ORIGINAL ARTICLE

Effectiveness of training program by blended learning on knowledge and practices regarding first aid among preparatory year engineering students at Assiut University

Adel M Aljawfi[1], Rabaa H Hassanen[2], Soad A Sharkawy[2]

[1]Department of Community Health Nursing- Faculty of Medicine and Health Sciences, Thamar University, Yemen.
[2]Community Health Nursing - Faculty of Nursing, Assiut University, Egypt

Corresponding Author: Adel M Aljawfi **Email:** aljawfiadel@yahoo.com

ABSTRACT

First aid training is necessary for engineering students to increase their health and safety knowledge relating to reducing damage and suffering and improving their chances of survival. Objective: This study aims to evaluate the effectiveness of a training program by blended learning on knowledge and practices regarding first aid among preparatory year engineering students at Assiut University. A pretest, posttest design was used in this study. About 85 participants were selected randomly from the preparatory year of engineering students at Assiut University. Participants were randomly selected and provided with a first-aid training program. Data were collected via a self-administered knowledge questionnaire sheet and an observational checklist pre, post, and three months after the program intervention. The repeated measured ANOVA was used. Results: The study revealed that 61.2% of students had poor knowledge scores about first aid in the pre-test with a total mean of 65.16±24.41, which improved to 95.3% of students who had good knowledge scores in the post-test with a total mean of 121.89±10.27, and slightly declined to 77.6% having good knowledge scores in the follow-up test with a total mean of 110.93±27.38. Moreover, 85.9% of students had poor practice scores about first aid in the pre-test with a total mean of 19.19±4.71, which improved to 72.9% having good practice scores in the post-test with a total mean of 52.49±7.84, and 65.9% having good practices scores in the follow-up test with a total mean of 48.64±13.49. The study concluded that the training program by blended learning showed a positive effect on knowledge and practices of students at post and follow-up tests. This provides a safe learning environment for engineering students. Recommendation: Blended learning programs should be taken as a learning approach in the health training program implementation.

INTRODUCTION

The community frequently has a negative impression of first aid because they think only medical professionals can provide it. Therefore, most people do not have the necessary first aid skills, which leads to an inability to assist accident victims.[1]

First aid (FA) is the first emergency care provided to a casualty or injured person before the arrival of professional medical care. A first aider describes any qualified person who has received authorized training indicating that he or she can provide first aid[2]. The goals of first aid are to preserve life, prevent health from declining, promote recovery, and help ensure safe transportation to the nearest medical facility.[2]

The engineering work environment is hazardous because of the exposure to numerous chemical, physical, and mechanical risks. It involves various activities such as working in restricted places, heights, physical handling, lifting operations, working directly with machines and electricity, demolition, and groundwork.[3]

Engineering sector workers exposed to hot weather conditions or intense sunlight may lead to sunstroke and heat-related illnesses (HRIs). Egypt is characterized by the hot summer season, and working in hot conditions can put a load on employees that may cause heat-related disease.[4]

According to (WHO), a burn is a skin or organic tissue injury induced mainly through heat, radiation, radioactivity, electricity, friction, or chemical contact. To enhance patient outcomes, preserve medical resources, and reduce healthcare costs, avoiding injuries is crucial, as providing effective first aid and treating burns as soon as possible.[5]

Electrocution is the most prevalent risk to electrical workers, although other risks include arc flashes, falls, and thermal burns. The most frequent electrical safety risks that increase the chance of being electrocuted include exposed wires, energized parts, and defective or malfunctioning wiring or equipment.[6]

Helping victims in accidents and crises until the arrival of professional aid is vital. Therefore, first aid training can enhance engineering students' knowledge and abilities to assist them in better recognizing various engineering risks and hazards throughout their engineering courses training and preparing them for greater safety after graduation.[7]

Blended learning (BL) is becoming increasingly popular among university students. It combines online and classroom learning activities. The strategy of BL sets a methodology for making optimal use of internet resources, digital tools, and technology to facilitate face-to-face engagement between students and instructors, flexibility, and a better learning experience.[8]

Blended learning motivates learning and academic success and promotes student self-confidence and autonomy through asynchronous and synchronous teaching strategies like webinars, live chats, blogs, etc.[9]

Community health nurses are professionals identified as vital for improving health literacy. They develop training programs that address occupational health hazards, safety, and care. Therefore, these interventions can improve recovery and decrease human damage.[10]

Students of industrial training institutions (ITI) eventually go on to work in a variety of fields and industries and are subject to accidents. The most crucial thing to do when someone is harmed is to assist. Everyone should be able to help an injured individual successfully until they can obtain expert medical attention,

especially industrial employees. Even though ITI students had finished their school education, they lacked basic first aid skills for situations including burns, dog bites, wounds, and convulsions.[11]

Similar results of low knowledge were reported in a study done by Semwal et al. in 2017 in which only 17% of students had good knowledge of first aid and poor knowledge was found in 33.3% of students.[12]

A study conducted by Mobarak et al. regarding first aid knowledge and attitude of secondary school students in KSA in 2015 found that the first aid preparedness in Saudi students was inadequate.[13]

The academic environment in which future engineering professionals are trained remains largely ignored by researchers; this is a significant gap since, due to their use of heavy machinery and equipment in the academic engineering laboratories which offer a range of risks, some similar in intensity to those that occur in workplaces [14]. In addressing this research problem, this study implemented a first aid training program by BL targeted at the preparatory study year of engineering students.

