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Learn with Fun: Train School Students about First Aid Based on Game

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Abstract: Background: School students' lives are seen to be seriously threatened by unintentional injury. First aid education through game-based learning may be appropriate for schoolchildren's developmental stage and help them advance their knowledge and abilities. **Aim:** to evaluate the effect of a game-based training program on school students' knowledge and practices about first aid. **Method:** A quasi-experimental study with a one-group pre-post-test design including 60 preparatory school students in two governmental preparatory schools, representing urban and rural areas in Sherbin Center. **Tools:** This study used three tools for collecting data about school students' socio-demographic and academic attributes, knowledge, and practice toward first aid. **The results:** 93.3% of school students had an unsatisfactory total score level of knowledge in the pretest, which changed to 93.3%, and 85.0% had a satisfactory total score level of knowledge in the immediate test and after one-month post-test, respectively. Related to practice, 5.0% of school students had adequate total score levels in the pretest that changed to 100% in the immediate test and after one month of post-test. **Conclusion:** There was an improvement in school students' knowledge and practice levels immediately post-implementation and one month later compared to pre-implementation of game-based training. **Recommendations:** It is recommended to install game-based programs to empower schools' health education programs that prioritize the most prevalent injuries and first-aid scenarios.

Keywords: First aid, Game-Based, Learn, School, Students, Train.

Introduction

Unintentional injuries have become the primary cause of death for school-age children globally because increasingly severe injuries have been reported in schools. More than 95% of these fatalities take place in low- and middle-income countries. According to the World Health Report, from approximately 12% in 1990 to 15% in 2000 and nearly 20% in 2020, more people were impacted by injuries associated with school (Al-Maietah, Obeidat, & Al-Oran, 2023; Bou-Karroum et al., 2022; & Al-Hajj et al., 2020).

In 2020, the World Health Organization (WHO) estimated that four primary causes accounted for around 72% of deaths among teenagers between the ages of 10 and 24: car accidents (30%), unintentional injuries (15%), homicide (15%), and suicide (12%). Then, kids between the ages of 10 and 17 sustain around a million major sports-related injuries annually in schools (Widiastuti & Adiputra, 2022; Pizarro et al., 2024). For students between the ages of seven and fourteen, injuries are the leading cause of death. This highlights the need for first-aid instruction in schools, which occasionally saves lives (Tadesse & Jemebere, 2022).

Fortunately, first aid is taught in schools; there may be a significant increase in the population having first aid training over time. They will feel more confident and be able to provide CPR and first aid to the injured person more quickly (Cheng, Yeung, Sharma, So, Ko, Wong, Lam, & Lee, 2021; Alenezi, Bohulaigah, Aldajani, Alotaibi, & Alshammari, 2024).

School students can experiment, play, make decisions, and have fun in a safe environment simulating circumstances with less hazardous outcomes through games. Making learning engaging for students could be achieved by incorporating games or game-like elements into training sessions (Leitão, Maguire, Turner, & Guimarães, 2022; Nair & Mathew, 2019).

The goal of including game elements, according to Landers (2014), is not to teach students about them; rather, it is to modify their behavior and attitude, which will enhance their learning. The presence of these elements will also raise their level of motivation, which will enhance learning outcomes (Hammady & Arnab, 2022; Nair & Mathew, 2019).

Role-playing games can aid in school students' learning because they are entertaining, include elements of play, and provide them with freedom of movement. When learning includes school students actively, they will respond more powerfully, which will optimize their understanding of the material. According to Indrawati, Larasati, Purwaningsih, Nursing, Polytechnic, Ministry, and Surabaya (2021), and Ruiz-Ezquerro (2021), school students who actively participate in learning activities acquire more knowledge and have a significant impact on those who have mastered learning objectives.

