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The Effect of Snakes and Ladders Game on Earthquake Disaster Knowledge in Students

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ABSTRACT
Introduction: Indonesia's position on the Pacific Ring of Fire makes it highly prone to earthquakes. However, disaster preparedness among elementary school students is still lacking, highlighting the need for innovative educational methods to enhance their knowledge and readiness. This study aims to assess the effect of the snakes and ladders game method on elementary students' knowledge of earthquake disaster preparedness. **Method**: This study used a pre-experimental quantitative design with 31 students from Elementary School Students at Bandungrejo. Data were collected using two questionnaires, one measured earthquake knowledge, and the other measured earthquake preparedness. Pre and post-test results were analyzed using Spearman Rank Correlation to evaluate the correlation between education and knowledge improvement ($p<0.05$). **Result:** This study found a significant increase in students' knowledge after the intervention. Before the game-based education, 80.6% of the students had insufficient knowledge of earthquake disasters, but after the intervention, 83.9% of students had good knowledge. Statistical analysis showed a significant improvement ($p = 0.001$) in students' understanding. **Conclusion**: The use of the snakes and ladders game method significantly improved students' knowledge of earthquake disaster preparedness. This approach proves effective in enhancing disaster awareness in an engaging and interactive manner. The study suggests adding game-based learning to the elementary school curriculum to better prepare students for disasters.

Keyword: Disaster, Knowledge, Snake and Ladder

INTRODUCTION

Natural disasters are sudden events that cause major damage that disrupt the basic structure and normal function of a society or community (1). One of the most common forms of natural disasters is an earthquake (2). Earthquakes involve the release of energy from the movement of the earth's crust. Indonesia, as a country located in the Pacific Ring of Fire, is very vulnerable to natural disasters, especially earthquakes (3). Natural disasters caused by natural, non-natural, and human factors can threaten people's lives and livelihoods (4). Although Indonesia is vulnerable to earthquakes, the

level of understanding of the community, especially children in schools, in dealing with earthquakes is still relatively low (5). Therefore, an innovative approach is needed in earthquake disaster education that can improve students' understanding and skills in dealing with the disaster. One solution that can be used is to adapt the snakes and ladders game to convey earthquake disaster education material, which is expected to increase students' knowledge and preparedness for earthquake disasters (6).

In recent years, Indonesia has experienced a high number of earthquakes annually. For instance, in 2021, there were 12,351 recorded earthquakes (7). Natural disasters such as volcanic eruptions, earthquakes, tsunamis, floods and landslides occur very frequently in Indonesia. During this period, 257 natural disasters were recorded in Indonesia out of a total of 2,866 natural disasters in Asia. Malang City and Malang Regency rank 133rd nationally for earthquake occurrence rate. Malang is very vulnerable to earthquakes, so earthquake disaster education is needed to reduce or mitigate the impact of earthquakes (8).

Preparedness is more emphasized on efforts to prepare the ability to carry out emergency response activities quickly and accurately in relation to disaster management efforts in Indonesia, schools as public spaces have a real role in building community resilience (8). School preparedness is intended to make the school community know, understand, and care about the surrounding nature as well as improve skills to reduce risks in the event of a disaster (9). One type of learning method is the modified snakes and ladders game method. The modification in question is the provision of education through game media with the addition of images and writing or information about disaster preparedness in the boxes contained in the snakes and ladders game (10). Education with this modified snakes and ladders game will help children understand how to protect themselves in the face of disaster (11). Learning media by combining snakes and ladders games with disaster education material is an innovation that is appropriate and feasible to develop in the era of technological disruption like today (12).

Research (13), comparing educational games to conventional methods for disaster preparedness found that games significantly improve knowledge levels. For instance, a study on eruption disaster preparedness showed that educational games had a positive effect on students' knowledge. The snakes and ladders game has advantages over other games in providing earthquake education, including interactive learning, being able to recognize the concept of risk and consequences, training cooperation and communication, visualization and symbiolism (14). Penelitian ini bertujuan untuk mengetahui efek penggunaan game ular tangga terhadap pengetahuan kesiapan bencana gempa bumi pada siswa sekolah dasar.

