Fire Safety Game: an Educational Learning Innovation to Increase Fire Safety Knowledge among Vocational Students

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Abstract. Fire is an emergency that can occur anytime and anywhere, including industrial areas, with a broad impact on losses. An innovative approach is needed to promote fire safety behavior for vocational students. This study aimed to examine the effectiveness of educational games called fire safety games on fire safety towards the knowledge of fire safety behavior among vocational students. This study uses experimental research with a pre-post test design involving 38 participants who fit the inclusion criteria. Participants have randomly divided into fire safety games only 19 participants, and the fire safety game combination with PPT consisted of 19 participants. Data were analyzed using paired T-test. The result showed significant differences in the two groups' knowledge of fire safety to prevent fire between the two groups. The results indicate that the fire safety game can be used as a learning device to increase fire safety knowledge.

Keywords: fire safety game, knowledge, vocational students, fire safety

1 Introduction

Fire is one of the emergency conditions that has excellent potential to occur in public areas, including industry. Fires can have far-reaching consequences, ranging from property loss to loss of life [1]. Based on this, it is crucial to instill knowledge and a deeper understanding of fire, from identification to preventing fire hazards, especially in vocational students. Vocational students are prepared by vocational education to become competent and professional in their work [2]. Self-awareness of potential fire hazards is built through learning the general concept of fire, one of the OSH (Occupational Health and Safety) materials. Understanding the general idea of fire carried out at the Creative Media State Polytechnic still uses conventional learning methods, namely lectures, questions and answers, and assignments. It Makes learning tend to be boring, and the student learning experience is minimal. Therefore, there is a need for alternative learning media that are more interesting and can increase student enthusiasm for understanding the general concept of fire. The Digital game method has been proven for educational and training purposes [3].

Learning through games provides many benefits. According to some researchers, games are a learning method with great potential to help complement and strengthen the material and make it fun, active, practical, motivating, and entertaining to improve learning outcomes [4]. Several studies describe learning games, such as jam games, board games, serious games, computer-based games, and role-playing. There needs to be more research on game

development for work safety materials, especially for vocational schools. Learning through games is widely used in themes related to medicine, science, and the social sciences [5]. Researchers have experimented with using various technologies to teach OSH. Several researchers have developed OSH materials through educational games by utilizing virtual reality (Second Life) and a serious game called "Blaze" based on video game play to raise students' awareness regarding fires [6]. Games with fire safety for vocational students still need to be discovered. Fire safety games are an alternative to today's learning for vocational students because learning using the ubiquitous model (learning anywhere) is quite effective for vocational students. Students can study without being limited by time and place and without having to bring modules or books to understand the material [7].

2 Research Methods

This study uses the type of experimental research. This research was conducted in June–October 2022 at the Graphic Engineering Department, State Polytechnic of Creative Media. The population in this study were all students of the Graphic Engineering Department. The sample in this study was 38 students in semesters 1, 3, and 5. Before and after the intervention, primary data were collected. The researcher collected data using a Google Form after obtaining informed consent from the respondents.

Participants in this study were divided into two groups. The first group in this study was the group that was given material through power points in class and continued playing games. The second group in this study was the group that was given a fire safety game without being explained the material beforehand. This research measures the knowledge score just after intervention (short term). The same was stated by Pender, Murdaugh, and Parsons when they noted that the efficacy of healthcare promotion campaigns had to be measured repeatedly, mainly after intervention alone (short term), after the intervention was administered. In line with Arbianingsih, who used a brief intervention in the research[8]. Data were processed and analyzed descriptively and inferentially using SPSS 22.0 with paired T-tests.

3. Result and Discussion

The descriptive analysis was defined as comparing each item score for both intervention groups before and after the specified intervention. Before and after the fire safety game intervention was delivered to groups 1 and 2, the mean knowledge scores for each item are shown in Table 1. The vocational student's understanding of fire extinguisher regulations was the knowledge item that received the highest score (score 100) following the intervention. With a mean score of 43, the fire extinguisher rule, which was included as a ground item, had the most considerable score increase in the fire safety game. The fire that entered the ground improved its score combined with the material in the fire safety game.

The mean score description of each knowledge item among the measurements after the fire safety game intervention to both intervention groups is shown in Table 1. Knowledge-based score improvement after being given a fire safety game was only 70.8%, while in a fire safety game with material students, it was 75.3%. The p-value, on the other hand, was 0,001 following the fire safety game intervention. This discovery demonstrates that fire safety game intervention effectively improves fire safety knowledge and prevents fires in the industry.

