THE EFFECT OF WEB-BASED LEARNING ON ACADEMIC ACHIEVEMENT OF COMMUNITY HEALTH NURSING STUDENTS IN PERSONAL PROTECTIVE EQUIPMENT MODULE

[1]Maha Ibrahim Ibrahim, [2]Sahar Mohammed Soliman, [3]Samia Mahmoud Abd el-Moaty

Domenstrator in Community Health Nursing, [2] Prof.in Community Health Nursing [3] Assist.Prof. in Community Health Nursing, Mansoura University.

Abstract

Background: Health care-associated infection (HCAI) is a major problem for patient safety. Personal protective equipment (PPE) as defined by OSHA is specialized clothing or equipment, worn by an employee for protection against infectious materials. So, Proper education of health care workers (HCWs)about PPE is very important in clinical teaching and consider essential part of the undergraduate nursing programs. Web-based learning is rapidly emerging as a predominant paradigm in the delivery of education in society and it can be efficiently used for different types of education. It is platform independent, convenient in access, cost saving, easily updated contents and with emerging technologies it can be made more effective. The aim of this study is to assess the effect of web-based learning on academic achievement of community health nursing students in personal protective equipment module. **Method:** A randomized control trial research was used. The study was carried out in skill lab of community health nursing at faculty of nursing, Mansoura University from February to May 2017. The subjects of the study included 140 community health nursing students. These students were assigned randomly into two groups: web based group which included 70 students studying with web based learning module (WBL) and traditional group which included 70 students studying with traditional learning using face to face lecture and demonstration. Four tools were used for data collection: Structured self-administered questionnaire to assess students' socio demographic &occupational characteristics, students' knowledge about PPE and students' attitude toward web based learning and finally the practice assessment checklist. **Results:** the students in the web based group had significantly higher scores on both personal protective equipment knowledge and skill learning than students in the traditional group (**P≤ 0.01**).The students also showed positive attitude toward the web-based learning module. **Conclusion:** The study concluded that both traditional and web-based learning resulted in improvement of knowledge and practice regarding PPE. However, the web-based learning was more effective than traditional learning in increasing students' knowledge and improving skills regarding PPE.

Keywords: web based learning, traditional learning, personal protective equipment, nursing student achievement

Introduction:

Teaching has been changing under the influence of social changes. The university education should fulfill the requirements of the social dynamic reality by organizing a learning process to enable students to operate in professional practice.[1]

One of the new methods of teaching and learning is electronic learning (e-learning) which is promoting the transition

from teacher-centered learning to student-centered learning. E-Learning is used widely with other terms such as online learning, technology-mediated learning, web-based learning, computer-based learning.[2,3,4]

Online learning is an appropriate addition to the 21st century educational system. Universities across the country are steadily increasing their use of online courses as a means of generating lifelong learning.[5,6] Therefore, web based learning (WBL) can be efficiently used for different types of education. It is platform independent, convenient in access, cost saving, easily updated contents and with emerging technologies it can be made more effective.[7]

Web based learning provides materials easy and adaptable access to learning and can overcome some of the limitations of traditional learning methods such as the students are passive recipients. WBL makes the students able to be independent thinkers and have self-exploration. In addition, Web based learning has many advantages; it includes different learning styles, saves time and allows sharing information and skills. [8,9,10]

Infection control measures are important for safety of health care system. Teaching of infection control measures such as personal protective equipment (PPE) is very crucial for nursing students and it is considered essential part of the undergraduate nursing programs.[11,12].

Thus, it is deemed necessary to conduct this study to assess the effect of web-based learning on academic achievement of community health nursing students in personal protective equipment module.

Aim of the study:

To assess the effect of web-based learning on academic achievement of community health nursing students in personal protective equipment module.

Subjects and Method

Design:

A randomized control trial was used in this study.

Setting:

The study was carried out in skill lab of community health nursing at faculty of nursing, Mansoura University.

Sampling:

Sample size:-

Minimum required total number of students was 130 students (65 students/ group) when the confidence interval (2-sided) is 80% and the power is 70% and the ratio sample size is 1. Actually a total number of 140 students (70 students for web-based group and 70 students for traditional group).

Tools for data collection:

After reviewing the relevant literature, four tools were developed by researcher in this study for data collection.

Tool I: Structured self-administered questionnaire to assess students' Socio demographic & occupational Characteristics:

This tool was used to assess socio demographic &occupational characteristics of students such as (sex, age, residence, work nursing with studying).

Tool II: Students' knowledge self-administered structured questionnaire:

This tool was used prior to the teaching intervention and, after the teaching intervention and used to assess students' knowledge about personal protective equipment (PPE).It was classified to 9 categories, all of these

categories are composed of 63 questions (multiple choice) one mark awarded for each correct response.

The total scores of the knowledge ranged from 0 to 63, one point for each correct answer.