The preparatory year contains all students before their specialization. While students in the engineering faculty spend the majority of their education days in a faculty, which is the most likely setting for accidents resulting from natural work in the faculty laboratories and projects locations, such as electrocution, burn, bleeding, injuries, fainting, heat stress, and fracture, etc. Also, the engineering faculty has no health learning in their education curriculum plan and does not emphasize first aid and essential life support in the work environment. It is crucial to implement the current study, a training program involving seven first aid procedures related to common injuries and accidents among the engineering trainees, to enable them to provide the correct immediate care for causalities at the site of accidents and support the need to establish a safety culture within this educational institutions.[14]

Blended learning allows for greater flexibility in education, education has become a more effective interactive process than traditional classrooms. Studies were done at Aal al-Bayt University and Hafar Al-Batin Governorate to analyze the impact of adopting mixed education vs standard classroom-based instruction on student attainment. The results indicated that there were statistically significant differences attributable to the teaching method and in favor of the experimental group that studied through blended learning. Another study measured the impact of blended learning on first aid skills in the Department of Physical Education and Sports in the State of Kuwait. The results indicated a statistically significant difference between the mean scores in which the experimental group receiving blended learning delivery outperformed the control group in an achievement test.[15]

Blended learning was adopted in this study because it increased learner acceptance, improved learner engagement and motivation, reduced training expenses, and reached more learners who may have some control over some aspects of their learning such as time, location, and path. It also boosts student retention and dedication to their educational goals. As a result, blended learning is a superior educational option [16]. Therefore, the current study aims to evaluate the effectiveness of a training program by blended learning on knowledge and practices regarding first aid among preparatory year engineering students at Assiut University.

HYPOTHESES

There will be a significant improvement in engineering students' knowledge and practice regarding first aid after implementing a training program by blended learning.

METHODS

Design and Setting
A pretest, posttest design was used in this study. The laboratories of engineering faculty offer a range of risks, some similar in intensity to those in workplaces; they are used during safety and prevention training. Due to this, the study was conducted at the Faculty of Engineering, Assiut University.

Participants
The participant group was a systematic random sample of preparatory-year engineering students. Based on prior research, the mean knowledge score of first aid for pre - intervention was 69± 15 and for the post - intervention was 75±15. To detect the differences in means between related groups with the G*Power 3.1.9.7 program, an effect size of 0.4, paired t-tests, significance level (α) of 0.05, and power (1-β) of 0.95 were used. A total sample size of 85 students were required.[17]

Inclusion criteria
- Students that enrolled in a public education system
- Students who agree to participate and continue in this study

Exclusion criteria
- Students that refused to participate in this study.
- Students that enrolled in the special programs.

Measurements

1. Engineering students' socio-demographic data:
It included Part (1): Engineering students' personal data: name, age, and sex and Part (2): Socioeconomic status according to El-Gilany scale.[18] It was utilized to assess the socioeconomic status of the Egyptian family and includes 7 domains. This scale is categorized into a very low, low, middle, and high level of socioeconomic status.

2. Engineering students' knowledge about first aid:
The researchers developed this tool after reviewing the relevant literature.[19–22] This tool comprises (47) questions that address the theoretical parts of FA. It assessed the engineering students' knowledge about FA, including basic concepts of first aid, definitions, causes, signs and symptoms, first aid, and prevention of fainting, sunstroke, bleeding, wounds, fractures, burns, and electrocution. The scoring system followed each correct answer given (1) and incorrect given (0). Total scoring (137 graded) was classified as poor if the score was < 60% (<82.2), fair if the score was 60% to < 75% (82.2 - <102.8), and good if the score was 75% or more (102.8 -137).[23]

3. Observational checklist:
The researchers developed this tool after reviewing the relevant literature to assess engineering students' practices about first aid [19–22]. It consists of (61) items divided into seven parts; first aid practice about fainting (five items), sunstroke (seven items), bleeding (eight items), wounds (eight items), fractures (eleven items), burns (sixteen items), and first aid practice about electrocution (six items). The scoring system was calculated according to the total score of 61. One (1) degree was awarded for each achieved item, and zero (0) was awarded for not

achieved. It was classified as poor practice if the score was < 60% (<36.6), fair if it was 60% to < 75% (36.6-<45.8), and good practice if it was 75% or more (45.8-61).[23]

Validity and Reliability

Five academic professors from Assiut University's Nursing Faculty performed validity for all tools and the content of the educational program. Four were from community health nursing and one from medical and surgical nursing, who reviewed the tools for clarity, relevance, comprehensiveness, understanding, and applicability[20]. The reliability was measured using the Cronbach alpha coefficient test to knowledge questionnaire about first aid was (0.88) and the observational checklist for assessing student practices about first aid was (0.90).[20]

A pilot study

A pilot study was carried out on 9 engineering students (10%),[20] prior to data collection to investigate the accuracy, applicability, and time necessary to fill out the form of study tools. No changes were made and added to the studied sample.

Data collection

The present study's data were collected from the beginning of October 2021 until the end of April 2022, two days weekly. A clarification of the purpose of the research was presented to engineering students to get their cooperation before beginning data collecting.

