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# The Impact of a Game-based Teaching Approach on Developing Disaster Awareness in Social Studies Classes[1]

# Oyunla Öğretim Yaklaşımının Sosyal Bilgiler Dersinde Afet Bilinci Gelişimine Etkisi



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**Abstract.** This study investigated the effects of game-supported education and gamification techniques on students' learning of earthquake awareness and protection methods. Utilizing a quantitative approach, the research employed a quasi-experimental design with a pre-test–post-test control group model. The study was conducted with 5th grade students in Balıkesir, and data were analyzed using SPSS 22. Activities such as the "Earthquake Bag Preparation Game," "I'm Prepared: Before, During, and After the Earthquake," and "Earthquake Hunt" significantly improved students' knowledge of earthquake preparedness. Additionally, the study observed positive outcomes in the development of essential skills for responding to earthquakes during and after such events. The findings indicate that gamified education is an effective tool for raising awareness and promoting learning on critical topics such as disaster preparedness. It is recommended that future research explore the long-term effects of game-based learning across different age groups and educational levels. Furthermore, supporting teachers with appropriate materials and resources is essential to facilitate the wider adoption of these methods in schools".
***Keywords:*** Disaster awareness, Earthquake awareness, Social studies, Teaching through games.

**Öz.** Bu çalışma, oyun ve oyunlaştırma teknikleriyle desteklenen eğitimlerin, öğrencilerin deprem bilincini ve depremden korunma yöntemlerini öğrenmesindeki etkisini incelemektedir. Nicel yöntemlerle yürütülen araştırma, yarı deneysel desen kapsamında ön test-son test kontrol gruplu modeliyle tasarlanmıştır. Balıkesir'deki 5. sınıf öğrencileriyle gerçekleştirilen çalışmada, veriler SPSS 22 ile analiz edilmiştir. Geliştirilen "Deprem Çantası Hazırlama Oyunu", "Deprem Öncesi, Anı ve Sonrası Hazırlıklıyım Oyunu" ve "Deprem Avı" gibi etkinlikler, öğrencilerin deprem bilgilerinde anlamlı artış sağlamıştır. Ayrıca, deprem sırasında ve sonrasında gerekli becerilerin kazanılmasında olumlu sonuçlar gözlemlenmiştir. Oyunlaştırılmış eğitimlerin afet bilinci gibi kritik konularda etkin bir araç olduğu sonucuna varılmıştır. Gelecek araştırmaların farklı yaş grupları ve eğitim düzeylerinde oyun tabanlı öğrenmenin uzun vadeli etkilerini incelemesi önerilmektedir. Ayrıca, okullarda bu yöntemlerin yaygınlaşması için öğretmenlere materyal ve kaynak desteği sağlanmalıdır.
***Anahtar Kelimeler:*** Afet bilinci, Deprem farkındalığı, Oyunla öğretim, Sosyal bilgiler.

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## Introduction

One of the most emphasized common goals in shaping national education policies is to raise individuals who are resilient in the face of disasters. To achieve this objective, education systems may adopt a variety of teaching and learning methods, with some countries implementing similar approaches and techniques. However, it is important to note that the diversity of methods applied in this process is often limited by the training and competencies of teachers in this area.

While social studies education aims to cultivate individuals who can adapt to the changes and developments in the world (Öztürk, 2006), teachers employ a wide range of instructional techniques to achieve this goal (Çelikkaya and Kuş, 2009). One such method is game-based teaching. This approach is not only frequently utilized in social studies but has also become a common strategy in various other educational fields, including mathematics (Başün and Doğan, 2018; Dönmez et al., 2021), English (Gömleksiz, 2005), history (Karabağ Gülin and Aydoğan Okan, 2015; Özdemir, 2018), geography (Adanalı, 2019), and early childhood or basic education (Boz, 2018; Jančič and Hus, 2017).