The knowledge level was categorized into three Levels: Poor = scores less than 50% of total scores (less than 31.5), Fair = scores 50% to 65% of total sores (31.5- 40.95) & Good = scores more than 65% of total scores (more than 40.95).

Tool III: The practice assessment checklist:

This tool was used prior to the teaching intervention and, after the teaching intervention and used to assess the students' practice of donning &doffing PPE such as (gloves, gown, mask, respirator ,eyewear ,face wear and footwear) that is included in personal protective equipment module. This practice checklist consisted of:-

  * Donning &Doffing gloves checklist, which classified into two practice categories and the total items of donning &doffing gloves checklist were 26 steps one mark awarded for each correctly done step.

  * Donning &Doffing gown checklist, which classified into two practice categories and the total items of donning &doffing gown checklist were 9 steps one mark awarded for each correctly done step.

  * Donning &Doffing mask checklist, which classified into two practice categories and the total items of donning &doffing mask checklist were 9 steps one mark awarded for each correctly done step.

  * Donning &Doffing eyewear and face wear checklist, which classified into two practice categories and the total

items of donning &doffing eyewear and face wear checklist were 10 steps one mark awarded for each correctly done step.

  * Donning &Doffing respirator checklist, which classified into two practice categories and the total items of donning &doffing respirator checklist were 17 steps one mark awarded for each correctly done step.

  * Donning & Doffing footwear checklist, which (included 2 items = 2 marks)

  * Sequence of donning &doffing PPE checklist, which classified into two practice categories and the total items of sequence of donning &doffing PPE checklist were 31 steps one mark awarded for each correctly done step.

The practice level was categorized into two Levels: unsatisfactory = scores less than 65% of total scores (less than 67.6) & satisfactory = scores more than 65% of total scores (more than 67.6).

Tool IV: Students' attitude self-administered structured questionnaire:

This tool was used to assess students' attitude toward web-based learning for (usefulness, Design and online strategy). This tool consists of 25 statements requiring a response on 3 point Likert- rating scale with 3 continuum (agree, neutral, disagree).

A scoring system was used to quantify the students' attitude. 2 marks was given to agree, 1 mark to neutral and 0 to disagree which made up a total score of 50 mark as the following:-

  1- Usefulness of web based learning (included 16 items = 32 marks)

  2- Design of web based learning module (included 4 items = 8 marks)

  3- Online strategy (included 5 items = 10 marks).

Method:

This study was accomplished throughout two main phases:

Phase I: Preparatory phase

1- Administrative process

- An ethical approval was obtained from the Faculty of Nursing Research Ethics Committee (FNREC)/ Mansoura University to conduct the study.
- An official permission was obtained from the dean of Faculty of Nursing, Mansoura University, head of community health nursing department after clarifying the purpose of the study, set the time for beginning the study and explaining the process of the study as well as to gain their cooperation and support during data collection.

2- Literature review

Review of national and international literatures on the various aspects of the web based personal protective equipment education using scientific published articles, internet search and textbooks. This review was a guide for developing the study tools.

3- Developing of the study tools

Tools were developed by the researcher based on reviewing the relevant literature. Validity of the developed tools was tested by the following: Content validity by submitting the tools to a jury of 5 experts in the field of "community health nursing". Face validity by conducting a pilot study on 10% (n= 14)of students who were studying community health nursing course in the first semester (2016 - 2017) and were not included in the study. It was used to evaluate the clarity, applicability, and reliability of the research tools and estimate the approximate time required for data collection. Reliability for the attitude scale was done by using

Cronbach's alpha and the result was 0.85. Based on the collected information, the necessary modifications were done, some questions were added, and others were clarified or omitted.

4- Development of web based module requirements

- Determine the objectives and the desired outcomes of the module .
- Decide the best design for delivery of the content and activities that will produce those outcomes.
- Identify the content of the module (types of personal protective equipment, donning &doffing gloves, gown, mask, respirator, eyewear, face wear and sequence of donning& doffing PPE) was developed by the researcher based on the literature review .
- Designing the web based learning module using a combination of written documents and interactive multimedia. The theoretical content was identical to that of the traditional teaching session.
- The content of the web-based learning module was displayed by using graphics, pictures, videos and animation. This interactive web-based learning module with these features allowed the students to see, hear and interact with the instructor and other student during the learning process. After a brief orientation to navigational features beside the help screen in the module, participants were instructed to work through the module independently for the duration of the session.
- The web-based learning module composed of 3 sections which are; written content, videos, and interactive section which include virtual lab.

- The contents were validated by the experienced educators who made valuable comments on both contents and module. It was modified accordingly and uploaded on **http://www.thehealthgardens.Com/PPE**

Phase II: Operational phase
1. Data collection:

The duration of data collection approximately 3 months from February to May 2017.