1. Pre-test

This phase was conducted for five weeks before the implementation of the program to assess the engineering students' knowledge and practices regarding first aid. A self-administered knowledge questionnaire sheet was used to collect their knowledge about FA, which engineering students filled out after clarifying the instruction. The average time spent filling each self-administered sheet was 25-30 minutes. An observational checklist was used to assess the engineering student's practices in the pre-test by the researchers. They observed the practices of the students when they were applying the first aid measures via role play and demonstration. About ten to twelve checklists were finished per day. Each item was marked as completed if followed or not completed if not followed.

2. Training Program

This phase included the arrangement and implementation of the program. The timetable for sessions was decided, and the study sample was divided into eight groups, each containing 11 students, except group 8, which included 12 students. The researchers used teaching methods such as lectures, discussions, presentations, role play, and demonstrations. The media and materials used were PowerPoint presentations, videos, pictures, first aid kits, and a handout booklet (printed and pdf copy) was provided to each participant. Zoom video conference was used for teaching the theoretical part, and the practical part was conducted in the class.

This program implementation was carried out for eight weeks. Five days were given for online education of the theoretical part of the program (1st, 2nd, and 3rd sessions) conducted via Zoom video conference. Then the implementation of the practical part of the program (4th and 5th sessions) was carried out over seven weeks.[24]

The program content was created based on the relevant literature and available resources describing first aid components and specifying items related to engineering hazards to enhance engineering students' knowledge and practices about

FA. It was revised by five nursing experts (one from medical surgical nursing and four from community health nursing at the Faculty of Nursing, Assiut University). The program was carried out for seven weeks. It was given in five sessions:

- The 1st session included the engineering work accidents and injuries, definition, purposes of FA, and first aid kit content. This session was conducted via Zoom video conference. It was given 1.5 hours.
- The 2nd session contained definitions, causes, signs & symptoms, first aid, and prevention of fainting, sunstroke, bleeding, and wounds. This session was conducted via Zoom video conference. It was divided into two parts, each part given 1.5 hours.
- The 3rd session included definitions, causes, signs & symptoms, first aid, and prevention of fractures, burns, and electrocution. This session was conducted via Zoom video conference. It was divided into two parts, each part given 1.5 hours.

- The 4th session included applying first aid for fainting, sunstroke, bleeding, and wounds. This session was conducted by class learning. It was divided into two parts, each part given 3 hours.
- The 5th session included applying first aid for fractures, burns, and electrocution. This session was conducted by class learning. It was divided into two parts, each part given 3 hours.

3. Post and Follow up tests:

The evaluation was performed through a post-test immediately after the program's intervention. Each session ended with immediately student's re-demonstration of the first aid procedure to assess their practices in the post-test using an observational checklist (the observation was done by the researchers). Then, their knowledge in the post-test was assessed immediately after the training program was accomplished using the knowledge questionnaire sheet.

After three months of the program, a follow-up test was performed to evaluate engineering students' knowledge and practices using the same pre-test tool II & tool III.
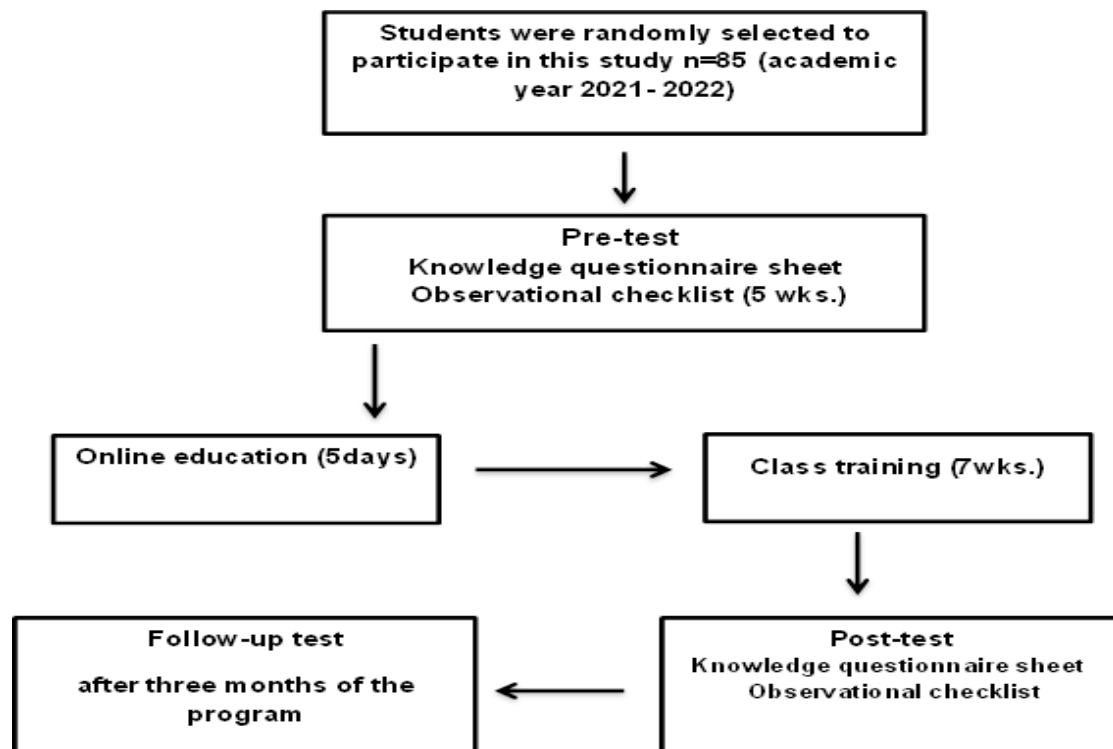
Figure 1. Flow chart of research.