Table 1. Description of knowledge of every item before and after fire safety game intervention was given to intervention group only game and group with a combination

no	Knowledge item	Fire safety Game			Fire safety game and material students		
		pre	post	Δ	pre	post	Δ
1	Cause of fire	47	57	10	31	73	42
2	Solid object fire class	31	57	26	10	78	68
3	Fire class due to electricity	57	**94**	37	31	**94**	63
4	fire extinguisher function	57	**95**	38	68	**89**	21
5	Kind of fire extinguisher	57	84	27	52	84	32
6	Techniques of fire extinguisher	26	58	32	21	42	21
7	Setting up the fire extinguisher	36	47	11	15	68	53
8	Color of fire extinguisher	68	95	27	78	84	6
9	Regulation of fire extinguisher	57	**100**	43	52	**89**	37
10	The body part of the fire extinguisher	26	21	-5	26	52	26
	Knowledge mean score	46,2	70,8	24,6	38,4	75,3	36,9

The trend of increasing knowledge can be seen from the mean score of knowledge-based before and after the intervention, reaching 24.6–36.9 percent. This follows the hypothesis in this study that there was an increase in the knowledge score of vocational students majoring in graphic engineering after being given intervention in both groups. Based on table 1, the highest average was found in the group that used games combined with materials, with an average score of 75.3%. The results of the bivariate test showed significance for the intervention with a p-value of 0.001. This discovery led to that fire safety game intervention was proven effective in improving vocational students' knowledge about fire safety to prevent workplace fires.

The results of this study are in line with research conducted at SD Uchuwatul Islam, Bandung, which implemented a "sehati" android-based application to improve the knowledge and skills of parents. Statistical test results obtained: p = 0.001[9]. Supported by research conducted by Arbianingsih, who developed an android-based game for elementary school children in Makassar, "arbicare" education increased knowledge about healthy behaviors to prevent diarrhea at one week, two weeks, and one month after intervention with a p-value of 0.001[8].

In terms of education, game-based learning in-depth assessments can be divided into summative and formative evaluations. Summative evaluation is usually done at the end of the learning process. This evaluation is designed to test the learner's understanding, memory, or mastery of the material that has been presented[10]. This research used fire safety games for

summative evaluation after the traditional class. But it also tests whether the fire safety game, without being given material, also results in a change in knowledge.

The game is an alternative method to understand the skill and concept without harming the students and can improve the knowledge score after implementation[11]. The conclusion of the meta-analysis conducted by Wouters et al. was that games might be an effective learning medium[12]. Fire safety is a serious game. A serious game can influence learning in two ways: cognitively and as a motivator[12]. The data indicate that vocational students are more receptive to game combinations with conventional approaches such as PPT (Powerpoint) than only games. In line with entrepreneurship, games are also used as companion learning modules. This influences motivation to learn more about entrepreneurship[10].

The learning process in a game-based digital environment enables students to experiment with various behaviors, confront multiple obstacles, and assume direct risks from every action and initiative they take. However, errors and accomplishments may be reproduced in the digital game world. The core of the learning process is repetition and reflection on experience, in addition to competence in instructional technology, evaluation, and assessment[10]. In a Game-Based Learning study, Teed discussed why games have become one of the most successful tools for learning activities (GBL). This was mainly because games may push pupils to study. Games are enjoyable, engrossing pupils in the subject matter for more effective learning and encouraging them to learn from their errors.

Students will be inquisitive about advanced media and will use technology to present the content[7]. Therefore, it is crucial to direct students' attention to the correct learning objectives and provide them with immediate assistance when they encounter difficulties during the ubiquitous learning process, particularly for those learning tasks that require frequent interactions with the learning objectives[13]. The principle of media selection is applied so that the information or message to be conveyed can be adequately achieved and become an effective and efficient medium. Health promotion media should strive to facilitate the acceptance of health messages by the public. Media must have the ability to be captured by many senses so that the message conveyed is easier to understand and so that it can be applied. Kumboyono (2011) said that the more substances involved in absorbing information, the easier it will be to increase knowledge, attitudes, and behavior [14].

4. Conclusion

The fire safety game effectively improved knowledge about fire safety for vocational students. A fire safety game is recommended with material students to help fire safety in the industry. This game can be further developed for vocational students with other majors.

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