A. Pre assessment phase:
- The researcher started by introducing herself to the students in both groups and giving them a brief orientation about aim and design of the study.
- Pretest questionnaire was distributed to the students in both groups at the beginning of the semester to assess their knowledge and practice about personal protective equipment.

B. Implementation phase
- According to the results of preliminary assessment of knowledge and practice of students about personal protective equipment, the researcher designed web-based module.
- Implementation phase lasted for 3 months.
- The same content was used for students in both groups through two different teaching methods ,traditional learning and web based learning.
- The researcher contact with the students in both groups through various ways: e-mail, and other social media such as (WhatsApp).

i. Traditional teaching group--:
- The students in traditional group were 70 students; divided into 3 groups (group 1,2,4). Each group ranged from (23-24) student .

- The sessions were conducted at community health nursing skill lab. Each session involved 23-24 student.
- The session duration 2hours X 1 day/ week (4 week) for each group.
- Different teaching and learning methods were used during the sessions namely; lecture, discussion, brainstorming, demonstration, redemonstration, black board, printed handout, audiovisual materials.

ii. Web based teaching group-:
- The students in the web based group were 70 students; divided into 3 groups (group 3,5,6). Each group ranged from (23-24 student).
- The study group received an overview of the web-based learning as well as a direction for using the web based module and the chat room. Also, they were instructed how to login by using username and password, then students were instructed to work through the module independently for 5 weeks.
- Contact with the students through e-mail and internet chat room.

C. Evaluation phase:
- The students in traditional and web based groups were evaluated for their knowledge and practice by using the study tool II, III.
- The students in the web-based group was evaluated for their attitude about the web-based learning by using the study tool V.

2. Statistical analysis:

The collected data were coded, entered and analyzed by personal computer using Stand for statistical product and service solutions (SPSS) program version 20. After complete data entry, the analysis was conducted by applying frequency tables with percentages. ANOVA test was used for

comparison between and within groups. All tests were performed at a level of significance (P-value) equal or less than 0.05 was considered statistically significant. Quantitative data was described as mean ± SD (standard deviation). The results had a table of "baseline characteristics" comparing the two groups which were not differ significantly. This indicates the two groups were comparable to each other.

Results:

Table (1) shows that (60%) of students in the traditional group and (78.6%) of students in the web based group were females, more than half (58.6%) of students in the traditional group aged 22 year and less than half (44.3%) of students in the web based group aged 21 year. Regarding their residence, (72.9%) of students in the traditional group and (77.1%) of students in the web based group live in rural area, in addition, (92.9 %) of students in the traditional group and (72.9%) of students in the web based group wear personal protective equipment(PPE) during clinical training in hospital during their academic study. Concerning training on technique of wearing PPE, the majority (91.4%, 90%) of students in the traditional and web based groups respectively trained on technique of wearing PPE in the faculty of nursing.

Table (2) presents poor score level of knowledge for all (**100**%) students in the traditional group and (**98.6**%) of students in the web based group in relation to personal protective equipment pre learning intervention. However, all (**100**%) of students in the traditional and web based groups showed good score level of knowledge post learning intervention. There was highly statistical significant difference between traditional and web

based groups regarding the previous item (**P≤ 0.01**).

Table (3) illustrates the percentage of change regarding total knowledge pre and post learning intervention in traditional and web based groups . The results showed that the percentage of change pre and post the traditional group was (**67.5%**) and the percentage of change pre and post the web based group was(**71.7%**).While the percentage of change between the traditional and web based groups was (**14.7%**).

Table (4) shows that there was statistical significant difference between traditional and web based groups regarding satisfactory level of practice related to PPE (donning & doffing gloves, gown, mask, eyewear, face wear, respirator and footwear (**P≤ 0.01**).

Table (5) shows that there was statistical significant difference between traditional and web based groups regarding the total practice. (**P≤ 0.01**).

Table (6) illustrates the percentage of change regarding practice categories pre and post learning intervention in traditional and web based groups. The percentage of change between traditional group and web based group related to donning & doffing of mask score **8.6%**.While the percentage of change between traditional group and web based group related to sequence of donning& doffing PPE score was **3.7%** and was **3.2%** related to total practice score.

Table (7) illustrates attitude of web based group regarding web based learning. The results showed that **88.6%, 82.9%, 78.6%** of students in the web based group agreed that visuals and animations facilitate the understanding of the subject and web-based courses provide learning opportunities that would not have, explanation of subject facilitates the understanding of the subject and there was

enjoyment of learning lessons through the web, online communication enhances students' computer-related information handling skills and students have ability to review the subject whenever they want respectively.