Ethical considerations

Written approvals for this study were obtained from the Ethical Research Committee of the Faculty of Nursing, Assiut University (Approval no: 2730025). Students were informed about the purpose and plan of the study, and written consent was obtained from all students.

Statistical analysis

SPSS version 22 was used for data entry and analysis; the data were given in numbers, percentages, means and standard deviations. Repeated measured (RM) ANOVA was utilized to compare between means of the three related groups (pre-test, post-test and follow-up test). When significant interactions were identified in the ANOVA test, the Bonferroni correction was used for post hoc comparisons. The P – Value was considered statistically significant if it was < 0.05.

RESULTS

Participants' socio-demographic data

The engineering students comprised 67.1% of males and 32.9% of females, with 76.5% of them less than 20 years old. 95.3% of students did not attend previous FA training programs, 62.4% reside in urban areas, and 36.5% live in low social classes (Table 1).

Knowledge and practice mean scores in pre, post, and follow up tests

There was a significant improvement in the means scores of all knowledge and practices dimensions in post and follow-up tests, with the total mean score of the student's knowledge improved from 65.16±24.41 in the pre-test to 121.89±10.27 in the post-test and 110.93±27.38 in the follow-up test, with a statistically significant difference found at p<0.001*. Moreover, the total mean score of students' practices improved from

19.19±4.71 in the pre-test to 52.49±7.84 in the post-test and 48.64±13.49 in the follow-up test, with a statistically significant difference found at p<0.001*. (Table 2 &3).

Figure 1 illustrates that 61.2% of engineering students had poor total knowledge scores in the pre-test and improved in the post and follow-up tests to 95.3% and 77.6%, respectively, which were good knowledge scores.

Figure 2 illustrates that 85.9% of engineering students had poor total practice scores in the pre-test and improved in the post-test and follow-up tests to 72.9% and 65.9%, respectively, which were good practice scores.

Table 1. Distribution of socio-demographic data of preparatory engineering students (N=85).

Variables	No. (85)	%
Age: (years)		
< 20	65	76.5
≥ 20	20	23.5
Sex:		
Male	57	67.1
Female	28	32.9
Father education:		
Read & write	4	4.7
Preparatory	4	4.7
Secondary	9	10.6
Intermediate (2 years) institutes	12	14.1
University	43	50.6
Postgraduate	13	15.3
Mother education:		
Read & write	16	18.8
Secondary	13	15.3
Intermediate (2 years) institutes	16	18.8
University	28	32.9
Postgraduate	12	14.1
Attending training program:		
No	81	95.3
Yes	4	4.7
Residence:		
Urban	53	62.4
Rural	32	37.6
Social class:		
Very low	21	24.7
Low	31	36.5
Middle	19	22.3
High	14	16.5

Table 2. Total mean score of knowledge about first aid and its dimensions over time among preparatory year engineering students who received training program (n = 85).

Variable	Pre-test (n= 85)	Post-test (n= 85)	Follow-up (n= 85)	p-value*	p-value** (pairwise comparison)	
	Mean±SD	Mean±SD	Mean±SD		P¹	P²
Basic first aid concepts	11.20±4.62	20.01±1.36	19.13±4.87	<0.001*	<0.001*	<0.001*
Fainting	6.59±3.47	13.93±1.77	12.28±3.95	<0.001*	<0.001*	<0.001*
Sunstroke	5.01±2.18	8.73±1.00	7.79±2.29	<0.001*	<0.001*	<0.001*
Bleeding	4.25±2.29	9.59±1.54	8.60±2.63	<0.001*	<0.001*	<0.001*
Wounds	9.52±4.45	17.82±1.49	16.14±4.27	<0.001*	<0.001*	<0.001*
Fractures	7.55±2.93	13.18±1.34	12.00±2.87	<0.001*	<0.001*	<0.001*
Burns	13.74±6.45	25.35±2.03	23.06±5.37	<0.001*	<0.001*	<0.001*
Electrocution	7.31±3.79	13.28±0.92	11.93± 3.16	<0.001*	<0.001*	<0.001*
Total mean score of knowledge about first aids	65.16±24.41	121.89±10.27	110.93±27.38	<0.001*	<0.001*	<0.001*