The goal of community health nursing as a specialization is to prevent, treat, and restore health in a safe and clean environment (Bhopal, 2022; Hassanen, Sharkawy, & Aljawfi, 2023). According to Astuti and Mustakim (2022) and McCabe, Davis, Mandy, and Wong (2022), the greatest position for a nurse can be that of a health educator, enhancing health literacy and providing health education programs on attaining wellness to adolescents or the community to achieve optimal health status.

While existing research has demonstrated the effectiveness of gamification in enhancing learning outcomes across various subjects, its application in first aid education for school students remains relatively unexplored. Several researchers have focused on the use of games in higher education or for specific skill development, with limited attention to the potential of game-based learning for imparting essential first-aid knowledge to young learners. Moreover, the long-term effect of game-based first-aid training on students' knowledge retention and practical skills has not been adequately investigated. This research gap highlights the need for innovative approaches to make first aid education engaging and effective for school-aged children.

AIN OF THE STUDY:

The study aimed to evaluate the effect of game-based training on school students' knowledge and practices about first aid.

Research Hypotheses:

- Game-based training improves school students' knowledge of first aid.
- Game-based training improves school students' practice of first aid.

METHOD

Study Design:

A one-group pre-post-test design quasi-experimental study was conducted to achieve the aim of the current study.

Study Setting:

Two nominated governmental preparatory schools, representing urban and rural areas in Sherbin Center, were Abdel Rahman Ouda in the metropolitan area, Sherbin City, and Abu-Galal in the rural area, Abu-Galal village.

Study Subjects:

Preparatory school students at the three grade levels and from both genders were the study participants.

Sampling Technique and Sample Size:

A quota sampling technique with two phases to recruit school students: First, gender and level were used to categorize them. The second phase is to conveniently enroll a disproportionate number of people from different levels and genders until the necessary sample size is recruited.

Sample Size: With a 95% confidence level, the sample size was determined to identify any increase in school students' knowledge or practice from an expected level of 30% or less before the intervention to 60% or higher following it. The necessary sample was calculated to be 46 school students using the Epi Info software tool (CDC, 2014). This number was adjusted to 60 to account for the anticipated 5% dropout rate.

Tools of Data Collection:

Tool I: School students' socio-demographic and academic attributes were determined by a self-administered structured questionnaire including gender, age, residence, and academic level.

Tool II: The researchers developed a self-administered structured questionnaire based on Abd El-Hay, Ibrahim, and Hassan (2015) and Panda, Karir, and Patra (2019) to assess school students' knowledge regarding first aid pr-game-based training, immediate post-tests, and follow-up post-tests (after one month). It consisted of 45 multiple-choice questions.

Scoring System:

For each knowledge question, a correct response was scored one and the incorrect or did not know one was zero. For each area of knowledge, the scores of the items were summed up, and the total was divided by the number of items, giving a mean score for the part. These scores were converted into a percentage score. According to **Martin and Jolly (2002)** and **Contreras et al. (2006)**, school students' knowledge total score ranged from zero to 45, which was categorized into two categories:

- Satisfactory if the score is 60% or more (27 marks or more)

- Unsatisfactory if the score is less than 60% (from 0 to 26 marks)

Tool III: The researchers assess school students' practice while carrying out first aid for fainting, CPR, choking, burns, poisoning, epistaxis, wounds, electrocution, and fractures using an observational checklist developed based on El Magrabi, Elwardanyaly, and Khalaf (2017) and Abo Elsoud (2018). It was used in pr-game-based training, immediate post-tests, and follow-up post-tests (after one month).

Scoring System:

The total scores of school students' practice ranged from zero to 132 marks that were distributed as follows: For each situation, a correct and complete response was scored two, a correct and incomplete response was scored one, and an incorrect and not done response was scored zero. The scores of the items were summed up and converted into a percentage score. The school students' practice was considered adequate if the score was 60% or more and inadequate if it was less than 60%, based on **Wafik and Tork (2014).**

Validity and Reliability of the Tool:

Five community health nursing experts from the Mansoura University Faculty of Nursing ensure the developed tools' face and content validity, clarity, understandability, relevancy, comprehensiveness, and feasibility. As well, a pilot study was conducted on six students, or 10% of the total study population, and was not included in the main study. As a result, all necessary modifications were made. Based on experts' recommendations and the pilot study, minor adjustments were made.

