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**Original Article**

# Development of a disaster mitigation learning program for kindergarten students through physical fun games

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**Abstract**
***Background:*** Children are the most vulnerable group when natural disasters occur, but few children have the knowledge to save themselves when a disaster occurs. The lack or even ignorance of the actions that need to be taken when a disaster occurs is the cause of the high number of child victims during natural disasters. This research aims to develop and validate a natural disaster mitigation games program that can increase children's knowledge of natural disaster preparedness. ***Methods:*** 140 students were involved in testing research products. The method used in this research is research & development with 10 stages. Validity analysis of item suitability through Aiken v which was processed using Microsoft Excel. Reliability data was analyzed using SPSS 20. ***Results:*** Natural disaster mitigation learning products were produced which were conceptualized through 7 fun disaster mitigation games consisting of games for earthquakes, volcanic eruptions, tsunamis, floods, landslides, tornadoes, forest fires. The results of this research obtained optimal content validity values (Aiken V = 0.81). Average internal validation value (r=0.81). The reliability value was obtained using Cronbach's Alpha with a value of 1.0. From the test results, it was concluded that the disaster mitigation learning program for kindergarten students through fun physical disaster games was valid and reliable. ***Conclusions:*** The findings show that the disaster mitigation learning program through physical fun games mitigation has proven to be valid and reliable for use in teaching kindergarten student natural disaster mitigation material. Through learning physical fun mitigation games, children are more active in understanding the concept of disaster mitigation where children directly practice self-saving actions. The physical fun games mitigation program provides children with emergency skills, knowledge of evacuation routes, how to use safety equipment, and actions to take in emergency situations. Children's knowledge of mitigation makes children agents of change in building a culture of safety and disaster mitigation in their environment.
**Keywords: kindergarten, fundamental motor skill, mitigation disaster, physical fun games**

## Introduction

Indonesia's geographical location on the Pacific Ring of Fire causes a high risk of natural disasters. In the last 20 years, Indonesia has experienced several major natural disasters such as tsunamis, earthquakes, floods, landslides and fires (Onrizal et al., 2020). The timing of disasters is difficult to predict and occurs suddenly, causing people to be unprepared to face disasters. Indonesian National Data released 3522 natural disasters in 2022 which resulted in 259,349 people dying (*Laporan Kinerja BNPB Tahun 2022*; Onrizal et al., 2020). (Flores et al., 2023; Jones et al., 2020) children are the most vulnerable group when natural disasters occur) (Kousky, 2016). Physical weakness and lack of knowledge make children the most vulnerable victims during natural disasters. Unfortunately, there is still a systematic lack of attention to children in the discourse of disaster preparedness (Rana et al., 2023)

Children's lack of knowledge of how to take self-protection measures when a disaster occurs has an impact on the high number of child victims. Lack of experience is the main factor in being unprepared to face disasters (Manouchehri et al., 2023). Research shows that the level of children's preparedness for disasters is low (Russell et al., 2023). Data reveals that children are the biggest victims when natural disasters occur, reaching 50%-60% of the total victims (B et al., 2023; Russell et al., 2023). The number of children affected by natural disasters every year is very high and is expected to increase along with global warming (Rukiko et al., 2023). Empirical facts show that the index of children's social resilience to disasters is still in the low category. Of the children, 51% have knowledge of disaster resilience in the low category (Rana et al., 2023). Children affected by disasters not only experience physical injuries, they also experience trauma which causes stress, depression


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and mental disorders (Ginsburg et al., 2007; Mikulecký et al., 2023). To minimize the risk of child victims during a disaster, it is necessary to develop disaster preparedness for children.

Disaster risk reduction is an organized approach to examining and addressing factors associated with disaster risk and exposure. Disaster risk reduction is important to minimize the risk of disaster impacts. Children are a resource that must be cared for and mobilized to support disaster preparedness and resilience for the present and future (Simpson et al., 2023). Children can be involved in disaster risk reduction activities by learning about disaster preparedness (Pfefferbaum et al., 2018). Research results reveal that increasing children's knowledge and skills to deal with disasters has an effect on reducing risks due to disasters (Seddighi et al., 2022). Cognitively imparting knowledge through a multidimensional approach to disaster resilience for children is essential and effective (Onrizal et al., 2020). Evidence reveals that providing interventions can increase theoretical disaster knowledge which can also extend to practical skills (Niemistö et al., 2019).

It is felt that the potential for teaching children knowledge about disaster preparedness has not been carried out optimally. The previous learning process was carried out verbally, which made it less interesting and easy to forget. The ability to carry out structured learning interventions through physical activity by creating fun physical disaster games programs has not been implemented on a massive scale. Research reveals learning through activityPlay is able to promote cognitive, social, physical and emotional knowledge, as well as facilitating the environmental conditions necessary for children to develop. (Cerika Rismayanthi, 2013; Henrique et al., 2023) Programmed play activities can increase children's knowledge regarding the content included). The pattern of learning through games is very suitable for children because it is up lifting the principle of playing while learning, learning while playing (Khoirunisa & Surakarta, 2016). The use of games in the learning process can increase students' enthusiasm for carrying out the movements being studied (Pranoto et al., 2021).

Children's participation in safety planning plays an important role, but findings on the ground reveal inadequate arrangements for disaster response education among children (Rana et al., 2023). Possession of knowledge can increase children's resilience and self-confidence to face disaster risks (Chawla & Heft, 2002) So that children have the knowledge to face disaster risks, there needs to be a learning process. Learning experiences aimed at children through movement activities will be successful if they are appropriate to the child's level of ability, arranged in a planned manner, implemented systematically and delivered by competent staff (Maciej Serda et al., 2013) Based on the importance of children's knowledge to be aware of facing disaster risks, researchers consider it important to promote disaster mitigation learning through the development of fun physical games programs for natural disasters.