* Repeated measure ANOVA test
** Bonferroni post hoc test
P= pre vs. post vs. Follow up,
P1= comparing between Pre-test Vs. Post-test
P2= comparing between Pre-test Vs. Follow-up
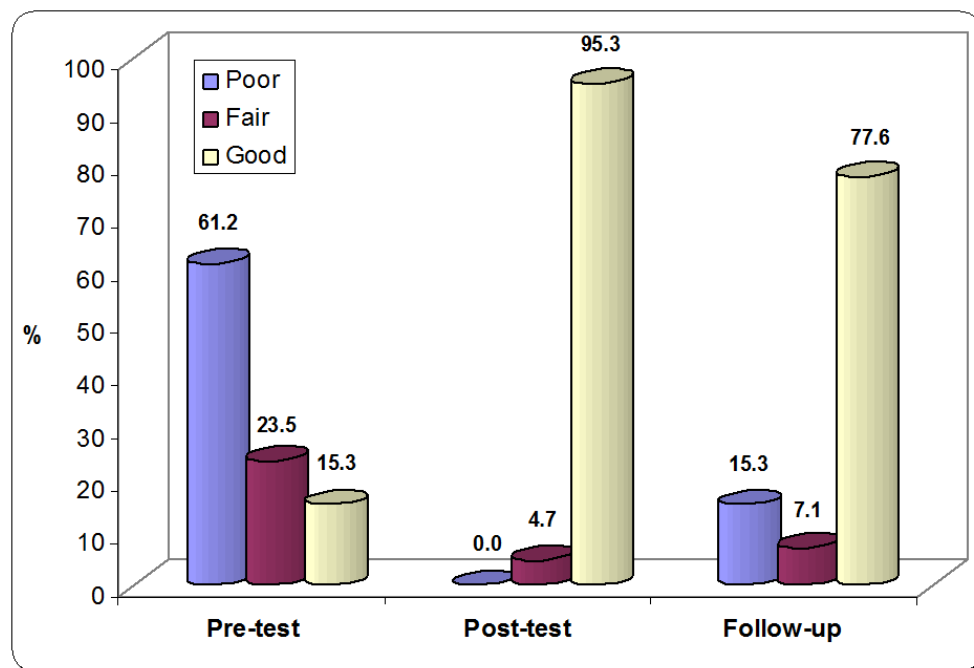 * Statistically significant difference (p<0.05)

Figure 1. The total knowledge score about first aid among preparatory engineering students at pre, post, and follow up tests (N=85).

Table 3. Total mean score of practice about first aid and its dimensions over time among preparatory year engineering students who received the training program (n = 85)

| Variable	Pre-test (n= 85)	Post-test (n= 85)	Follow-up (n= 85)	p-value*	p-value** (pairwise comparison)	
	Mean±SD	Mean±SD	Mean±SD		P¹	P²
Fainting	1.51±0.61	4.32 ± 0.80	3.96±1.22	<0.001*	<0.001*	<0.001*
Sunstroke	1.96±0.75	6.02±1.09	5.52±1.76	<0.001*	<0.001*	<0.001*
Bleeding	2.59±1.11	6.95±1.19	6.45±1.82	<0.001*	<0.001*	<0.001*
Wounds	2.67 ± 1.16	6.98 ± 1.13	6.45±1.83	<0.001*	<0.001*	<0.001*
Fractures	3.21 ± 1.55	9.29 ± 1.97	8.65±2.74	<0.001*	<0.001*	<0.001*
Burns	4.81±1.48	13.53±2.20	12.56±3.55	<0.001*	<0.001*	<0.001*
Electrocution	2.44±0.71	5.40±0.62	5.05±1.22	<0.001*	<0.001*	<0.001*
Total mean score of practice about first aids	19.19±4.71	52.49±7.84	48.64±13.49	<0.001*	<0.001*	<0.001*

* Repeated measure ANOVA test
** Bonferroni post hoc test
P= pre vs. post vs. Follow up,
P1= comparing between Pre-test Vs. Post-test
P2= comparing between Pre-test Vs. Follow-up
    * Statistically significant difference (p<0.05)
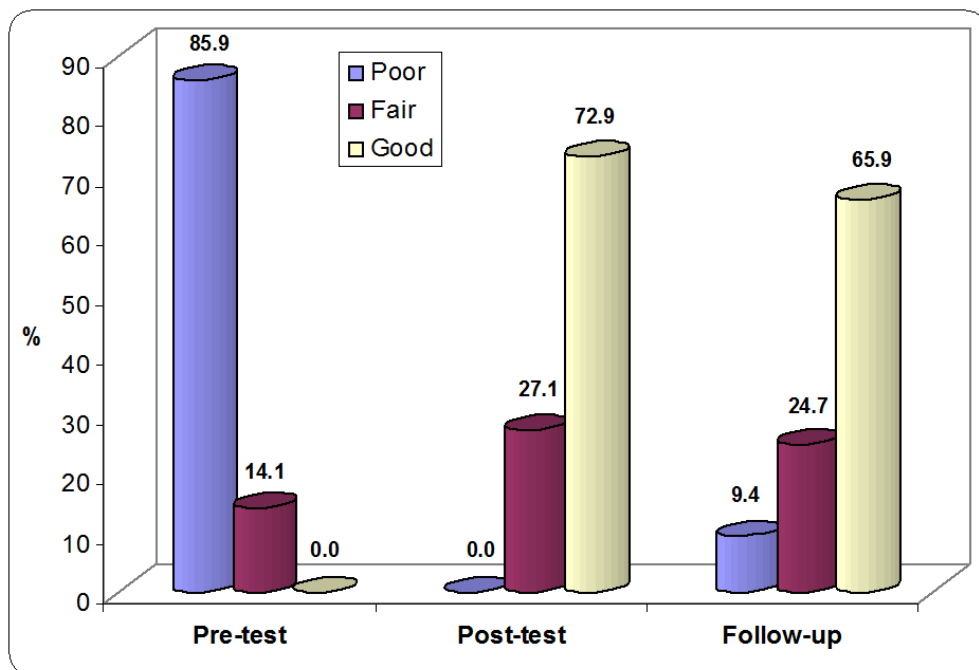
Figure 2. The total practice score about first aid among preparatory engineering students at pre, post & follow up tests (N=85).

