used twofold; the first stage as a pretest previously the application of computer mediated instruction techniques and the later time as a posttest afterwards the application of it. The computer mediated instruction technique training (CMI) was implemented over three stages: preparation, implementation and evaluation stage.

1. The preparatory stage : In this phase the researchers exasperated to treasure a meaning to the new conception through satisfactory grounding of the researchers and content

a. Researcher preparation

- Reading the accessible evidences about computer mediated instruction technique either current or timeworn up to the time of data collection from books, digital libraries and websites comprising

the nationwide and worldwide researches interconnected to the topic.

- Self-training on computer mediated instruction technique methods

b. Content preparation

- The researchers developed a computer mediated instruction technique on critical nursing care content.

2.The Implementation stage: In this stage the researchers realized pretest for mutually the study and control groups via the tools to estimate the critical care nurse students' knowledge and skills. The application of CMI preparation took approximately four sessions over four weeks, one session per week; two sessions theoretical and two practical sessions. Each theoretical session took around two hours (the time of the usual lecture) while the practical session took for three hours (the time of the usual section). It is taking place in the first term of the second academic year of the faculty of nursing 2019-2020. The training program was reputable on the assimilation between CMI and critical care nursing content as following; the researcher identified MOODLE, face book group digital platforms for a synchronized theoretical lecture while Edmodo and Microsoft team platform for synchronized clinical sections and WhatsApp group for students' follow up. Study group, students asked to activate their university email and get participated in these platforms.

3.The Evaluation stage: In this stage the researchers appraised the students in mutually groups to appraise their knowledge and skills via the study tools at the completion of the training.

Ethical consideration

The study was revised and approved by the research and ethics committee of the faculty of nursing, Alexandria University. All respondents were abundantly informed about the research purpose and the nature of the study. Furthermore, entirely respondents were prerequisite to signpost their willingness to join in the study by signing a consent form. Participants were informed of their right to take out from the study at any stretch starved of any punishments. The confidentiality and privacy of all participants was preserved throughout data collection and analysis. The questionnaires used for data collection were held merely by the research team.

Statistical analysis

Data were taken care of to the computer and dissected utilizing IBM SPSS programming bundle variant 20.0. (Armonk, NY: IBM Corp) Qualitative information was revealed consuming number and percent. Quantitative information was illustrated consuming mean, standard deviation. Significance of the got results was absolute at the 5% level.

Results

Table 1 shows the personal and academic characteristics of study and control groups, whereas the whole number of students was 160 who randomly tranquil of 80 per respectively of the control and study group. As for the students' gender, there was an equal distribution among both groups, while the majority of both groups' age was 21 years old. Concerning the students' academic achievement and their computer skills, it

was found that there was almost equal distribution of students' GPA among both groups. In relation to students' computer skills, it was found that around half of the students in both groups were excellent. Furthermore, a Chi square test was conducted to assess the homogeneity of the participants from both groups and the results revealed no significant difference in participants' age, gender, academic achievement, their computer and language skills in addition to their previous qualification, whereas p was above 0.05 in all these variables.

Table 2 shows both groups' knowledge before and after application of CMI technique; the table revealed that the mean and standard deviation of knowledge post-test among study group was higher than control group (23.13 ± 0.837) (11.81 ± 1.922) respectively, and there was a statistical significant differences between the study and control groups and in the study group afterward the implementation of CMI technique in relation to students' knowledge whereas $P = 0.000$.

Table 3 shows both groups' practice level before and after application of CMI technique; the table revealed that; the mean and standard deviation of practice level post-test among study group was extremely higher than control group (34.37 ± 1.029) (13.24 ± 2.892) respectively, also a statistical significant differences were found between the study and control groups and in the study group afterward the implementation of CMI technique in relation to students' practice

whereas $P = 0.000$.

Table 4 shows students' knowledge levels before and after application of computer mediated instruction technique in both groups; whereas all study group students got high scores while three quarter of control group students got moderate score in post- test. Also, there was a statistically significant difference between study and control group in the favor of study group after application of CMI as $P = 0.000$.

Table 5 shows students' practice levels before and after application of CMI technique in both groups; whereas all study group students got high scores while, about three quarter of control group students got moderate score in post- test. Also, there was a statistically significant difference between study and control group in the favor of study group after application of CMI as $P = 0.000$.

Table 6 shows the correlation between students' knowledge, practice after application of CMI technique and their personal characteristics. It was found that; a highly significant positive correlation was found between the students' knowledge, practice and their computer and English language skills after application of CMI technique as $p = .000^{**}$. However, no significant relationship was found between the students' knowledge as well as practice and each of their age, gender, GPA and qualification among the study group, whereas p was more than .05 respectively.