METHOD

This study used a quantitative approach with a pre-experimental design to assess changes in students' knowledge about earthquake disasters after being educated using the snakes and ladders game. The study involved 31 students from SDN 1 Bandungrejo, selected through total sampling, meaning the entire population was used as the sample.

Data were collected using two questionnaires, one on earthquake knowledge and the other on earthquake preparedness. Each questionnaire had 10 items covering topics such as earthquake understanding, causes, signs, and mitigation, using a one-point Likert scale. The questionnaires were validated by experts before use, and their reliability was tested with Cronbach’s Alpha, resulting in a score of 0.4065 for the pre-test and 0.8419 for the post-test, indicating good reliability in the post-test. Data were analyzed using the Spearman Rank Correlation test to determine whether there was a significant relationship between the education and increased student knowledge ($p < 0.005$).

RESULT

The results of the description of individual student factors are in table 1 below.

Table 1 Distribution of respondent characteristics

No	Variable	Category	Frequency (f)	Percentage (%)
1	Age	7 Tahun	7	22
		8 Tahun	19	62
		9 Tahun	5	16
		Total	31	100
2	Gender	Male	17	54
		Female	14	46
		Total	31	100

Based on table 1, it is found that the characteristics of students in this study are from the aspects of age and gender. More than half of the respondents in this study were 8 years old, as many as 19 students (62%). Half of the respondents were male, as many as 17 students (54%).

Table 2 Distribution of Knowledge Before Earthquake Disaster Education

Variabel	Experimental Group	
	Frequency (f)	PreTest Percentage (%)
Sufficient	6	19.4
Deficient	25	80.6

Based on table 2 above, it can be seen that the influence of knowledge before earthquake disaster education using the snakes and ladders method characterized the variables before the intervention in 31 respondents in grade 2 elementary schools in Malang Regency studied, almost all of them, namely 25 respondents (80.6%) had insufficient knowledge and a small portion, namely 6 respondents (19.4%) had sufficient knowledge about earthquake disasters.

Table 3 Distribution of Knowledge After Earthquake Disaster Education

Variabel	Experimental Group	
	Frequency (f)	PostTest Percentage (%)
Good	26	83.9
Fair	5	16.1

Based on table 3 above, it can be seen that the effect of knowledge after earthquake disaster education using the snakes and ladders method characterized the variables after the intervention in 31 respondents in grade 2 elementary schools in Malang Regency who were studied, almost all of them, namely 26 respondents (83.9%) had good knowledge and a small proportion, namely 5 respondents (16.1%) had sufficient knowledge about earthquake disasters. The following are the results of measuring knowledge of earthquake disasters before and after the intervention using the Wilcoxon Signed Rank Test as follows.

Table 4 Results of statistical test analysis of the Effect of Earthquake Disaster Education on the Knowledge

Pre test	Post test	Δ	p- value
Mean ± SD	Mean ± SD	-4.877	0.001
40.65±3.109	84.19±1.721		

Table 4 shows that the average value of knowledge after earthquake disaster education using the snakes and ladders method has progressed between before and after the intervention. Based on the results of the normality test using the Wilcoxon Signed Rank Tes. it was found that there was an influence on earthquake disaster knowledge before and after the intervention with indicators (p=0.001) and (Δ=-4.877). The results of this study indicate that the intervention (i.e. education about earthquake disasters using the snakes and ladders game method) has a real impact on increasing students' knowledge about earthquake disasters. The value of Δ = -4.877 shows a decrease of 4.877, which means that there is an increase in students' knowledge after the intervention, with negative changes reflecting improvements in students' understanding.