The following Cronbach's alpha test guaranteed the reliability of the instruments in the Statistical Package for the Social Sciences (SPSS) v23: The knowledge questionnaire yielded a Cronbach's alpha test of 0.891, while the practice observational checklist yielded a Cronbach's alpha test of 0.985. Those values indicate excellent internal consistency, based on Tavakol and Dennick (2011) and Vaske, Beaman, and Sponarski (2016).

Field Work:

Administrative Design:

To obtain permission from the nominated preparatory schools, Abdel Rahman Ouda and Abu Galal, to conduct the current study, the responsible authorization of the Faculty of Nursing at Mansoura University submitted an official letter to the Directorate of Education in Sherbin City, which issued the permeation to those schools.

Ethical Considerations:

The researchers obtained approval from the Research Ethics Committee, Faculty of Nursing, Mansoura University and child assent. The researchers introduced themselves, and a simple explanation of the aim and process of the study was provided to them. They were assured that their participation in the study was voluntary and that the collected data was treated anonymously and confidentially and only used for scientific research purposes. Participants were informed that they had the right to ask any question related to the study and to withdraw at any time from the study.

Phases of the Study:

The study moved through four phases, including assessment, planning, implementation, and evaluation, from October 2022 to May 2023, as follows:

Phase 1: Preparation and Assessment Phase:

At first, the principal researcher introduced herself to all school students; then she explained the aim and study process. The principal researcher attended the previously mentioned setting three days a week (Sunday, Tuesday, and Wednesday) from 9 a.m. to 12 p.m. to collect data about school students' socio-demographic and academic characteristics, knowledge, and practice related to first aid by using first, second, and third tools. This took place for 30 minutes per student.

Phase 2: Planning Phase:

The researchers developed the content of the training based on the results of the baseline assessment and literature review, which consisted of five sessions. The researchers determined the training logistics (timetable, games, material, and evaluation methods). The training was financed by the researchers, including all items required for practical sessions, such as adult CPR dolls, infant CPR dolls, gauze, bandages, splints, alcohol, and personal protective equipment (PPE) such as gloves. The principal researcher used different teaching materials, such as PowerPoint presentations (PPT). Simplified presentation slides were made in an easy-to-understand way for the school students and provided many pictures and a few words that were easy for the school students to understand. Various teaching methods were used in the form of group discussions, demonstrations and re-demonstrations, and role-playing games.

Phase 3: Implementation Phase:

The game-based training was held in schools' libraries; its time was arranged according to the schedule of school students in every school and the coordination between the principal researcher and the directors of schools. The game-based training consisted of five sessions, two for the theoretical part and the others for the practical part. The school students were divided into six groups, with ten students in each.

Game-based training included several role-playing games; the content was shaped into the game to provide a scenario-based learning environment that allowed school students to gain real-world experience. The game stories were set to suit the school environment. Roles took place in-game as there were school students who participated as victims and others who acted as first aid providers in different situations. Each school student could take on different roles and freely had the choice to act as a character; this was carried out under the supervision and control of the principal researcher.

Phase 4: Evaluation Phase:

Immediately after the post-game-based training and after a month, school students' knowledge and practice related to first aid were assessed to determine if there was any improvement and whether they retained knowledge and practice over time by using second and third tools.

Statistical Analysis:

The data were presented using descriptive statistics in the form of frequencies and percentages. Medians were used for continuous variables and percentages for categorical variables. The chi-square (X2) of association was used to calculate changes over time for qualitative variables. The Friedman test was used to test changes in median scores over three-time points within one group. A Spearman correlation coefficient test (r) was used to create a correlation between two quantitative variables to clarify a positive or negative correlation (if $r < 0.20$ as very weak, r between 0.20-0.39 as weak, r between 0.40-0.59 as moderate, r between 0.60-0.79 as strong, and $r > 0.80$ as very strong). The final results were considered not significant if $p > 0.05$ and significant if $p \leq 0.05$.