In addition to, more than two thirds **(67.1%)** of the students in the web based group agreed that the web-based learning module useful and could easily learn from it and web-based courses focus on the students' needs more than the traditional classroom. More than half (**61.4%, 60%, 55.7%, 52.9%, 51.4%)** of the students in the web based group agreed that the web-based courses help students overcome travel barriers, web-based courses help students overcome scheduling barriers, they enjoy of quizzes through the web and they feel comfortable when doing the course task through the web, web-based courses allow the pace of learning, reading the course materials in web environment is helpful for the understanding and web-based instruction helps to neutralize personality conflicts that may occur in the traditional classroom respectively. While less than one third **(32.9%)** of the students in the web based group agreed that they feel confidence about completing assignments through the web.

Concerning online strategy, less than three quarters **(74.3%,71.4%)** of the students in the web based group agreed that web-based courses should be recommended to their friends and learning through Web-based courses was convenient respectively. less than two third **(65.7%, 61.4%, 57.1%)** of the students in the web based group agreed that web-based courses preferred than traditional classroom courses, web-based should be recommended for learning other courses and web-based courses should be

utilized more often to deliver learning courses respectively .

Regarding design of web based module, the majority **(84.2%, 82.9%, 81.4%, 71.4%)** of students in the web based group agreed that the features in terms of voice, font, color, animation, graphic designs were of high quality and appropriate to the level of students, program instructions are easy to follow, it is easy to move from one topic to another and the web based module is appropriately designed and the content of module in each chapter is not excessive respectively.

Table (8) reveals that the web-based learning module was evaluated for three attributes. The results showed a mean score of (**32.8 ± 4.87**), indicating high satisfaction of the students and good quality of the web-based learning module.

Concerning Usefulness of web based learning, the students found the web-based learning method useful and facilitate learning process with mean scores of (**21.67 ± 3.7**).

Regarding online strategy, most students agreed that the web-based learning module was appropriate for effective learning with a mean score of(**6.6 ± 1.5**).

In relation to design of web-based module, most students indicated that the developed web based module was appropriately designed with mean score of (**4.57± 0.7**).

Discussion:

Learning is an act of acquiring knowledge. Learners may acquire new knowledge or modify existing knowledge. There are many ways of learning, which includes traditional (face-to-face) learning, distance learning or web-based learning. [13]

The predominant educational approach in nursing and the health

professions was teacher based prior to the 21st century, as evidenced by the abundant use of traditional teaching methods, including lectures; interactive discussions with and without demonstrations; seminars; audiovisual augmentation media and collaborative teaching.[14]

In traditional learning, students are facing some limitations, like inactiveness of the students, students misunderstanding‹ loss of information and poor retention. Additionally, it allows for little or none audience participation. (15,16,17)

Collectively, these issues have compelled us as nurse educators to seek alternative methods in clinical skill instruction like web- based learning which helps students to learn specific knowledge and skills by serving as an easy-to-use device to reinforce classroom instruction.

Web-based learning has encouraging effects in improving both students' knowledge and skills performance and enhancing self-efficacy in performing nursing skills, with a high satisfaction rate expressed by students. ‹. (18,19,20)

In web-based learning, students have the advantage of learning at their own pace, taking class anytime anywhere. It can be customized to meet the individual needs of the students and it accommodates different types of learning styles. It encourages students to take personal responsibility for their own learning. When students succeed, it builds self-knowledge and self-confidence in them. (21,22)

Therefore, the present study was carried out to assess the effect of Web-based learning on academic achievement of community health nursing students in personal protective equipment (PPE) module**.**

Concerning acquisition of knowledge, the present study revealed that the students in the traditional and web-based groups had poor score level of knowledge regarding personal protective equipment prior teaching intervention and there was not any statistical significant difference. This may be due to that they exposed to knowledge related to personal protective equipment without application.

The findings of the present study illustrated that the web-based learning method produced significant knowledge gains with a mean score of **(61.5±1.3)** compared to a mean score of **(53.6±2.4)** for the traditional group. The possible explanation is that web-based learning simplifies the content through graphics, animations, high quality pictures and videos. In addition, web-based learning provides students with new and interesting learning experiences. This point of view is in agreement with **Saini et al., (2014)** [23] who stated that, The potentially of WBL tools facilitates students in utilizing multimedia, audio, video, conferencing and chatting room in delivering learning material. It always facilitates effective learning.

Mccutcheon et al., (2015) [24]**; Saini et al., (2014)** [25]**and Zhu C, (2012)** [26] reported that, online learning system can enrich students' collaborative learning activities and their knowledge construction via group interaction.Student satisfaction and the level of knowledge construction in the web-based learning environment are important variables influencing student learning, especially in a student-centered web based learning environment. Additionally, The Web-based instructional system (WBIs) helps student, teacher and institutions in improving overall learning process. WBIs increase the outcome of students in comparison to traditional

learning. The outcome includes the learning, satisfaction and performance.

However, these findings are in contrast to the findings of **Mehrdad, (2011)** [27] who found that, web based learning is an effective as traditional learning and resulted in similar achievement and course satisfaction.