DISCUSSION

3.1 Knowledge Before the Earthquake Disaster Education by Playing Snakes and Ladders Method

The effect of knowledge before earthquake disaster education on the characteristics of variables before the intervention in 31 respondents in grade 2 elementary schools in Malang Regency studied, almost all of them, namely 25 respondents (80.6%) had insufficient knowledge and a small proportion, namely 6 respondents (19.4%) had sufficient knowledge about earthquake disasters. The results of this study indicate that most grade 2 elementary school students in Malang Regency had insufficient knowledge about earthquake disasters before being given education.

This is in line with the research of (15) that many students had insufficient knowledge before the intervention of disaster preparedness education. Indonesia many students at the primary level have insufficient knowledge about natural disasters, including earthquakes that are still relatively low (16). This research emphasizes the importance of disaster education to increase students' awareness and preparedness for disaster risk in Indonesia. This finding is in line with previous research that also mentions the low knowledge of students in Indonesia about natural disasters.

According to the researchers, disaster education is important to increase students' awareness and preparedness in dealing with disaster risks, such as earthquakes, in the future. Disaster education in schools is needed so that students can be better prepared and know what to do in emergency situations such as disasters. Information processing theory makes an important contribution to learning design by providing a foundation on prior knowledge, how to design cognitive-oriented learning objectives, and the concept of feedback (17). Prior Knowledge Theory states that a person's understanding of new information is highly dependent on prior knowledge.

Research shows that learning is more effective when new information is linked to knowledge already stored in long-term memory. While prior knowledge is important, other factors such as learning strategies and teaching methods also play a role in successful learning. There is a view that correcting misconceptions is more difficult than teaching new concepts, so more adaptive and effective learning methods are needed.

3.2 Knowledge after Earthquake Disaster Education with the Snakes and Ladders Playing Method

The effect of knowledge after earthquake disaster education on the characteristics of the variables after the intervention on 31 respondents in grade 2 elementary schools in Malang Regency who were studied, almost all of them, namely 26 respondents (83.9%) had good knowledge and a small proportion, namely 5 respondents (16.1%) had sufficient knowledge about earthquake disasters.

This is in line with the research of (18), showing an increase in students' knowledge of disasters. In addition, students showed high enthusiasm and improved ability in identifying appropriate steps to deal with emergency situations. The program was also well received by teachers and students, who saw the potential of Snake Board Edu-Game as an innovative learning tool that can be integrated in the school curriculum especially in disaster education in elementary schools.

The theory according to David Kolb (1984) uses the term “Experiential Learning” (hereafter abbreviated as EL) which means learning through reasoning about experience. Kolb's EL model is the focus of the author's next theoretical review. David Kolb (1984) is a figure in the rise of EL practices. He defines learning as “The process by which knowledge is created through transformation of experience”. For Kolb, learning is not just the reception or transmission of subject matter, but the interaction between subject matter and experience that transforms each other (Knowles, 1998: 146-147). Kolb explains that effective learning occurs through direct experience. Playing methods such as snakes and ladders allow children to experience simulated earthquake situations, understand safety procedures, and recognize their impact in a more interesting way than conventional methods (19).

The results of this study strongly suggest the importance of implementing innovative educational methods, such as the use of educational games, in teaching important topics such as disaster. Not only does this approach increase students' knowledge about earthquakes, but it also successfully motivates them to actively participate in learning. With more innovations like this, disaster can be more effectively delivered to children, creating a generation that is better prepared for disasters. It also illustrates that fun and interactive learning methods should be more widely implemented in the elementary school curriculum.

