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The effect of fire-safety education on the knowledge and safety competency of college students

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Abstract

The purpose of this study was to test the effects of video-based fire safety education among college students on the students' fire safety knowledge and disaster safety awareness and competency. Improvements were found in fire safety knowledge (t = -3.24, p = 0.001), social disaster awareness (t = -2.25, p = 0.025), basic disaster awareness (t = -2.44, p = 0.015), and disaster safety capacity (t = -2.04, p = 0.043). The contents of safety-education materials should be continuously developed. Those materials should be provided to many people, and future research should test the longer-term effects of those educational interventions.

Keywords: *Fire Safety Education, College Students, Knowledge, Safety Competency*

1. INTRODUCTION

As global warming accelerates due to the development of modern society, unpredictable natural disasters and disasters accompanying urban development are common [1]. Education for appropriate responses to such disasters is important [2]. In particular, fire-safety education can be useful, and its effectiveness increases with the number of training sessions [3]. Repeated education using video materials has been suggested. Disaster-safety awareness is a major variable influencing the practice and capacity of safety-related action [4-5]. Therefore, educational programs that reinforce practical information and awareness about disasters should be continuously developed.

Recent fires caused by lack of safety awareness have increased national attention to fire safety. This is especially true in schools, because they are responsible for the education of future generations [6]. Preventive education on fire safety is important in primary and secondary schools, and it should also be maintained in universities, for the benefit of adult learners.

Using audiovisual materials in education has certain advantages: They are highly favored by students, they are effective for transmitting information and for motivating learners, and they are efficient in self-iterative learning according to the needs of the learner [7]. Disaster situations, especially fires, are rare, which limits students' actual experiences in those situations, so video materials of highly realistic situations can be effective and practical option.

Against that backdrop, this study sought to test the effectiveness of video materials for fire safety education among college students living in university dormitories, with regard to knowledge, awareness, and competency.

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2. METHODS

2.1 Study design

This study was a non-equality controlled study of the effects of video-based fire safety training on fire safety knowledge, disaster safety awareness, and competency among college students.

2.2 Participants

The participants were college students living in a university dormitory in a medium-sized city. Students in the experimental group (n = 149) were given fire-safety training using video materials in addition to fire-safety education booklets, and those in the control group (n = 172) were given only the booklets.

Recruitment notices were placed in six dormitories within the university. All university students who volunteered and agreed to participate in the study were allowed to participate. The test group and the control group were divided by dormitory, to minimize contamination. Initially, there were 158 students in the test group and 195 in the control group. Because some withdrew consent and some did not participate in the post-intervention data collection, the final numbers in the test and control groups were 149 and 172, respectively.

2.3 Study instruments

2.3.1 Fire safety knowledge

The level of fire safety knowledge was measured using a self-report questionnaire consisting of questions developed based on the details of fire safety education. It comprised 15 items, each in a 5-point Likert-type format. Higher summary scores indicated higher levels of knowledge of fire safety. In this study, the internal-consistency reliability (coefficient α) of this scale was 0.90.

2.3.2 Disaster safety awareness

Disaster safety awareness was measured with a partially modified and supplemented version of the tool used in a previous study of the awareness of disaster safety among college students [8]. The tool comprised a total of 13 items in a 5-point Likert-type format, covering basic (5 items), social (3 items), and cultural (5 items) awareness of disasters. Higher scores indicate higher levels of disaster awareness. In a previous study [8], the internal-consistency reliability (coefficient α) of this scale was 0.92, and in this study it was 0.89.

2.3.3 Disaster safety competency

Disaster safety competency was measured using the five-item tool developed in a previous study [9]. Each question-item has a 5-point Likert-type response format. Higher summary scores indicate disaster safety competency. In a previous study [9], the internal-consistency reliability (coefficient α) of this scale was 0.80, and in this study it was 0.93.

2.4 Data collection

The researcher explained the purpose and method of the study to the participants, and told the participants that they could withdraw their consent at any time. Those who chose to participate then gave their informed consent in writing.

Data were collected in October and November 2019 at one university in a medium-sized city in South Korea. After baseline data were collected from both groups, the intervention was given to the experimental group: They watched a fire safety video at least once a week. Video training materials were not provided to the control group. Standard educational booklets related to fire safety were provided to both groups. Follow-up data were collected from both groups 4 weeks after the baseline surveys. After the follow-up data were collected, video educational materials were made available to the students in the control group.

2.5 Data analysis

The data were analyzed with SPSS 26.0 (SPSS, Inc, Chicago, IL, USA). The homogeneity of the participants' characteristics was analyzed with the Chi-squared test, and the homogeneity of the variables measured in advance was tested with t-tests for independent samples. The effects of video-based fire safety education on fire safety knowledge, disaster awareness, and competency were analyzed with t-tests for independent samples, using the difference between the baseline and follow-up scores of the two groups.

3. RESULTS

3.1 Homogeneity of participants

There were no significant differences between the two groups in age, gender, or religion (Table 1).