DISCUSSION

According to statistics, youth such as engineering students are at high risk of injury. Students at vocational training institutions are frequently exposed to various hazards due to their activities. Many of these activities are carried out in workshops with equipment, tools, electricity, and various materials. Therefore, FA training prepares students to respond to crises and offers timely and effective care for many occurrences.[25]

Concerning the knowledge mean score about basic first aid concepts, the present study findings showed that there was a statistically significant (p≤0.01) improvement in the mean scores of the post-test and follow-up test. These findings are consistent with Balai &Tripathi.[26], who documented that the post-test mean score about general information on first aid was significantly higher than the pre-test mean score. The considerable gains in students' understanding of the basic first aid concepts following the program were attributed to the students' age as they are more inclined to take first aid concepts, as well as being encouraged by blended learning.

Moreover, the knowledge mean score of fainting in the pre-test was 6.59±3.47 and significantly improved in the post-test to 13.93±1.77 and in the follow-up test was 12.28±3.95, with a statistically significant difference found (p≤0.01). These outcomes were in accordance with Mahmoud,[27] who demonstrated that the mean score of fainting knowledge in the pre-test was 1.53 compared with mean scores of 3.82 and 3.67 in the post-test and follow-up, respectively.

In addition, the current study results showed that, the mean knowledge score of sunstroke increased significantly from 5.01±2.18 in the pre-test to 8.73±1.00 in the post-test and 7.79±2.29 in the follow-up. These results agree with Alkot et al.[28],who indicated that the knowledge level about heat exhaustion increased from about half of the participants who had good knowledge in pre-education to the majority of them after education. This in our opinion is due to a lack of health educational programs and the improvement which occurred in the post-test and follow-up were due to the effectiveness of the training program.

Furthermore, the results revealed that the means knowledge scores of bleeding and wounds in the pre-test were 2.59±1.11, 2.67 ± 1.16 and increased significantly to 6.95±1.19, 6.98 ± 1.13 and 6.45±1.82, 6.45±1.83 in the post-test and follow-up respectively. These results are similar to Alboliteeh et al.[29] who showed that more than three-quarters of students had satisfactory knowledge about bleeding and wounds in the post-test. First aid for bleeding and wounds were newly recognized procedures among engineering students and they have great desire to acquire more knowledge in this concern. So, the training program had a statistically significant effect on improving first aid knowledge among engineering students in post and follow up tests.

In addition, the findings revealed that the mean knowledge score of fractures improved from 7.55±2.93 in the pre-test to 13.18±1.34 in the post-test and 12.00±2.87 in the follow-up. These results are similar to Mohamad et al.[30] who documented that less than three quarters of participants had correct knowledge about fractures in the pre-test compared to the majority of them in the post-test and follow-up.

Regarding to knowledge about burns the students demonstrated improvement in their mean score from13.74±6.45 in the pre-test to 25.35±2.03 and 23.06±5.37 in the post-test and follow up respectively. These outcomes are in the same line with Chandrachood & Acharya[11] who stated that one fifth of

participants had 20 knowledge scores of burns in the pre-test to become 62 in the post-test and 53 in the follow up.

Also, the current study results showed that the mean score of electrocution knowledge increased from 7.31±3.79 before training to 13.28±0.92 and 11.93±3.16 after training and 3 months after the program. These outcomes were in accordance with Behairy &Al-Batanony,[31]who found that less than one-fifth of participants had good knowledge about electrocution in the pre-test, but most had good knowledge in the post-test and follow-up test.

The present results reported improvement in the student's means of practice of fainting FA from 1.51±0.61 in the pre-test to 4.32 ± 0.80 and 3.96±1.22 in the post-test and follow-up respectively. This outcome agrees with Elmagrabi et al.[32] who documented that most participants had correct performance about fainting in the post-test.

Moreover, there are significant improvements in the practice means scores about bleeding, wounds, fractures, and burn first aid from2.59±1.11, 2.67 ± 1.16, 3.21 ± 1.55, and4.81±1.48 in the pre-test to 6.95±1.19, 6.98 ± 1.13, 9.29 ± 1.97, and 13.53±2.20 in the post-test respectively. These findings agree with Alboliteeh et al.[29] who presented that the majority of students had adequate practice in the post-test about bleeding, wounds, fractures and burns first aid but three-quarters of them had adequate practice about wounds FA.

Also, the results showed that the mean practice score of electrocution first aid was 2.44±0.71 in the pre-test and increased to 5.40±0.62 in the post-test. This result agrees with Behairy & Al-Batanony. [31] who presented that the majority of participants had good practice about electrocution first aid in the post-test.

Regarding the total score of engineering students about FA, these results indicate that their knowledge and practice were insufficient in the pre-test,

while there was a significant improvement after the intervention of the program by BL and a slight decline in follow-up evaluation.

The present study showed that more than two-thirds of students had poor knowledge scores with a mean of 65.16±24.41 and the majority of them had poor practice scores with a mean of 19.19±4.71 in the pre-test. This is because most students did not attend any previous training about first aid, and there is not enough media exposure to raise first aid awareness among the general public. These findings are consistent with Ali et al. [33] who stated that, 2.2% of participants had satisfactory knowledge about first aid in the pre-test and enhanced to the vast majority of the participants in the post-test and 82.7% at 3 months after the program.