3.3 The Effect of Earthquake Disaster Education with the Play Snakes and Ladders Method on Knowledge of Earthquake Disasters in Students of SDN 01 Bandungrejo, Grade 2

The results of this study showed a significant increase in the average value of students' knowledge about earthquake disasters after being given education using the snakes and ladders method, compared to students' knowledge before the intervention. Based on the results of the Wilcoxon Signed Rank Test, a significant effect was found on students' knowledge about earthquake disasters before and after the intervention, with a significance value ($p = 0.001$) and a change in value ($\Delta = 4.877$). These results indicate that the snakes and ladders method can significantly increase students' knowledge, indicating that the experiential learning approach is very effective in the context of disaster education in elementary schools. This study also revealed that students' knowledge about earthquake disasters before the intervention in 31 respondents from grade 2 elementary school students in Malang Regency showed that almost all of them, namely 25 respondents (80.6%), had poor knowledge. However, after the earthquake disaster education intervention using the snakes and ladders method, almost all respondents, namely 26 students (83.9%), showed an increase to having good knowledge. This shows that disaster education using fun and interactive methods such as snakes and ladders can provide better understanding compared to conventional methods.

Another study highlighted the effectiveness of a game model in improving knowledge and physical fitness among elementary school children in tsunami-affected areas, showing better results in the intervention group compared to the control

group (20). Several previous studies also support this finding. One of them is a study by (18), which states that innovative and creative methods in learning can motivate students to actively participate in learning activities. The use of games as a learning method, such as the snakes and ladders game, allows students to learn in a more fun and interactive way (21). By involving students directly in games that educate about various types of natural disasters and the steps to deal with them, the snakes and ladders method has been shown to improve students' knowledge of the causes and impacts of disasters and their ability to respond to emergency situations. This study (22), also emphasizes that methods that involve students in direct experience help strengthen their learning, because they not only memorize information, but also experience the situation in a more realistic simulation. Kolb (1984) in his theory of experiential learning states that concrete experience is a prerequisite for mastering physical skills, reflection, the formation of abstract concepts, and the ability to assess and review actively. The application of this learning theory, such as simulations, role-playing, and games, provides concrete experiences for students to master the skills and abilities as described above. Kolb explains that effective learning occurs through direct experience, where students can feel the situations taught in real life. In this context, the snakes and ladders game allows students to experience an interactive and fun learning process. They not only receive information about earthquakes, but also interact with learning materials through simulations that build their understanding more deeply (19). In this study (23), the snakes and ladders method was proven to increase students' awareness and preparedness for disasters. Using games as a learning tool creates a fun environment, which in turn increases student motivation and engagement. Active learning, as applied in the snakes and ladders game, increases students' understanding and retention of information, because they are directly involved in the learning process and can practice the correct steps in dealing with disasters (24). Game-based learning methods can improve students' understanding of complex topics, such as disaster management (25). In a fun and interactive way, students not only learn theories about earthquakes, but also practice directly responding to and handling disasters. This method not only provides benefits in terms of knowledge, but also in terms of developing life skills, which are essential in preparing students to face real-world emergencies.

Thus, the snakes and ladders method can be implemented as an effective alternative in disaster education in elementary schools. This experiential learning provides a basic understanding that is important for disaster preparedness among children. As stated by (19), direct experience is the key to forming a deep understanding and skills that can be applied in real life. Therefore, disaster education that integrates games such as snakes and ladders can provide long-term benefits, not only in terms of knowledge about disasters, but also in equipping students with the skills and attitudes needed to act effectively in emergency situations. In line with these findings, the use of snakes and ladders games should be more widely applied in the elementary school curriculum in Indonesia. Given the importance of providing knowledge about disasters from an early age, the implementation of this method can help save lives and improve disaster preparedness among the younger generation in the future.

CONCLUSION

Disaster education using the snakes and ladders game method can significantly improve students' knowledge about earthquakes, from poor knowledge to good knowledge after the intervention. This approach has been proven effective in increasing students' awareness and preparedness for disasters in a fun and interactive way. Based on these findings, this study suggests that experiential learning methods, such as the snakes and ladders game, be introduced and integrated into the

elementary school curriculum in Indonesia. This will help students be better prepared for disasters and develop the skills needed to act in emergency situations.

Conflicts of interest

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