Table (1): Personal and academic characteristics of study and control groups

Characteristics	Groups				Significance	
	Control (n = 80)		Study (n = 80)		Test of Sig.	P
	No.	%	N.	%		
Gender						
Female	39	48.8	4	50.0	$\chi^2=0.025$	P = 0.874
Male	41	51.2	4	50.0		
Age (years)						
20	6	7.5	5	6.5	$\chi^2=0.0976$	P = 0.755
21	74	92.5	7	93.8		
Academic achievement						
A-	5	6.3	5	6.3	$\chi^2=3.714$	P = 0.715
B+	15	18.8	1	12.5		
B	15	18.8	2	25.0		
B-	10	12.5	1	12.5		
C+	10	12.5	1	12.5		
C	15	18.8	1	12.5		
C-	10	12.5	1	18.8		
			5	8.8		
Computer skills						
Excellent	45	56.2	40	50.0	$\chi^2=1.294$	P = 0.524
Good	25	31.2	25	31.2		
Bad	10	12.5	15	18.8		
English level						
Excellent	30	37.5	30	37.5	$\chi^2=0.091$	P = 0.934
Good	25	31.2	25	31.2		
Bad	25	31.2	25	31.2		
Previous qualification						
Secondary school	75	93.8	75	93.8	$\chi^2=0.081$	P = 0.944
Technical	5	6.2	5	6.2		

χ^2 : Chi square test; p: value for comparing between the two studied groups, *: Statistically significant at $p \leq 0.05$

Table (2): Comparison between nursing students' knowledge of study and control groups before and after application of CMI technique

Items	Study group		T (P)	Control group		T (P)	Study/ Control 1 (Pre)	Study/ Control 1 (Post)
	Knowledge Mean Scores			Knowledge Scores				
	Pre	Post	Pre	Post	Mean			
Min- Max	1-7	21-24	93.50 (0.000) *	1-6	7-17	32.51 (0.000) *	1.090 (0.277)	48.298 (0.000) *
Mean ± SD	3.18±1. 715	23.13± 0.837		3.44±1.268	11.81±1.922			

T student t test * statistically significant at $p \leq 0.05$

Table (3): Comparison between nursing students' practice of study and control groups before and after application of CMI technique

Items	Study group		T (P)	Control group		T (P)	Study/ Control (Pre)	Study/ Control (Post)
	Practice Mean Scores			Practice Mean Scores				
	Pre	Post	Pre	Post	Mean			
Min- Max	2-8	31-36	131.91 (0.000) *	1-6	7-19	29.168 (0.000) *	5.735 (0.000) *	61.569 (0.000) *
Mean ± SD	4.48±1.746	34.37±1.029		3.16±1.091	13.24±2.892			

T student t test * statistically significant at $p \leq 0.05$

Table (4): Comparison between both groups' knowledge levels before and after application of CMI technique

Knowledge levels	Study group		Control group				χ^2 (P)	Study/ Control (Post)		
	pre	Post	Pre	Post	Pre	Post				
	No.	%	No.	%	No.	%	No.	%		
Low	80	100.0	0	0.0	80	100	9	11.2	127.64	160.00
Moderate	0	0.0	0	0.0	0	0.0	71	88.8	(0.000)	(0.000)
High	0	0.0	80	100.0	0	0.0	0	0.0	*	*

T student t test * statistically significant at $p \leq 0.05$

Table (5): Comparison between both groups' practice levels before and after application of CMI technique

Practice levels	Study group		Control group				χ^2 (P)	Study/ Control (Post)		
	pre	Post	Pre	Post	Pre	Post				
	No.	%	No.	%	No.	%	No.	%		
Low	80	100.	0	0.0	80	100	10	12.5	124.44	160.00
Moderate	0	0.0	0	0.0	0	0.0	70	87.5	(0.000)	(0.000)
High	0	0.0	80	100.0	0	0.0	0	0.0	*	*

T student t test * statistically significant at $p \leq 0.05$

Table (6) Correlation between students' knowledge and practice after implementing CMI and their characteristics

Variable		Age	Gender	GPA	Computer skills	Language skills	Qualification
Students' knowledge	R	.213	.233	.443	.971	.983	0462
	P	.120	.131	.214	.000**	.000**	.234
Students' practice	R	.294	.292	.673	0963	.949	.494
	P	.132	.121	.411	.000**	.001*	.223

r: Pearson coefficient, * $p \leq .05$ at 5% level denotes a significant difference, ** $p \leq .01$ at 1% level denotes a highly significant difference

Discussion

In an era of advanced technology in nursing education, CMI technique can be considered as one of the rapidly growing innovative tactics that can be implemented by modern nursing educators as an alternative or assistive for the traditional instructor led education. CMI incorporates numerous benefits for nursing students as well as nursing educators including; easily self-accession or self-enrollment, extensive availability at anytime and anywhere, highly student-instructor interaction (**Roh, & Park, 2010**). As well, CMI has the prospective to prepare nursing students for the competencies, which improve students' achievement encompassed; critical thinking, problem solving, self-learning, creativity, reflective practice and interaction, team work, as well as communication skills (**Eyal, 2012**). That is why, nurse educators are challenged by measuring the effectiveness of computer mediated versus traditional instructor led instructions among nursing students for successful preparation of future competent nurses.