Results

Table 1: shows that 66.7% of the school students were girls, and 38.4% were aged 13. In addition, 58.3% were residents of rural areas. Regarding training courses, no one attended training courses in first aid.

Table 2: demonstrates that 93.3% of school students had an unsatisfactory total score level of knowledge in the pretest. As for the immediate test, 93.3% of the school students had a satisfactory total score level of knowledge, while 85.0% of the school students had a satisfactory level of knowledge after one month in the post-test. There was a highly statistically significant difference (p = 0.0001).

Table 3: declares that 5.0% of school students had adequate total score levels of practice in the pretest. As for the immediate test, after one month of post-test, 100% of the school students had an adequate total score level of practice. There was a highly statistically significant difference (p = 0.0001).

Table 4: reveals a weak correlation between the school students' total knowledge and practices regarding first aid in pre-training sessions (r = 0.292), with a statistically significant difference in the pre-test (p = 0.023).

RESULTS

Table 1: ***School Students' Socio-Demographic and Academic Attributes***

Item	**N=60**	**%**
Gender		
Boys	20	33.3
Girls	40	66.7
Age by years		
12	20	33.3
13	23	38.4
14	17	28.3
Residence		
Urban	25	41.7
Rural	35	58.3

Table 2: ***School Students' Total Score of Knowledge Regarding First Aid Pre, Immediately, Post, and One Month After Implementation of the Game-Based Training***

Knowledge level	**Test time (N = 60)**						**Test of significance**	**p-value**
	Pre		**Immediately post**		**One month after**			
	N	**%**	**N**	%	**N**	%		
Total score of knowledge (45 marks)								
Satisfactory	4	6.7	56	93.3	51	85.0	x^2= 116.052	0.000
Unsatisfactory	56	93.3	4	6.7	9	15.0		
MD	7		39		34		Friedman	0.000

Satisfactory scores ≥ 60% of total scores**. Unsatisfactory scores** < 60% of total scores. **MD =** median**.** $\mathbf{X^2}$ **=** chi-square test**. Level of significant** (p≤0.05).

Table 3: ***School Students' Total Score of Practice Regarding First Aid Pre-, Immediately Post-, and One Month After the Implementation of the Game-Based Training***

Practice level	**Test time (N = 60)**						**Test of significance**	**p-value**
	Pre		**Immediately post**		**One month after**			
	N	**%**	**N**	%	**N**	%		
Total score of practice (132 marks)								
Adequate	3	5.0	60	100.0	60	100.0	x^2=166.829	0.000
Inadequate	57	95.0	0	0.0	0	0.0		
MD	**11**		**116**		**99.5**		Friedman	0.000

Adequate scores ≥ 60% of total scores. **Inadequate scores** < 60% of total scores. **MD** = median. $\mathbf{X^2}$ = chi-square test. **Level of significant** (p≤0.05).

Table 4: ***Correlation between School Students' Total Score of Knowledge and Practice Regarding First Aid Pre, Immediately, Post, and One Month After Implementation of Game-Based Training***

Predictor	**Total knowledge scores**					
	R			**p-value**		
	Pre	**Immediately post**	**One month after**	Pre	**Immediately post**	**One month after**
Total practice scores	0.292	0.096	0.056	0.023	0.467	0.674

DISCUSSION

A school is an appropriate setting for first aid instruction since it can provide training for a large number of students at a reasonable cost. Annual first-aid training in schools maintains the level of knowledge and skills acquired; raising the proportion of first-aid-trained individuals can lower accident fatality rates and foster shared responsibility, both of which are essential for the advancement of society (Tse, Alexiou, 2021).

Concerning school students' total score levels of knowledge, the results of this study show that most students had an unsatisfactory level of knowledge before implementation of the game-based training that improved to most having a satisfactory level and declined to the majority immediately post- and post-implementation of the game-based training after one month, respectively, with a statistically significant difference.