While some of the game-based teaching methods frequently used in social studies education are specifically designed as game-oriented instructional approaches within the field (Akkuş and Aslan, 2013; Korcu, 2019; Magnacca, 2013; Sontekin et al., 2024; Uygun Kamile et al., 2018; Watson, 2010), other studies focus how game-based teaching affect students' academic success in social studies lessons (Akkuş and Öğütveren, 2024; Altınbulak Demet et al., 2006; Boz, 2018; Erkan and Keremgil Çelik, 2023; Pehlivan and Demirel, 2022; Uygun Kamile et al., 2018; Yaşar et al., 2023). Although the effectiveness of game-based teaching methods in various subject areas has been demonstrated in numerous studies, research involving the perspectives of teachers and students on the applicability of these methods also reinforces these findings (Başün and Doğan, 2018; Bostan and Turan, 2023; Çelikkaya and Kuş, 2009; Karataş, 2021; Özdemir, 2018; Salur, 2024; Yaşar and Bayır, 2010). Common findings across studies utilizing game-based teaching methods indicate that students' motivation to learn increases in classes where these methods are applied, and teachers report satisfaction with their instructional roles (Bostan and Turan, 2023; Şahin, 2017; Yaman, 2020).

As demonstrated by existing research on the positive impact of game-based teaching on student learning (Şahin, 2017), this approach has been increasingly applied across various educational subjects and disciplines. In Türkiye, curriculum updates and revisions are made not only to enhance the permanence of learning but also to improve the implementation of educational programs. One such improvement involves the integration of modern teaching methods, particularly for subjects where traditional approaches may fall short or fail to generate sufficient awareness. Disaster education is one such area, with numerous studies indicating that students often do not achieve the desired level of knowledge or awareness (Adanalı et al., 2022; Mızrak, 2018; Önal, 2019). In the pursuit of a disaster-resilient society, the advancement of instructional strategies—such as game-based learning—has proven especially effective in earthquake education (Doğan and Koç, 2017). While disaster awareness training was initially introduced through the Life Sciences course, transforming the targeted knowledge and skills into higher-order behaviors has become a central goal in both the 2018 Social Studies Curriculum (MoNE, 2016) and the updated Social Studies Curriculum introduced under the Türkiye Century Education Model in 2024 (MoNE, 2024). In this context, the use of game-based teaching

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techniques emerges as a natural and effective method in courses designed to foster disaster education and awareness.

When adapting traditional games, digital games, or strategy and leisure games for educational purposes, it is essential to consider several key factors, including alignment with curriculum objectives, the ability to engage students, and the capacity to meet their learning needs (Doğan and Koç, 2017; Hilton, 2006; Okada and Matsuda, 2019; Prensky, 2003). To ensure the effectiveness of game-based teaching, it is important to evaluate these aspects individually. One critical distinction to acknowledge is the difference between game-based learning and gamification. While the aim of game-based learning is to provide students with the skills they need to acquire through games, gamification should be perceived as an auxiliary teaching technique such as facilitating learning and increasing participation in learning environments, rather than replacing direct learning (Avolio et al., 2014; Kim et al., 2009; Simões et al., 2013). In this respect, game-based learning directly facilitates knowledge and skill acquisition, whereas gamification serves as a supplementary strategy that supports the learning process without replacing traditional instruction. Ultimately, whether game-based learning or gamification is employed, both approaches contribute to the development of students' diverse personal and social skills through active and participatory classroom experiences.

**Purpose of the study**

Earthquakes are among the most frequent and devastating natural disasters in Türkiye, often resulting in significant physical and psychological consequences. Children, in particular, are among the most vulnerable groups affected by such disasters, highlighting the importance of providing disaster education from an early age. In this context, the necessity has arisen to develop game-based teaching practices aimed at achieving the learning outcome "SB.5.3.4. Questions the causes of disasters and environmental problems in their environment" within the scope of the social studies curriculum. This study set out to examine how game-based teaching activities, designed with the constructivist learning approach, affect students' earthquake awareness, anticipating that game-based learning environments would enhance students' active engagement in the course and contribute to the development of appropriate behaviors during and after earthquakes. Furthermore, the study focused on the role of game-based teaching in reinforcing the long-term retention of disaster education and its potential to support students' growth into disaster-resilient individuals

**Research guestion**

The study examined the question provided below:

- What is the effect of earthquake education supported by game-based and gamification techniques on students' levels of disaster awareness and the development of safe behaviors?