Moreover**,** the findings of the present study are in contrast to the findings of **Farley et al., (2011)** [28] who reported that the traditional lectures received better educational and enjoyment value when compared to the web-based learning. In addition, web-based tutorials are not seen to be as useful in the learning process as traditional learning.

While, **Al-Qahtani et al., (2013**) [29] suggest that, blended learning which mix E-learning and traditional learning can support students' learning more effectively than e-learning or traditional learning alone. It is possible to design approaches to blended learning which adopt the positive aspects of e-learning and can combine them with those of traditional learning.

From our point of view, we prefer to combine the two strategies of learning to provide learning that is more effective to the students.

With regard to acquisition of skill performance, the present study found that the students in both groups had similar unsatisfactory score level prior teaching intervention and there wasn't any statistical significant difference in the pre test score on donning &doffing gloves, gown, mask ,respirator, eyewear, face wear and PPE sequence between traditional and web based groups. However, after the intervention there was improvement of students' performance in web-based group more than traditional group. Also, there was statistical significant difference between web based and traditional groups.

It was clear that, the majority of students in traditional learning were forgetting to perform one-step or more or the sequence of their performance is wrong. The possible explanation for that may be the shyness of some students to ask the instructor for repetition when losing their attention during demonstration. In contrast to students in WBL, they were performing most of the procedure steps sequentially as they were able to repeat the demonstration at any point, anywhere at several times. This point of view is in agreement with **Lee,(2012)** [30] **and Ray P, (2010)** [31] who stated that, use of web as an educational tool has provided students with a wider range of new interesting learning experiences and teaching environments that not possible in traditional learning. In addition, improvements of student performance among students learning online exceeded those of students learning in traditional groups.

While these findings are contradicted with the results documented by **Misopoulos et al., (2018)** [32] **; Stöhr et al ., (2016) ;** [33] **Haughton et al ., (2015)** [34] **; Wilson et al., (2014)** [35]**; Guy et al ., (2013)** [36] **; Bowen et al ., (2012)** [37] **; Driscroll et al ., (2012)** [38]**; Ary et al ., (2011)** [39]**and Figlio et al., (2010)** [40], who found that, there was not any statistical significant differences of students performance pre and post intervention between traditional and online students.

However**, Titthasiri W,(2013)**[41] stated that, the blended learning mixed of e-learning and traditional learning would be an improvement of students' achievement. And **Al-Qahtani et al., (2013)** [42] found that, blended learning can support students' learning more effectively than e-learning or traditional learning alone.

The attitude of the learner is important and contributes to desirable learning outcomes. A positive attitude positively influences learning efficacy, motivation, and knowledge application as well as learning outcomes. **Karaman, (2011)** [43]. Students' attitudes towards the web-based learning course was positive in the present study, they considered it convenient, interesting, easy to use, helpful, and they would like similar web-based activities integrated into all subjects of the bachelor of nursing course. Also, students found the activities enhanced learning, provided them with the tools to practice learning, and enabled them to study at their own pace.

Moreover, most of the students in the web-based group were satisfied with their web-based learning experiences, they feel more confident to use computer and technology in learning. Additionally, most of them found that WBL enhances students' computer and information skills, this is in agreement with **Button et al., (2013)** [44], who stated that, information and communications technology (ICT) facilities, computer skills, and information skills are the fundamental requirements for learners to engage successfully in e-learning. Information literacy has become essential for nurses, alongside clinical skills

Furthermore, these findings are congruent to **Chong et al., (2016)** [45], who indicated that, the majority of nurses strongly agreed that e-learning is a convenient way to learn, offers a rich and flexible learning environment, provides ready access to knowledge relevant to nursing practice, and allows interaction with facilitators and others. In addition, **Khatib N, (2016)** [46]. **; Karaman, (2011)** [47] **and Moule et al., (2010)** [48] reported that the majority of nurses and nursing students have positive perceptions toward e-learning, identifying it as an essential component due to its flexibility and suitable for their working conditions and needs.

Computer technology has a significant effect on undergraduate nursing student's attitude towards e-learning. It is evident that poor technology with frequent technical difficulties discourages students to participate in e-learning courses. Therefore in order to increase satisfaction levels of students with e –learning, it is important for students to be equipped with the main tools for e-learning which include knowledge and skills of computers and internet uses. **Fakude L , (2012)** [49].

On a global view, the web-based learning module proved to be effective for nursing students. Web based learning module improved nursing student's actual knowledge on personal protective equipment. In addition, those who used the program performed the selected basic nursing skills better than those who did not. Moreover, the easy accessibility, convenience, and self-pace of learning are the strengths of web based learning. On the other hand, the web-based learning has its disadvantages, such as instructors must spend time designing and creating it, demonstrating the skills, shooting the videos, maintaining and updating the program, and problems with uploading. Overall, however, the advantages outweigh the disadvantages.