The current study findings publicized that; statistical significant differences were found between the study and control groups and in the study group afterwards the implementation of CMI technique in relation to students' knowledge. This issue comes in

congruence with the study of **Pitre and Cain 2014** who found that CMI implementation was associated with a higher knowledge score compared to the traditional group technique. Also, with the study of **Klein and Tutty 2016** who revealed that CMI improve college students' knowledge compared with face to face technique. This issue may be due to the ability of CMI to stimulate the student's thinking ability and availability of permanent suitable online resources, which improve skills of recalling and correlation between the previous and new knowledge and concept that support the first research hypothesis.

Furthermore, the current study finding revealed that; statistical significant differences were found between the study and control groups and in the study group afterward, the implementation of CMI technique in relation to students' skills. Consistence with **Öztürk and Bulut 2012** who found that the students who received CMI had high performance scores in clinical practice than those who learned by the traditional demonstration. Also, the study of **Gungadeen 2015** who revealed that CMI improve students' skills with medical practice and help students to be more focused on their practical error correction. This issue may be due to the advantage of embedded practice and learning activities in CMI to guide the students' performance and practice through checking their understanding,

monitoring their progress as well as providing the student with immediate feedback. Whereas, during CMI implementation and at the end of each section, the instructor provided an opportunity for students to do self-assessment for their progress then provided them with a corresponding feedback to guide them to appropriate direction.

Hence, the students' scores of knowledge and practice were higher after providing CMI among the study group, which supported by the result of Cain, & Pitre, 2016 who considered the Internet as an efficacious tool in expediting student learning. Whereas, the Internet facilitated the exploration, retrieval, and access of educational support resources with subsequent positive impact on a student academic performance. Correspondingly, other researchers found that the growing resources on the Internet were linked to growing gain from the learners' side.

As for the relationship between students' knowledge and practice after implementing CMI techniques and their age and gender, the current study revealed no significant correlation. Whereas, students' post-test score of both knowledge and practice was not related to their age or gender differences. Resemblance with the findings of Badiei et al. 2016 who found no relationship between nurses' age as well as gender and their knowledge or practice after receiving electronic continuous medical education.

On contrary, the current study revealed a highly significant positive relationship between students' knowledge after implementing CMI techniques and their computer skills and English language skills. Reasonably excepted whereas, the students who were

competent in using computer and Internet and had good English language level were more able to explore knowledge, benefit from the wide variety of CMI learning resources which guided the students to enhance their understanding of multifaceted theoretical concepts better than others. Correspondence with the findings of Essa et al. 2018 that the students who were competent in computer skills had higher level knowledge retention after receiving computer instruction.

Beyond that, the current study displayed a significant positive relationship between students' practice after implementing the computer mediated instruction techniques and their computer skills and English language skills. Whereas, the students who had higher competency in computer as well as English language skills demonstrated higher skills' performance. That may be rationalized related to students' chance to master their practice better after receiving the instructors' feedback in addition to the students' opportunity to assess their own performance in either summative or formative approach. Which is in line with Gad et al. 2012 who found that students' knowledge and skill retention of endotracheal airway suctioning was improved after performing computer-based learning. Correspondingly, to the findings of Khatoon and Prakash 2020 who found the students' practice scores were significantly higher after receiving computer assisted learning.

Conclusion

The current study investigated the effect of computer mediated instruction technique on critical care nursing students' knowledge and practice and discovered the relationship of that effect with students' characteristics. The current study findings concluded that critical care

nursing students who were subjected to computer mediated instruction technique had better knowledge scores and practice performance than those of the control group. Hence, the current study has proven the effectiveness of integrating computer mediated instruction technique with traditional learning in enhancing students' knowledge acquisition as well as clinical practice performance.

Recommendations

Based on the existing study results, it can be recommended that CMI technique should be incorporated in critical care nursing theory and clinical education to advance the standard of students' knowledge and clinical practice. Apparently, enhancing students' computer skills as well as English language skills must be emphasized in all academic nursing institution and by nursing educators, whereas these skills are highly correlated to students' theoretical and practical levels and to prepare them as future competent nurses.

Conflict of interest

There were no conflicts of interest.

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