Results are consistent with a study conducted in Benha City, Egypt (2020) by El-Sayed, Afifi, and Elfeshawy to assess a program based on evidence for lifesaving in two orphanage households. It was shown that while the majority of the children in the study had good overall knowledge after the program, all of the children had poor total knowledge before the program.

Behairy and Al-Batanony (2015) carried out a study in Unaizah City, Qassim, at preparatory and secondary schools. According to their report, the majority of students had inadequate knowledge in the pre-test, but this knowledge increased in the post-test, with 100% of students demonstrating good knowledge.

Furthermore, Brahimoğlu, Akarsu, and Polat's study (2024) in Turkey examined the impact of first-aid instruction on the knowledge of school-age children and showed that the post-test total score was statistically substantially greater than the pre-test. Additionally, Bandyopadhyay et al. (2017) showed a statistically significant difference in the knowledge level between the pre-and post-tests after researching the efficacy of first aid training on schoolchildren in Singur Block, Hooghly District,West Bengal.

The results of this study reveal that most of the school students had an inadequate total level of practice before the implementation of the game-based training, which improved to all of them having an adequate total level

of practice immediately post- and post-implementation of the game-based training after one month, respectively, with a statistically significant difference.

These findings are consistent with Wafik and Tork (2014) evaluation of the impact of a first aid training program delivered by undergraduate nursing students to students enrolled in government preparatory schools in Egypt. Their findings revealed that almost all of the students had incorrect practices before improving to correct practices in the posttest and follow-up tests one month later.

Also, Mohammed (2018) evaluated the impact of a training program on preparatory school students' practices of first aid in Banha City. It was revealed that while the majority of preparatory school students had adequate practices following the program, this was less among less than one-fifth of them had it before the program.

As well, a study by Abdalla, Ahmed, Habiballa, Sargidy, Boshr, and Suhail (2023) assessed the effect of an educational training program on basic life support and first aid to deal with any risk between mechanical engineering students at Sudan University and revealed that statistically significant differences were seen between pre-and post-test.

Another study by Alboliteeh, Ali, Masood, and Al-Enzi (2019) revealed a significant improvement in the students' total practice level that was observed in the immediate and post-training implementation of the designed program at Hail University.

The researchers argue that the improvement in school students' knowledge and practice occurred immediately post- and after the game-based training program after one month. The cutest of the features of school students' developmental stage, which is characterized by the crucial influence of peers, the good motivation and enthusiasm for those school students from using the role-playing game, and that those school students were highly interested in getting benefits from the game-based training.

The current study illustrates that there was a statistically significant weak correlation between the school students' knowledge and practices in pre-game-based training. These results agree with a nationwide survey in Norway by Håkon, Tine, Johan, and Torben. (2017) illustrated that the majority of the population trained in first aid practices was good compared to their first aid knowledge, which was poorer than expected.

Finally, the researchers would like to spot the importance of formal and informal installation of health-related messages for children, especially via schools, as they have the most credible, trustable, and suitable environments either physically or psychologically to foster such subjects. Owing to first aid is a fundamental pillar for lifesaving, especially when targeting school students where unintentional injuries and related consequences prevail.

CONCLUSION

From the results that were drawn in this study, it is concluded that most school students had an unsatisfactory knowledge level before the implementation of the game-based training that improved to most having a satisfactory level and declined to the majority immediately post- and after the implementation of the game-based training by one month, respectively. As well, most of the school students had an inadequate total level of practice before the implementation of the game-based training, which improved to all of them having an adequate total level of practice immediately post- and after the implementation of the game-based training by one month. With a statistically significant positive weak correlation between the school students' total knowledge and practices regarding first aid in pre-game-based training.

RECOMMENDATION

It is recommended to install game-based programs to empower schools' health education programs that prioritize the most prevalent injuries and first-aid scenarios.

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