Conclusion:

Based on the findings of the present study, it can be concluded that the web-based learning was more effective than traditional learning in increasing students' knowledge and skills regarding personal protective equipment. This may be due to the interactive feature of the module with videos, colorful pictures and virtual lab while at the same time being well accepted by the students and they perceived it to be

useful, flexible, and convenient. Moreover, web-based learning can assist students in enhance their knowledge and acquiring skills during their free time outside formal lectures, at their own pace and schedule

Recommendation:

Based on the findings and conclusions drawn from the study, the following recommendations are suggested:

1. Integration of web-based education in different nursing specialties to incorporate information technology into the nursing education curriculum.

2. Emphasis on students' outcomes in long-term knowledge and skills retention is recommended.

Table (1): Distribution of traditional & web based groups according to their socio demographic &Occupational characteristics in each group.

Socio demographic &Occupational characteristics	Traditional Group (n=70)		Web based Group (n=70)	
	N	%	N	%
Sex				
Male	28	40%	15	21.4%
Female	42	60%	55	78.6%
Age				
21 year	19	27.1%	31	44.3%
22 year	41	58.6%	25	35.7%
23 year	10	14.3%	14	20%
□±S.D	**21.9(.635)**		**21.8(.769)**	
Residence				
Rural	51	72.9%	54	77.1%
Urban	19	27.1%	16	22.9%
Working in nursing during academic study				
No	57	81.4%	59	84.3%
Yes	13	18.6%	11	15.7%
Wear PPE during clinical training in hospital/outpatient clinic.				
During academic study	65	92.9%	51	72.9%
During private work	5	7.14%	19	27.14%
Trained on technique of wearing PPE				
In faculty	64	91.4%	63	90%

□ **(SD):** Mean (standard deviation)

Table (2): Distribution of traditional & web based groups regarding their score level of knowledge about Personal Protective Equipment pre& post learning intervention.

Knowledge items	Traditional group n=70				Web based group n=70				$\square$ ²	P
	Pre		Post		Pre		Post			
	N	%	N	%	N	%	N	%		
Definition & Purpose(4 marks)										
Good	4	5.7%	68	97.1%	4	5.7%	69	98.6%	256.984	.000**
Poor	66	94.3%	2	2.9%	66	94.3%	1	1.4%		
Types and rules of selection(6 marks)										
Good	5	7.1%	70	100%	4	5.7%	70	100%	**Monte Carlo test ᵃ**	.000**
Poor	65	92.9%	0	0%	66	94.3%	0	0%		
Gloves usage(14 marks)										
Good	0	0%	70	100%	1	1.4%	70	100%	**Monte Carlo test ᵇ**	.000**
Fair	5	7.1%	0	0%	4	5.7%	0	0%		
Poor	65	92.9%	0	0%	65	92.9%	0	0%		
Gown usage(6 marks)										
Good	6	8.6%	69	98.6%	3	4.3%	70	100%	267.246	.000**
Poor	64	91.4%	1	1.4%	67	95.7%	0	0%		
Respiratory PPE(12 marks)										
Good	0	0%	70	100%	2	2.9%	70	100%	**Monte Carlo test ᶜ**	.000**
Fair	0	0%	0	0%	1	1.4%	0	0%		
Poor	70	100%	0	0%	67	95.7%	0	%		
Eyewear and face wear usage(3 marks)										
Good	16	22.9%	69	98.6%	15	21.4%	70	100%	238.484	.000**
Poor	54	77.1%	1	1.4%	55	78.6%	0	0%		
Hair cover and footwear usage(6 marks)										
Good	4	5.7%	69	98.6%	3	4.3%	70	100%	**Monte Carlo test ᵈ**	.000**
Poor	66	94.3%	1	1.4%	67	95.7%	0	0%		
Donning and doffing of PPE(6 marks)										
Good	10	14.3%	70	100%	9	12.9%	70	100%	259.691	.000**
Poor	60	85.7%	0	0%	61	87.1%	0	0%		
Types of precautions(6 marks)										
Good	8	11.4%	69	98.6%	4	5.7%	69	98.6%	265.064	.000**
Poor	62	88.6%	1	1.4%	66	94.3%	1	1.4%		
Total knowledge score (63 marks)										
Good	0	0%	70	100%	1	1.4%	70	100%	**Monte Carlo test ᵉ**	.000**
Poor	70	100%	0	0%	69	98.6%	0	0%		

Poor =Scores less than 50%of total scores (less than31.5)
Fair = Scores 50% to 65% of total scores (31.5-40.95)
Good = Scores more than 65%of total scores (more than 40.95)
(a, b, c, d, e): (8,40,28,8,136) cells have expected cell count <5 $\square$**2**:Chi-square test
P: Significance.   * Significant (p< 0.05).   ** Highly significant (p<0.01)

Table (3): Mean difference between traditional & web based groups regarding total knowledge scores pre& post learning intervention

Item	Traditional group n=70			Web based group n=70			% of change
	Pre	Post	% of change	Pre	Post	% of change	
	M(SD)	M(SD)		M(SD)	M(SD)		
Total knowledge score	17.4(5.7)	53.6(2.4)	**67.5%**	17.4(5.1)	61.5(1.3)	**71.7%**	**14.7%**
F	2609.4						
P	0.000**						

F(one way-ANOVA)   *significant (p<0.05)   **P**(significance)   **Highly significant(p<0.01)

Table (4): Distribution of traditional & web based groups according to their satisfactory level of practices of different procedures of personal protective equipment.

