

Overview of the use of digital pop-up book media to improve students' preparedness for fire disasters at Islamic Boarding Schools in Jambi City

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Abstract

Background: Fire disasters pose a serious threat to students in school environments, particularly in Islamic boarding schools where fire prevention knowledge and emergency response preparedness are often limited. Innovative media, such as digital pop-up books, provide interactive learning experiences that can strengthen both awareness of fire prevention and readiness for emergency response.

Method: A descriptive quantitative study was conducted at Islamic boarding schools in Jambi City. A total of 60 students from grades 10 to 12 were selected using purposive sampling. Data were collected using a structured questionnaire based on LIPI-UNESCO preparedness indicators and analyzed using descriptive statistics.

Results: The majority of students (56.7%) demonstrated a high level of preparedness after the educational session, while 33.3% were in the moderate category and only 10% remained in the low category. The digital pop-up book was effective in improving students' knowledge of fire prevention and their readiness to respond to fire emergencies.

Conclusion: Digital pop-up book media is a promising educational tool to enhance fire disaster preparedness among students in Islamic boarding schools. Its integration into school-based disaster education programs is recommended to strengthen preventive knowledge and emergency response capacity.

Keywords: fire disaster preparedness; fire prevention education; digital pop-up book; disaster education; Islamic boarding schools

INTRODUCTION

Disasters both natural and non-natural continue to pose significant threats to human life, especially in vulnerable populations such as children and students(1). Among these, fire disasters remain one of the most common and destructive types, often resulting in loss of life, injury, property damage, and psychological trauma. Globally, the World Health Organization (WHO) reports that burn-related incidents cause approximately 180,000 deaths each year, primarily in low- and middle-income countries(2). The frequency and severity of fire-related emergencies underscore the importance of integrating fire disaster preparedness into public education, particularly in school environments(3).

In educational institutions, students face various risks related to fire hazards,

including electrical failures, improper use of cooking tools, flammable materials, and poor building design(4). These threats are even more critical in boarding school settings, where students reside full-time, and the presence of dormitories, shared kitchens, and dense living conditions increases the likelihood of rapid fire spread. Despite these risks, awareness and preparedness among students and school administrators remain inadequate, mainly due to the lack of systematic disaster education and practical response training(5)(6).

Indonesia is one of the countries that frequently experiences disasters, including fires. According to the National Disaster Management Agency (BNPB), there were more than 5,400 reported disaster events across the nation in 2023, with a significant number involving structural fires in schools,

public institutions, and residential areas(7)(8). In Jambi City, data from the Fire and Rescue Department revealed over 300 fire incidents in the past year alone, several of which occurred in school zones or surrounding areas. This situation reflects an urgent need to strengthen fire disaster preparedness efforts in educational settings, particularly in pesantren or Islamic boarding schools, where formal disaster training is often minimal or absent(9).

Madrasah-based and boarding school environments (pesantren) hold a unique place in Indonesian education. With thousands of pesantren scattered throughout the country, they accommodate millions of students living in dormitory-style settings under religious and academic instruction(10). However, many pesantren lack basic fire safety infrastructure, including alarms, extinguishers, evacuation signage, or trained staff. Moreover, the traditional education system in pesantren may not prioritize disaster risk education, which places students at greater risk during emergency situations. Without preparedness, even a small fire can escalate into a major tragedy, as observed in several incidents in recent years(11).

Disaster education is a crucial strategy for reducing risk, increasing awareness, and building a culture of preparedness. The United Nations Office for Disaster Risk Reduction (UNDRR) emphasizes the importance of incorporating disaster risk education into school curricula to strengthen resilience from an early age(2). Teaching students how to prevent, respond to, and recover from fire emergencies can empower them to protect themselves and others. However, such education must be delivered in ways that are age-appropriate, engaging, and accessible to learners with varying abilities and backgrounds(12).