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# Method

## Research model

This study aimed to research how game-based teaching methods implemented in the social studies curriculum impacted students' earthquake awareness, utilizing a quantitative research design. Quantitative studies are designed to examine the relationships between variables by systematically collecting and analyzing numerical data (Creswell and Creswell, 2022; Field, 2018). In the study, a quasi-experimental design was used that inluded pre and post tests and control and experimental groups. This design allows experimental intervention and facilitates causal inferences, even without random assignment between groups (Shadish, Cook, and Campbell, 2002). The non-equivalent control group design, commonly used in educational research, enables a comparison of groups when the experimental and control groups are not randomly assigned (Creswell and Creswell, 2022). In this study, the experimental group received game and gamification-based earthquake education and the control group learned with the previous methods that they were used to. Pretests and posttests were administered to both groups to assess changes in earthquake awareness levels. This approach is widely used to evaluate the effectiveness of educational interventions (Dimitrov and Rumrill, Jr., 2003).

SPSS 22 software was utilized to examine the study data and the independent samples t-test was used to assess the differences between the study groups. Quasi-experimental designs are a valuable method for evaluating the effectiveness of interventions, particularly in educational research. In this study, the quasi-experimental design provided an appropriate framework for examining the impact of gamification-based earthquake education on students' disaster awareness and the development of safe behaviors (Campbell and Stanley, 1963; Shadish et al., 2002). The application of this methodology will contribute to the formulation of recommendations for integrating gamification techniques into disaster education. Furthermore, this study will offer valuable insights that can guide future research on the incorporation of game-based learning into educational practices.

## Population and sample

The study group for this research consisted of 5$^{th}$ graders in a middle school in the central districts of Balikesir during the 2023-2024 academic year. Convenience sampling, a purposeful sampling method, was used to identify a total of 30 students as participants (Patton, 2014). Convenience sampling was chosen because it facilitates the collection of detailed data within a specific context and allows for the selection of participants who can voluntarily engage in the study (Creswell, 2012; Patton, 2014). This method also offers the advantage of easier access to the research setting and accelerates the data collection process (Yıldırım and Şimşek, 2011). In selecting participants, voluntary participation was prioritized, and ethical considerations were upheld by obtaining written consent from the parents. The findings derived from this sample aim to provide a comprehensive analysis of the effects of game-based and gamification-based earthquake education on students' learning outcomes.

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**Data collection tool**

In this study, an achievement test developed specifically for the social studies course was used as the data collection tool. The achievement test was developed in three phases. At first, "People, Places, and Environments" learning area was selected from the 5th grade Social Studies curriculum for the 2023-2024 academic year. Within this area, the topic of "earthquake" was addressed, and the test was designed to measure the impact of earthquake education delivered through the traditional course format on students' earthquake awareness levels. In the second phase, the achievement test incorporated both 4-option multiple-choice questions and short-answer matching questions. A total of 20 multiple-choice questions were developed in alignment with the learning outcome "SB.5.3.5. Explains the effects of natural disasters on social life with examples," as outlined in the curriculum. The questions were constructed based on the content of the 5th grade Social Studies textbook, ensuring they matched the achievement objectives for the chosen subject. Students were given 35 minutes to complete the test. In the third phase, expert opinions were sought to ensure the appropriateness of the test items for the students' level. Experts in social studies education, grammar, and measurement and evaluation, along with the social studies teacher, reviewed the items to ensure that the items of the prepared achievement test were appropriate for the student level. Additionally, a pilot study of the test was conducted with 60 students and relevant indexes were calculated (such as item difficulty index and item discrimination index). The ratio of the number of correct answers to the total number of responses were calculated to determine the item difficulty and the Henryson method and correlation coefficients were calculated for item discrimination index (Baykul, 2000). The analysis results and evaluations from the pilot study are presented in Tables 1 and 2.