Moreover, in the post-test the vast majority of students had good knowledge scores with a mean of 121.89±10.27 and about three-quarters of them had good practice scores with a mean of 52.49±7.84. In the follow-up, the present study documented that more than three-quarters of participants had good knowledge scores and a mean was 110.93±27.38 and more than two-thirds of participants had good practice scores with a mean of 48.64±13.49. These findings agree with Ali et al. [31] who stated that, the participants who had satisfactory practice increased from zero in the pre-test to 70.5% in the post-test and 59% at three months following the program.

The improvement in engineering students' knowledge and practices following the training program's implementation, can be explained by the success of blended learning in motivating the students to learn by new mixed technique (BL) and acquire new theoretical knowledge and its applicability in the faculty environment. Blended learning provided variety in the delivery of program material and created a more fun and engaging learning environment. Also, it made the students to learn the theoretical

part remotely at their homes instead of spending their time in the classes.

STRENGTHS AND LIMITATIONS

Multiple measurements were used in this study to measure the duration of the effects over time. The total score reached to the vast majority of engineering students who had good knowledge scores and to about three-quarters who had good practice score in the post-test comparing to the pre-test. In the current study, the blended learning was used as an effective teaching strategy in improving students' learning and interest as well as to limit students contact along theoretical part of the program to prevent the fears of students from contact in the place of training due to the outbreak of the Covid 19, in Egypt before and during the period of a training program. Although this study concentrated on training engineering students in first aid, there are some limitations. The training time before the students' final examinations was overloaded.

CONCLUSION

According to the study findings, the blended learning approach was utilized effectively in the implementation of the training program for leading and improving students' knowledge and practice scores with statistically significant differences found between the pre-test, post-test, and 3 months after the program, follow-up test. BL was a more interactive approach and met the demands of the learners. Engineering students' training provides a safe learning environment and enables them to cope with accidents safely; also, they will provide first-aid skills correctly in an emergency. This can save lives, prevent worse progress, enhance recovery, decrease hospitalization, and improve patient outcomes. Implementing a training program for engineering students enhances the collaboration and transfer of health knowledge and education across professions.

RECOMMENDATION

The current study recommended training programs about first aid should be continued for engineering students in all years and integrated into study curriculum to ensure acquiring enough knowledge and skills among students to help the casualty in emergency situations. Blended learning programs should be taken as a learning approach in the health training program implementation.

ACKNOWLEDGEMENTS

CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

REFERENCES

1. Yusniawati YNP, Maharyawan IWA, Robani A. Differences in the Effectiveness of the Direct Demonstration Method and Video Screening of First Aid in Traffic Accidents on the Increase in Knowledge of Senior High School Students. Nurse Heal J Keperawatan. 2020;9(2):133–8. doi: https://doi.org/10.36720/nhjk.v9i2.166

2. Zeng L, Fan S, Zhou J, Yi Q, Yang G, Hua W, et al. Undergraduate nursing students' participation in pre-hospital first aid practice with ambulances in China: A qualitative study. Nurse Educ Today. 2020;90:104459. doi: 10.1016/j.nedt.2020.104459.

3. Lu JL. Statistics on trends of occupational injury and related injuries in the philippines. Acta Med Philipp. 2021;55(6):604–15.

4. Rabeiy RE. Evaluation of indoor heat stress on workers of bakeries at Assiut City, Egypt. Int J Environ Sci Technol. 2019;16(6):2637–42. doi: https://doi.org/10.1007/s13762-018-1839-z

5. Batais MA, Alzahrani SA, Alzahrani NA, Alsolimi AF, Khan AA, Aldossari KK, et al. Knowledge and Practice of Burn First Aid Among Saudi Arabian Medical and Non-Medical University Students. Int Q Community Health Educ. 2021;41(4):405-10. doi: 10.1177/0272684X20972644.

6. Obi PI, Okoro CK, Okonkwo II. Electrocution, Accidents and Electrical Injuries in Nigerian Homes and Work Sites – Causes , Effects and Remedies. IOSR J Electr Electron Eng. 2020;15(2 Ser. II):53–61.

7. Bail R, Kovaleski J, Chiroli D, Silva V. Knowledge transfer and teaching in first aid and prehospital care in the engineering courses. Rev Eletrônica Científica Ensino Interdiscip. 2019;5(15):489–500.

8. Bhadri GN, Patil LR. Blended Learning: An effective approach for Online Teaching and Learning. J Eng Educ Transform. 2022;35(Special issue):53–60.

9. Anthony B, Kamaludin A, Romli A, Raffei AFM, Nincarean D, Abdullah A, et al. Blended Learning Adoption and Implementation in Higher Education: A Theoretical and Systematic Review. TTech Know Learn. 2022;27(2):531–78. doi: https://doi.org/10.1007/s10758-020-09477-z

10. Costa TFO, Sampaio FMC, Sequeira C, Lluch Canut MT, Moreno Poyato AR. Nurses' perspective about the Mental Health First Aid Training Programmes for adolescents in upper secondary schools: A focus group study. J Psychiatr Ment Health Nurs. 2022;29(5):721-31. doi: 10.1111/jpm.12823.

11. Chandrachood M V., Acharya S. A study to assess the effectiveness of training on first aid among students of industrial training institute in tribal area of Thane district, Maharashtra. Int J Community Med Public Heal. 2019;6(4):1573.