Conventional teaching methods, such as verbal explanations, printed pamphlets, or poster campaigns, often fail to capture students' attention or enable deep understanding of emergency concepts(13). These passive forms of instruction may not adequately prepare students to act in real-life

situations, where quick thinking and practical knowledge are essential. In contrast, interactive learning media particularly those that incorporate visual, auditory, and kinesthetic elements have been shown to improve knowledge retention, engagement, and behavioral change among students(14).

Digital educational tools have emerged as a promising innovation in this field. One such tool is the digital pop-up book, which combines the interactive features of traditional pop-up books with digital technology to create visually rich and immersive learning experiences. Created using presentation software such as PowerPoint or multimedia applications, digital pop-up books include animated elements, voice narration, clickable components, and simulated scenarios that help students visualize emergencies and understand appropriate response steps(15). This media is especially suitable for younger audiences or students with limited prior exposure to disaster education.

Previous research has demonstrated the effectiveness of multimedia-based learning in various health and safety topics. Studies show that digital storytelling, interactive animations, and gamified educational platforms can significantly improve student comprehension and motivation(16). In comparison, traditional methods such as lectures, posters, or printed modules are often less effective because they are passive, less engaging, and do not support long-term retention of safety knowledge. Several studies confirm that interactive digital media produce higher learning outcomes and stronger behavioral intentions than conventional teaching approaches, particularly in disaster education contexts.

In the context of disaster preparedness, such tools help bridge the gap between theoretical knowledge and practical action. For students living in boarding schools, where hands-on training may be limited, digital pop-up book media offer an alternative yet impactful method of building preparedness.

Despite its potential, the use of digital pop-up book media for fire disaster education remains underexplored in Indonesia, particularly in pesantren settings. Most existing studies have focused on natural disasters like earthquakes or floods, with limited emphasis on non-natural hazards such as fire. Furthermore, few have assessed the effectiveness of digital educational tools within the cultural and religious context of Islamic boarding schools. This study seeks to address that gap by examining how digital pop-up book media can enhance students' preparedness for fire disasters in a real pesantren setting in Jambi City.

Therefore, the objective of this study is to provide a descriptive overview of students' level of preparedness for fire emergencies after receiving an educational session using digital pop-up book media. The findings are expected to contribute to the growing body of knowledge on school-based disaster education and inform policymakers, educators, and pesantren administrators on the value of integrating interactive digital tools into fire safety preparedness programs.

METHOD

This study used a descriptive quantitative design to provide an overview of students' preparedness for fire disasters after being introduced to digital pop-up book media. The research was conducted at Islamic boarding schools in Jambi City, involving 60 students from grades 10 to 12 selected through purposive sampling.

Data were collected using a structured questionnaire based on LIPI-UNESCO indicators, covering five components: knowledge, attitude, emergency response planning, early warning systems, and resource mobilization. Students received an educational session using interactive digital pop-up book media, after which they completed the questionnaire. The results were analyzed using descriptive statistics to determine the level of preparedness, categorized as low, moderate, or high. Data analysis was performed using SPSS version 26.0.

RESULTS

1. Characteristics of Respondents

The study involved 60 students, evenly divided between the intervention and control groups. Table 1 summarizes their demographic characteristics.

Table 1. Characteristics of Respondents

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	28	46.7
	Female	32	53.3
Age	15-16 years	26	43.3
	17-18 years	34	56.7
Grade Level	Grade 10	18	30.0
	Grade 11	22	36.7
	Grade 12	20	33.3

The data show that most respondents were female (53.3%), aged between 17 and 18 years (56.7%), and distributed quite evenly across all grade levels.

2. Students' Fire Preparedness Levels

After participating in the educational session using digital pop-up book media, students were asked to complete a questionnaire to assess their level of preparedness. The results are shown in Table 2.