Table 1.
Item difficulty analysis results

| *Item* | *Difficulty Index* | *Evaluation* |
|---|---|---|
| 1 | 0,48 | Medium Difficulty |
| 2 | 0,48 | Medium Difficulty |
| 3 | 0,46 | Medium Difficulty |
| 4 | 0,48 | Medium Difficulty |
| 5 | 0,48 | Medium Difficulty |
| 6 | 0,30 | Difficult |
| 7 | 0,61 | Easy |
| 8 | 0,57 | Medium Difficulty |
| 9 | 0,48 | Medium Difficulty |
| 10 | 0,63 | Easy |
| 11 | 0,54 | Medium Difficulty |
| 12 | 0,67 | Easy |
| 13 | 0,67 | Easy |
| 14 | 0,30 | Medium Difficulty |
| 15 | 0,48 | Medium Difficulty |
| 16 | 0,67 | Easy |
| 17 | 0,67 | Easy |
| 18 | 0,63 | Easy |
| 19 | 0,31 | Difficult |

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| | | |
|---|---|---|
| 20 | 0,67 | Easy |
| 21 | 0,48 | Medium Difficulty |
| 22 | 0,48 | Medium Difficulty |
| 23 | 0,48 | Medium Difficulty |
| 24 | 0,69 | Easy |
| 25 | 0,31 | Difficult |
| 26 | 0,30 | Difficult |

When evaluating the difficulty indexes of the test items in Table 1 according to the reference ranges provided by Turgut and Baykul (2010) and Crocker and Algina (1986), the following items fall into the "Difficult" category (0.21- 0.40): Questions 6, 14, 19, 25, and 26. These items contribute to the overall difficulty level of the test.

Medium Difficulty (0.41- 0.60) Items: The majority of the test items fall within this range (1, 2, 3, 4, 5, 9, 11, 14, 19, 21, 22, 23), suggesting that the test is generally well-balanced. Items of medium difficulty are particularly important for distinguishing between low and high-achieving students.

Easy (0.61- 0.80) Items: Questions 7, 10, 12, 15, 16, 17, 18, 20, and 24 fall within this range. These items are designed to assess basic knowledge and have been included to enhance the accessibility of the test.

Table 2.
Item discrimination analysis results

| *Item* | *Item Discrimination Index* | *Evaluation* |
|---|---|---|
| 1 | -0,03 | Very weak, must be removed |
| 2 | 0,25 | Needs to be corrected and improved |
| 3 | 0,16 | Very weak, must be removed |
| 4 | 0,10 | Very weak, must be removed |
| 5 | 0,41 | Very good item |
| 6 | 0,17 | Very weak, must be removed |
| 7 | 0,48 | Very good item |
| 8 | 0,46 | Very good item |
| 9 | 0,53 | Very good item |
| 10 | 0,35 | Pretty good but still can be improved |
| 11 | 0,50 | Very good item |
| 12 | 0,07 | Very weak, must be removed |
| 13 | 0,51 | Very good item |
| 14 | 0,35 | Pretty good but still can be improved |
| 15 | 0,52 | Çok iyi madde |
| 16 | 0,26 | Needs to be corrected and improved |
| 17 | 0,45 | Very weak |
| 18 | 0,53 | Very good item |
| 19 | 0,55 | Very weak |
| 20 | 0,51 | Very good item |
| 21 | 0,45 | Very good item |

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| | | |
|---|---|---|
| 22 | 0,47 | Very good item |
| 23 | 0,41 | Very good item |
| 24 | 0,58 | Very good item |
| 25 | 0,31 | Pretty good but still can be improved |
| 26 | 0,53 | Very good item |



When Table 2 was examined in terms of discrimination index, it was determined that some items demonstrated very good discrimination (0.40 and above). However, certain items were found to be weak (0.10–0.24) or very weak (below 0.10), and it was recommended that these items be either revised or removed from the test. Specifically, items with discrimination indexes of -0.03, 0.10, 0.16, and 0.17 were suggested for removal. Conversely, items within the range of 0.35–0.50 were considered "quite good" and deemed suitable for retention with minor revisions (Kelley, Ebel, and Linacre, 2002). Following the evaluation of the analysis results, items identified as needing improvement were revised accordingly, and seven very weak items (1, 3, 4, 6, 12, 17, and 19) were removed from the final version of the test.

The achievement test used in the study consists of a total of 16 items. According to the item analysis results, the average item difficulty was calculated as 0.52, indicating that the test is generally of medium difficulty. The average item discrimination index was 0.44, indicating that the items included in the test possessed sufficient discriminatory power in distinguishing between students with varying levels of achievement (Turgut and Baykul, 2010).