Items	Traditional group n=70				Web based group n=70				χ2	P value*
	Pre		Post		Pre		Post			
	N	%	N	%	N	%	N	%		
Donning gloves (19 marks)	0	0%	70	100%	0	0%	70	100%	310.055	.000**
Doffing gloves(7 marks)	3	4.3%	69	98.6%	3	4.3%	70	100%	265.183	.000**
Donning & doffing gloves total score (26 marks)	0	0%	70	100%	1	1.4%	70	100%	**Monte Carlo test[a]**	.000**
Donning gown (4 marks)	0	0%	70	100%	2	2.9%	70	100%	276.230	.000**
Doffing gown (5 marks)	3	4.3%	66	94.3%	5	7.1%	69	98.6%	249.330	.000**
Donning & doffing gown total score (9 marks)	0	0%	70	100%	2	2.9%	70	100%	**Monte Carlo test[b]**	.000**
Donning mask(6 marks)	37	52.9%	69	98.6%	38	54.3%	70	100%	217.216	.000**
Doffing mask(3marks)	6	8.6%	69	98.6%	8	11.4%	69	98.6%	241.439	.000**
Donning & doffing mask total score (9 marks)	12	17.1%	69	98.6%	17	24.3%	70	100%	**Monte Carlo test[c]**	.000**
Donning eyewear and face wear (5 marks)	21	30%	68	97.1%	20	28.6%	69	98.6%	240.114	.000**
Doffing eyewear and face wear (5 marks)	0	0%	69	98.6%	3	4.3%	70	100%	273.212	.000**
Donning & doffing eyewear and face wear total score (10 marks)	3	4.3%	69	98.6%	4	5.7%	70	100%	**Monte Carlo test[d]**	.000**
Donning respirator (6 marks)	2	2.9%	70	100%	2	2.9%	70	100%	279.891	.000**
Doffing respirator(11 marks)	0	0%	69	98.6%	1	1.4%	70	100%	283.024	.000**
Donning & doffing respirator total score (17marks)	0	0%	70	100%	1	1.4%	70	100%	**Monte Carlo test[e]**	.000**
Footwear total score (2 marks)	3	4.3%	69	98.6%	4	5.7%	70	100%	201.9	.000**
Sequence of donning PPE (13 marks)	0	0%	70	100%	1	1.4%	70	100%	292.079	.000**
Sequence of doffing PPE (18 marks)	0	0%	70	100%	1	1.4%	70	100%	308.402	.000**
Sequence of donning &doffing PPE total score (31 marks)	0	0%	70	100%	1	1.4%	70	100%	**Monte Carlo test[f]**	**.000****

Satisfactory = scores 65% of total scores and more than
Unsatisfactory = scores less than 65% oftotal scores   **P**(significance)
X2: Chi-square test   * Significant (p< 0.05).
(a, b, c, d, e, f): (60,24,12,20,44,196) cells have expected cell count <5   **Highly significant(p<0.01)

Table (5): Distribution of traditional & web based groups according to their score level of total practice pre& post learning intervention.

Total Practice score (104 marks)	Traditional group n=70				Web based group n=70				χ2	P
	Pre		Post		Pre		post			
	N	%	N	%	N	%	N	%		
Satisfactory	0	0%	70	100%	1	1.4%	70	100%	Monte Carlo test [a]	.000**
Unsatisfactory	70	00%	0	0%	69	98.6%	0	0%		

Satisfactory = scores 65% of total scores and more than (67.6 and more)
Unsatisfactory = scores less than 65% oftotal scores   (less than 67.6)
X²: Chi-square test   **a:** 196 cells have expected cell count <5
P: Significance.   * Significant (p< 0.05)   **Highly significant(p<0.01).