12. Semwal J, Bakshi RK, Juyal R, Deepshikha, Vyas S, Kandpal SD. Study of knowledge and attitudes to first aid among school children of Doiwalablock, Dehradun. Int J Community Med Public Heal. 2017; 4(8):2934.

13. Mobarak AS, Afifi RM, Qulali A. First Aid Knowledge and Attitude of Secondary School Students in Saudi Arabia. Health (Irvine Calif). 2015;07(10):1366–78.

14. Moreira FGP, Ramos ALF, Fonseca KRC. Safety culture maturity in a civil engineering academic laboratory. Saf Sci. 2021;134(1):105076. doi: https://doi.org/10.1016/j.ssci.2020.105076

15. Ayob HH, Daleure G, Solovieva N, Minhas W, White T. The effectiveness of using blended learning teaching and learning strategy to develop students' performance at higher education. J Appl Res High Educ. 2023;15(3):650–62.

16. Shorey S, Kowitlawakul Y, Devi MK, Chen HC, Soong SKA, Ang E. Blended learning pedagogy designed for communication module among undergraduate nursing students: A quasi-experimental study. Nurse Educ

Today. 2018;61:120–6. doi: https://doi.org/10.1016/j.nedt.2017.11.011

17. Mirza M, Bukhari H, Falogy EA, Mohammed N, Basfar A, Kelantan S, et al. The Effect of a Structured First Aid Educational Training Course among Secondary School Students in Makkah City, An Intervention Study. Int J Adv Res. 2017;5(2):2543–51.

18. El-Gilany A, El-Wehady A, El-Wasify M. Updating and validation of the socioeconomic status scale for health research in Egypt. East Mediterr Heal J. 2012;18(9):962–8. doi: 10.26719/2012.18.9.962.

19. Metok T. Effectiveness of Training Programme on Knowledge and Practice Regarding Selected First Aid Measures Among Non Medical Professional Students. Master dissertation, Madha College of Nursing, Chennai [Internet]. 2014. Avialable from: http://repository-tnmgrmu.ac.in/10134/

20. Mohammed AA. The Influence of Training Program on Knowledge and Practices of Preparatory Schools' Children Related to the Selected First Aid. Am J Nurs Res. 2018;6(4):158–63.

21. AboElsoud MS, Ahmed HAH, Ahmed AMA-W, Farg HK. Training on First Aid forTeachers of Primary Schools At Ismailia City. J Nurs Heal Sci. 2018;7(5):28–38.

22. AlQahtani MA, Alfadhel SF, Aljehani RH, Bakri KA, Ahmed ZF, Elemem MO. Knowledge of first aid skills among medical and nonmedical students in Saudi Arabia. J Fam Med Prim Care . 2020;9(1):169–70.

23. Abdullah S, Darweesh AED, Mohammed N. Impact of Psycho Educational Program on Nurses' Knowledge and Practices Regarding Care of Patients with Delirium. Assiut Sci Nurs J. 2022;10(28.):10–20.

24. Hsieh P-Y, Lin H-Y, Chang C-H, Chang Y-C, Cheng H-P, Wang C-Y, et al. Effects of situational simulation and online first-aid training programs for nurses in general medical wards: A prospective study. Nurse Educ Today. 2021;96(21):104621. https://doi.org/10.1016/j.nedt.2020.104621 doi: 10.1016/j.nedt.2020.104621.

25. Lecours A, Therriault P-Y. Preventive behaviour at work of vocational students. J Vocat Educ Train. 2018;70(3):399–416.

26. Balai MK, Tripathi N. Effectiveness of Planned Teaching Programmeon Knowledge Regarding First Aid in Selected Conditions among Primary School Teachers Working in Selected Schools, at Adarsh Nagar, Jaipur. Asian J Nurs Educ Res. 2017;7(4):457.

27. Mahmoud SF. Effect of First Aid Health Educational Intervention for Special Education School Teachers at Zagazig City. Zagazig Nurs J. 2016;12(2):99–114.

28. Alkot M, Goweda RA, Shatla MM, AlFalogy EH. Knowledge and Practices of Mutawifeen (Pilgrims' Guides) Regarding Heat Related Illnesses Before and After Exposure to an Educational Program. Eur J Prev Med. 2016;4(4):95.

29. Alboliteeh M, Ali S, Masood ES, Al-enz NMM. The effect of the first-aid training program on students' traditional approaches that use in emergencies. Int J Adv Res Nurs. 2019;2(2):125–31.

30. Mohamad SS, Ragab A, Sanaa M, Ahmed M. First Aid Program For Nursery School Teachers. IOSR J Nurs Heal Sci. 2018;7(4):1–9.

31. Behairy AS, Al-Batanony MA. Effectiveness of First-Aid and Basic Life Support intervention program on school health advisors. J Heal Med Nurs. 2016;24(1):135–44.

32. El magrabi NM, ElwardanyAly S, Khalaf SA-RK. Impact of training program regarding first aid knowledge and practices among preparatory schools' teachers at Assiut City. J Nurs Educ Pract. 2017;7(12):89.

33. Ali MIE, Habib NS, Sharra HM. Effect of first aid training program on construction workers' self-efficacy in Egypt. Pakistan J Med Heal Sci. 2021;15(1):403–6.