Table 1. Homogeneity of participants (n = 321)

Characteristics	Categories	Experimental (n = 149) n (%)	Control (n = 172) n (%)	χ^2	p
Age (yr)	< 25	139 (93.3)	163 (94.8)	0.31	.639
	≥ 25	10 (6.7)	9 (5.2)		
Gender	Male	48 (32.2)	69 (40.1)	2.15	.163
	Female	101 (67.8)	103 (59.9)		
Religion	Yes	58 (38.9)	69 (40.1)	0.05	.909
	No	91 (61.1)	103 (59.9)		

3.2 Homogeneity of variables at baseline

At baseline, there were no significant differences between the two groups in fire safety knowledge, disaster safety awareness, or competency (Table 2).

Table 2. Homogeneity of variables at baseline (n = 321)

Variables	Experimental (n = 149) Mean ± SD	Control (n = 172) Mean ± SD	t	p
Fire-safety knowledge	52.89 ± 9.42	53.74 ± 11.44	-0.73	.465
Social awareness	9.87 ± 2.00	10.20 ± 1.99	-1.48	.140
Basic awareness	18.31 ± 2.83	18.38 ± 3.13	-0.22	.823
Cultural awareness	16.54 ± 3.41	16.95 ± 2.97	-1.15	.250
Disaster-safety competency	16.08 ± 3.53	16.83 ± 3.73	-1.87	.062

3.3 Effectiveness of video-based fire safety training

The fire safety knowledge of the experimental group improved by an average of 5.53 ± 13.00 points, while in the control group the improvement was only 1.52 ± 8.32 points. The difference between groups was statistically significant (t = -3.24, p = 0.001). Among the constituent domains of disaster safety awareness, no significant difference was found between the two groups in cultural awareness. Social disaster safety awareness was significantly improved in the experimental group (t = -2.25, p = 0.025), as was basic disaster safety awareness (t = -2.44, p = 0.015). Disaster safety competency increased by an average of 1.89 ± 4.76 points in the experimental group, but only by 0.95 ± 3.30 points in the control group, and the between-group difference was statistically significant (t = -2.04, p = 0.043) (Table 3).

Table 3. Effectiveness of video-based fire safety training (n = 321)

Variables	Experimental (n = 149) Difference (pre-post) Mean ± SD	Control (n = 172) Difference (pre-post) Mean ± SD	t	p
Fire-safety knowledge	-5.53 ± 13.00	-1.52 ± 8.32	-3.24	.001
Social awareness	-0.79 ± 2.89	-0.16 ± 2.01	-2.25	.025
Basic awareness	-0.74 ± 4.12	0.26 ± 3.12	-2.44	.015
Cultural awareness	-1.32 ± 5.32	-0.33 ± 3.42	-1.96	.051
Disaster-safety competency	-1.89 ± 4.76	-0.95 ± 3.30	-2.04	.043

4. DISCUSSION

Fire safety knowledge, social disaster safety awareness, basic disaster safety awareness, and disaster safety competency were improved by video-based training. These results are similar to those in a previous study [7], which showed the effectiveness (on knowledge and attitude) of video-based education regarding radiation safety. Regarding fire-safety education, however, it was not possible to make direct one-to-one comparisons to previously published research reports, as this appears to be the first study of the use of video materials for fire-safety education in undergraduate nursing students. While there is a lack of previous research on video-based fire-safety education in this population, the present results nonetheless suggest that the use of video can be effective in education on safety management. In addition, similar to the results of a number of previous studies [4-5, 10-11] that reported that safety awareness and behavioral practice were closely related, this study also confirmed that awareness and competency improved at the same time.

Among the outcome variables in the study, there was no significant difference in cultural safety perception. Culture refers to the products of perception, belief, and behavior patterns shared by individuals and groups [12]. In this respect, it is possible that repetitive education for a longer period of time might help achieve a change in cultural safety awareness.

The results of this study show that education using video can improve college students' fire safety knowledge, safety awareness, and competency. Limitations include non-random group assignment, and the participants not being blinded to their group assignment. The lack of randomization may be overcome by future randomized controlled trials. In addition, rather than studying only self-selected volunteers, it would be useful to expand participation to all college students, and to measure a wider range of outcomes.

Many technological enhancements have been used in educational settings. For the present study we used video materials. We would certainly have been interested in using virtual-reality technology, but it was not

available to us. Recently, virtual-reality technology has been adapted for use in fire-safety training for operating-room personnel [13]. Rossler et al. [14] used virtual-reality fire-safety training and compared the effects of traditional instruction alone to the effects of virtual-reality technology in addition to traditional instruction. In that study, virtual-reality technology they used was favorable to traditional instruction on some measures. They reported that their traditional instruction comprised lectures, presentation of fire-safety protocols, and discussions of clinical scenarios, but no mention was made of video. It might be reasonable to expect that virtual-reality technology would also have some advantages over video, but the literature appears to include no reports of direct comparisons between video and virtual-reality technology for fire-safety training among undergraduate nursing students, which indicates that this is a potentially fruitful area for further research.

5. CONCLUSION

For improving college students' knowledge, social awareness of disasters, basic awareness, and disaster-safety competency, fire-safety education using both video and printed materials was better than fire-safety education using printed materials alone. Competency is directly related to behavior, and the Theory of Planned Behavior [15] suggests that the practice of desirable behavior is determined by behavioral intention, that is, a change in individual perception. The contents of safety-education materials should be continuously developed, those materials should be provided to many people, and future research should test the effects of those educational interventions.

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