The test reliability was evaluated with the KR-20 formula and was calculated as .70. This value indicates an acceptable level of reliability, particularly for instruments used in the social sciences, and provides sufficient evidence regarding the internal consistency of the measurement tool (Büyüköztürk, 2012). These findings suggest that the achievement test is appropriate for the

The ethical process in the study was as follow:

- Balikesir University, Social and Human Sciences Ethics Committee provided the necessary ethics committee approval (Date: 06.12.2023, Number: E-2023/9)
- Parental permissions were obtained to take part in the experimental and control groups

**Data analysis**

Quantitative findings were examined by comparing students' responses to the achievement tests administered before and after the implementation of the activity. Accordingly, the effect of earthquake education on students' knowledge levels was evaluated via comparing and contrasting the results ontained from pre and post tests. SPSS 22 software was used for statistical analysis. To determine the appropriate statistical tests, the normality of the data distribution was examined. Subsequently, both dependent and independent samples t-tests were employed to analyze the differences within and between groups.

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## Results

The analyses results are presented below along with groups' average pre-test, effect size, and Mann-Whitney U Test findings.

### Normal distribution of pre-test data groups

Table 3 presents the skewness and kurtosis values used to assess whether the data from the experimental and control groups followed a normal distribution. The obtained values fall within the acceptable range, indicating that both groups exhibit a normal distribution, which is a necessary condition for the validity of statistical analyses.

Table 3.
Normal distribution test results table

| | | *Sk* | *Kurt* |
|---|---|---|---|
| Pre-test | Control | .162 | -.971 |
| | Experimental | -.214 | -1.175 |

The distributions wre regarded as normal due to the findings that the data for both groups had skewness and kurtosis values within the range of ±1.5. In line with this assumption, experimental and control groups' pre test scores were compared via an independent samples t-test was to observe statistically significant differences, if any. Table 4 shows the analysis results**.**

Table 4.
Table of independent samples t test results

| Group | *N* | *M.* | *SD* | *f* | *t* | *p* | *Cohen d* |
|---|---|---|---|---|---|---|---|
| Experimental | 30 | 48.23 | .18.47 | 58 | .134 | .893* | .083 |
| Control | 30 | 48.90 | .19.89 | | | | |

*Abbreviations:* N, sample size, M, mean, SD, standard deviation, df, degrees of freedom, t, t-statistic, p, p-value

*$p > .05$

No significant differences were found between both groups' average pre-test scores (t = 0.134, p = 0.893, p> 0.05), indicaitng that both groups had similar scores. Cohen's d reveals low effect size between both groups.

### Normal distribution of post-test data groups

Table 5 presents the skewness and kurtosis values for both groups to assess the normality of their post-test score distributions. The obtained values fall within the acceptable range of ±1.5, indicating that both groups demonstrate a normal distribution. This finding satisfies one of the key assumptions required for the validity of parametric statistical analyses.

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Table 5.
Normal distribution table

| | | *Sk* | *Kurt* |
|---|---|---|---|
| Post-test | Experimental | -.674 | -.826 |
| | Control | -1.56 | 2.89 |

Since the skewness and kurtosis values fell outside the acceptable range of ±1.5, it was determined that the data groups did not exhibit a normal distribution. Accordingly, the Mann-Whitney U test, a non-parametric alternative to the independent samples t-test, was employed to examine whether there was a statistically significant difference between both groups' post-test scores. Table 6 presents the results of this analysis along with the interpretation of the findings.

Table 6.
Mann-Whitney U test results table

| *Pre-test* | *N* | *Mean Rank* | *Sum of Ranks* | *U* | *p* |
|---|---|---|---|---|---|
| Control | 30 | 20.55 | 616.50 | 151.500 | .000* |
| Experimental | 30 | 40.45 | 1213.50 | | |

*$p < .05$

According to the results, there was a statistically significant difference between the mean ranks of both groups (experimental group, 40.45; control group, 20.55) (U = 151.500, p = .000). Hence it was concluded that the intervention implemented as part of the study had a significant positive effect on experimental group students'academic achievement.