Table 2. Student Preparedness Levels After the Intervention

Preparedness Level	Frequency (n)	Percentage (%)
High (>80)	34	56.7
Moderate (65-79)	20	33.3
Low (<65)	6	10.0

The table shows that the majority of students (56.7%) reached a high level of preparedness after the intervention. This

means they understood what to do in case of a fire, how to evacuate, and how to respond to early warnings. Another 33.3% of students were in the moderate category, meaning they had fairly good understanding, though there may still be areas to improve. Only 10% of students were still in the low category.

DISCUSSION

The results of this study show that most students at Islamic boarding schools in Jambi City reached a high level of preparedness for fire disasters after receiving education through digital pop-up book media. This indicates that the use of interactive, visual-based educational tools can effectively improve student understanding about how to respond in fire emergency situations.

Before the intervention, many students were not familiar with basic fire safety procedures, such as how to evacuate safely, how to recognize fire hazards, or what to do when a fire alarm sounds. However, after being exposed to the digital pop-up book, which included animations, voice narration, and simple fire response simulations, students showed significant improvement in their preparedness levels. The results of this study revealed that 56.7% of students reached the high preparedness category, 33.3% were in the moderate category, and only 10% remained in the low category. This indicates that the majority of students were able to develop the knowledge, awareness, and confidence needed to respond effectively to fire emergencies after the intervention. This aligns with the belief that interactive learning makes difficult topics easier to understand and remember.

This finding is supported by Richard Mayer's Cognitive Theory of Multimedia Learning(17), which states that students

learn better when information is presented using both words and visuals, rather than words alone. The theory explains that the human brain processes visual and auditory information through different channels, and when both channels are engaged, learning becomes more effective. This is known as the multimedia principle(18).

In this study, the digital pop-up book engaged both visual and auditory senses. Students could see how a fire might start and spread, and hear explanations of what actions to take. This dual input likely helped students better understand and remember the material. Compared to just reading a textbook or listening to a lecture, this method made learning more active, enjoyable, and relevant to real-life situations(19).

Another important theory that supports the effectiveness of this media is Bandura's Social Learning Theory(20). According to Bandura, people especially children and adolescents learn by observing others and then imitating what they see, especially when the behavior is modeled clearly and appears useful or rewarding. In the digital pop-up book, students watched animations of characters responding correctly to fire disasters(21). This modeled behavior helped students form mental images of what they should do in similar situations, increasing their confidence and readiness.

The use of digital pop-up books also matches the preferences of today's generation of students, who are digital natives and often more responsive to visual and technology-based media. Traditional methods like verbal explanations or printed posters may be perceived as boring or hard to understand, especially when explaining technical safety procedures. In contrast, digital media provides movement, color, sound, and interaction, which can hold

students' attention and help them stay focused(22).

imilar findings have been reported in other studies. Research by Wulandari(23) showed that students' disaster awareness improved significantly after using visual-interactive media. Another study by Fauziyah and Mulyani(24) found that pop-up books increased elementary students' understanding of evacuation procedures during fire drills. These studies support the idea that educational content must be engaging, age-appropriate, and practical to achieve lasting effects. Moreover, the success of this study demonstrates the importance of contextual learning education that is directly related to the students' real environment. Since the students live in a boarding school (pesantren), they need to know how to respond to fires that may occur in dormitories, kitchens, or prayer areas. By tailoring the educational media to reflect those environments, students were more likely to connect the material to their daily lives and apply it when needed(18).

The digital pop-up book media served not only as a teaching tool but also as a motivational and behavioral model. It helped students become more aware of fire risks, understand appropriate responses, and feel confident in their ability to protect themselves and others. These findings support the use of interactive media in school-based disaster education and suggest that similar tools can be adapted for other types of hazards or educational settings.

CONCLUSIONS

This study concludes that the use of Digital Pop-Up Book media significantly improves fire disaster preparedness among students at Islamic boarding schools. The media is effective in enhancing understanding, motivation, and emergency response readiness. It is recommended for wider implementation in school-based

disaster education programs, especially in high-risk environments such as pesantren.

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