Table (6): Mean difference between traditional & web based groups regarding practice categories pre& post learning intervention

Item	Traditional group n=70			Web based group n=70			% of change
	Pre M(SD)	Post M(SD)	% of change	Pre M(SD)	Post M(SD)	% of change	
Donning & doffing gloves score	10.5(2.5)	23.6(1.7)	55.5%	10.6(3.0)	25.0(1.1)	57.6%	5.9%
F	988.1						
P	0.000**						
Donning &doffing gown score	3.4(0.9)	8.2(0.6)	58.5%	3.7(1.1)	8.9(0.3)	58.4%	8.5%
F	993.1						
P	0.000**						
Donning& doffing mask score	4.4(1.2)	8.1(0.9)	45.7%	4.6(1.4)	8.8(0.5)	47.8%	8.6%
F	391.4						
P	0.000**						
Donning &doffing eye and face wear score	4.2(1.3)	9.2(0.7)	54.3%	4.5(1.6)	9.8(0.5)	54.1%	6.5%
F	561.1						
P	0.000**						
Donning &doffing respirator score	3.8(2.3)	15.5(0.9)	75.5%	4.1(2.6)	16.5(0.8)	75.2%	6.5%
F	1061.0						
P	0.000**						
Footwear score	0.78(0.74)	1.8(0.3)	58.9%	0.5(0.6)	1.9(0.2)	73.7%	5.6%
F	119.6						
P	0.000**						
Sequence of donning& doffing PPE score	6.1(2.4)	29.5(1.3)	79.3%	6.0(3.9)	30.6(0.9)	80.4%	3.7%
F	2306.0						
P	0.000**						
Total practice score	38(8.1)	107.6(4.3)	64.7 %	38.6(10.7)	111.1(2.4)	65.3%	3.2%
F	2371.7						
P	0.000**						

F(one way-ANOVA)   *significant (p<0.05)
P(significance)   **Highly significant(p<0.01

Table (7): Distribution of the web based group regarding their attitude about web based learning (n=70)

Web based learning	Web based group n=70					
	Agree		Neutral		Disagree	
	N	%	N	%	N	%
Usefulness of web based learning						
The web-based learning module useful and could easily learn from it.	47	67.1%	23	32.9%	0	0%
Web-based courses allow the pace of learning.	37	52.9%	29	41.4%	4	5.7%
Web-based courses provide learning opportunities that would not have.	62	88.6%	4	5.7%	4	5.7%
Visuals and animations facilitate the understanding of the subject.	62	88.6%	4	5.7%	4	5.7%
Explanation of subject facilitates the understanding of the subject.	58	82.9%	12	17.1%	0	0%
Confidence about completing assignments through the web.	23	32.9%	43	61.4%	4	5.7%
Enjoy of quizzes through the web.	39	55.7%	31	44.3%	0	0%
I feel comfortable when doing the course task through the web.	39	55.7%	27	38.6%	4	5.7%
Reading the course materials in web environment is helpful for the understanding.	36	51.4%	30	42.9%	4	5.7%
Enjoyment of learning lessons through the Web.	58	82.9%	12	17.1%	0	0%
Ability to review the subject whenever I want.	55	78.6%	15	21.4%	0	0%
Web-based instruction helps to neutralize personality conflicts/ differences that may occur in the traditional classroom.	36	51.4%	34	48.6%	0	0%
Web-based courses focus on the students' needs more than the traditional classroom.	47	67.1%	19	27.1%	4	5.7%
Web-based courses help students overcome scheduling barriers.	42	60%	28	40%	0	0%
Web-based courses help students overcome travel barriers.	43	61.4%	23	32.9%	4	5.7%
Online communication enhances students' computer-related information handling skills.	55	78.6%	15	21.4%	0	0%
Online strategy						
Learning through Web-based courses is convenient.	50	71.4%	12	17.1%	8	11.4%
Web-based courses should be utilized more often to deliver learning courses.	40	57.1%	27	38.6%	3	4.3%
I recommend web-based courses to my friends.	52	74.3%	15	21.4%	3	4.3%
I prefer web-based courses than traditional classroom courses.	46	65.7%	24	34.3%	0	0%
I recommend web-based for learning other courses.	43	61.4%	20	28.6%	7	10%
Design of web based module						
Program instructions are easy to follow.	58	82.9%	4	5.7%	8	11.4%
It is easy to move from one topic to another.	57	81.4%	13	18.6%	0	0%
The features in terms of voice, font, color, animation, graphic designs are of high quality and appropriate to the level of students.	59	84.2%	8	11.4%	3	4.3%
The web based module is appropriately designed.	50	71.4%	15	21.4%	5	7.14%
The content of module in each chapter is not excessive	50	71.4%	15	21.4%	5	7.14%

Table (8): Mean difference between attitude categories toward web based learning

Attitude categories		M (SD)	95% confidence interval of the difference	
			Lower	Upper
Usefulness of web based learning	(32 mark)	21.671(3.740)	20.857	22.686
Online strategy	(10 mark)	6.600(1.536)	6.229	6.957
Design of web based module	(8 mark)	4.571(0.714)	4.400	4.757
Total score of attitude	(50 mark)	32.842(4.871)	31.729	33.985

M(SD) = Mean(standard deviation)

3 point Likert –scale (2=agree ; 1=Neutral; 0=disagree)

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