## Discussion, Conclusion and Recommendations

### Discussion

The research findings demonstrate that the approach used in this study has significant positive impact on earthquake awareness, classroom participation, and knowledge retention for students. This result aligns with previous studies in the literature, which suggest that gamification enhances students' active engagement in the learning process and boosts their motivation levels (Lee and Hammer, 2011; O'Donovan, Gain, and Marais, 2013; Dicheva et al., 2015).

When comparing students' achievement levels in the end-of-course assessments with their performance after the game-based activities, it was found that the game-based assessment process contributed to more permanent learning. This outcome is consistent with similar findings in the study by Uygun Kamile et al. (2018). Furthermore, Önal (2021) also emphasizes that game-based learning positively impacts not only students' academic success but also their attitudes toward the course and their ability to retain information over the long term.

The significant differences observed between both groups' post-test results highlight the positive impact of the game-based activities on learning outcomes (Zongur, 2024). Specifically,

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activities like the "Earthquake Bag Preparation Game," "I'm Prepared Before, During, and After the Earthquake Game," and "Earthquake Hunt" developed in the study enhance disaster awareness and help students acquire essential skills more effectively. Similarly, research by Akkuş and Aslan (2013), Jančič and Hus (2017), and Korcu (2019) further emphasizes that game-based applications Araştırma bulguları, oyun temelli öğretim yaklaşımının öğrencilerin deprem bilinci, derse katılımı ve bilgi kalıcılığı üzerinde anlamlı ve olumlu etkiler yarattığını göstermektedir. Bu bulgu, literatürde oyunlaştırmanın öğrencilerin öğrenme sürecine aktif katılımını desteklediğini ve motivasyon düzeylerini artırdığını belirten çalışmalarla örtüşmektedir (Lee and Hammer, 2011; O'Donovan, Gain and Marais, 2013; Dicheva et al., 2015). serve as an effective method in disaster education.

Moreover, gamification has been found to enhance the growth of students' cognitive and social skills, including problem-solving, decision-making, and cooperation (Dönmez et al., 2021; Çavuş and Balçın, 2017). This highlights that educational games have multifaceted effects, influencing not only cognitive growth but also affective and social development. However, some studies suggest that gamification does not always yield positive outcomes. For instance, Hanus and Fox (2015) noted that students' motivation levels can decrease over time, negatively impacting their academic performance. These contradictory findings indicate that the quality of the pedagogical design and the teacher's competence play crucial roles in the success of game-based teaching processes.

As highlighted in the study by Korkmaz and Öztürk (2020), social studies education enhanced by games significantly contributes to students' academic success and attitudes toward the subject compared to traditional methods. The findings of this study also align with these results. However, for game-based approaches to have lasting effects, it is essential for teachers to be properly equipped to use these methods effectively. The literature frequently emphasizes the need for teachers to receive adequate training in game design, implementation, and evaluation to ensure the successful integration of educational games (Karataş, 2021; Bostan and Turan, 2023; Salur, 2024).

**Conclusion and recommendations**

This study addressed the impact of game-based teaching methods on earthquake awareness, academic success, and knowledge retention in social studies for students. The findings indicate that game-structured activities enhance students' interest and participation in the lesson, promote long-term learning, and foster awareness of critical issues such as disaster preparedness. Specifically, earthquake-themed games were found to be effective in developing both cognitive and affective skills, while also contributing to the acquisition of higher-level skills such as decision-making, problem-solving, and taking responsibility.

It was observed that the educational games developed in this study encouraged students to actively engage in the learning process and fostered a positive attitude toward the social studies course. In this regard, game-based teaching can be viewed as a powerful pedagogical tool that enhances not only academic success but also the general nature and standards of the learning experience.

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However, it has become clear once again that for game-based teaching to be implemented effectively, teachers must be equipped with the necessary knowledge and skills related to this approach. In this context, it is crucial to systematically integrate game-based teaching into teacher training programs. Future studies exploring the long-term effects of game-based teaching methods across various age groups and education levels will further enrich the literature in this field. Additionally, educational institutions should provide appropriate materials and resources to support game-based learning, facilitating teachers' implementation of these methods. Expanding the use of game-based teaching methods, especially in raising awareness of disasters like earthquakes, is essential. This approach is expected to offer significant benefits by helping students develop crucial skills needed for handling critical situations.

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