Promotion of the development of natural disaster mitigation learning programmes through fun physical disaster games are made based on the child's cognitive level and development of children's mobility. The program's principles are based on adaptation to the user's age level, creativity and imagination, flexibility, security, and evaluation. There are seven learning courses made consisting of earthquakes, mountain eruptions, tsunamis, floods, landslides, angina, and forest fires. Through the development of the program the child is expected to acquire knowledge of the types of natural disasters and the actions to be taken in the event of a natural disaster.

## Materials & methods

### *Study design*

This research uses an R&D design, a research design consisting of 10 stages: 1) Preliminary research and collection is carried outcollecting data related to the types of natural disasters that often occur in Indonesia. 2)research planning, carried outcurriculum analysis, physical activity analysis and disaster mitigation learning as well as creating concepts for developing learning programs. 3)early product development, creating mitigation learning products consisting of 7 forms of disasters through the concept of fun games. 4) expert validation, conducting expert consultations regarding program design. 5) product revision, making program improvements based on expert advice. 6) early test, testing the product on a test sample. 7) product revision, carrying out revisions based on expert advice based on initial test results. 8) field test, carrying out field tests based on the results of product revisions. 9) final product revision, carrying out product revisions based on suggestions from experts. 10) dissemination, delivering product innovation (Arnold et al., n.d.).

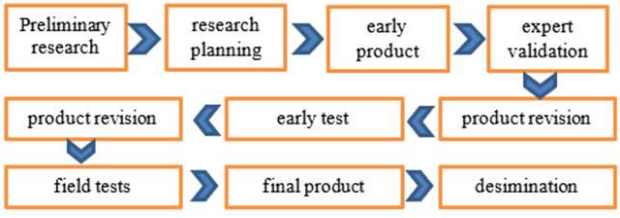


Diagram 1. R&D Research Design (Borg & Gall, 1989)

### *Participant*

A total of 140 kindergarten students in Indonesia participated in this research with age criteria of 4-6 years. Research subjects were taken from 7 regions that have the potential for different natural disasters. The 9

experts who are competent to be program validators consist of 3 motor learning experts, 3 early childhood education experts, and 3 learning practitioner experts.

***Procedure***

The research procedure consists of testing the validity and reliability of the program. Validity and reliability values were obtained through assessing 9 expert judgments by filling in an evaluation form consisting of 25 question items. The assessment item indicators consist of (1) safety of the learning program for children, (2) suitability of the program to the school curriculum, (3) suitability of the program to natural disaster mitigation material, (4) suitability of the program to the child's physical ability level, and (5) activeness. program to introduce disaster mitigation to children.

***Statistical analyses***

The content validity assessment was analyzed using the Aiken V formula, while the program reliability was analyzed using SPSS 20.

## Results

### Product description

The product of this research is learning media in the form of physical fun disaster games books. In the book there are 7 fun physical disaster games programs which consist of learning about disaster mitigation for earthquakes, volcanic eruptions, tsunamis, floods, landslides, tornadoes and forest fires. The disaster physical fun games program combines several forms of movement skills in the form of running, jumping, skipping, throwing, crawling with several actions that need to be taken when a natural disaster occurs, such as protecting the head, taking protective equipment, looking for a shelter. There are stages that teachers need to take in implementing disaster physical fun games, namely 1) understanding the concept of learning material, 2) preparing the necessary equipment, 3) explaining the forms of natural disasters to students and the actions taken when a disaster occurs, 4) practicing disaster physical fun games according to procedures, 5) carry out evaluations. The physical fun disaster games book also includes a learning evaluation sheet to see the extent of students' understanding of the actions taken when a natural disaster occurs.


**Figure 1**. Disaster mitigation book cover

### Validity and Reliability

Validity and Reliability of disaster physical fun games learning products were obtained from the assessment results of 9 experts who were analyzed using the Aiken V and Cronbach's Alpha formulas (Stoklosa et al., 2021). Indicators the assessment is carried out using scale 4. The assessment scale 4 consists of the categories: (1) not suitable, (2) quite suitable, (3) suitable, (4) very suitable.Intensive discussions were held with the validators where the product underwent 2 revisions, arriving at the conclusion that the results of the 7 physical fun disaster games programs developed could be implemented. Validity analysis uses the Aiken V techniquewithscore V = 0.81 in the category of high expert validity value. More clear details can be seen in table 1.

**Table 1.** Aike V analysis

| Expert (N) | Item | ∑Evaluation | x̄ Assessment | ∑s | x̄s | V | Category |
|---|---|---|---|---|---|---|---|
| 9 | 1-25 | 821 | 91.22 | 551 | 61.22 | 0.81 | Tall |

Internal validity was conducted with n 140 participants from kindergarten students. The average correlation value is (0.81). Clearer details regarding Aiken's V Criteria and Categorical Cores can be seen in table 2.

**Table 2.** Content Validity

| Criteria and Categorical Cores Aiken's V | Score | Aiken's Category V |
|---|---|---|
| Security | 0.82 | High |
| curriculum suitability | 0.82 | High |
| suitability of mitigation materials | 0.80 | High |
| suitability of physical abilities | 0.80 | High |
| active introduction of disaster mitigation | 0.82 | High |

There were two product revisions before and after the program test was carried out in the field. Product improvements are based on expert validation suggestions. These suggestions become the basis for improving the product so that it can be concluded that the product can be implemented. Expert suggestions for product revision are displayed in table 3:

**Table 3.** Expert Validation Comments

| Expert (N9) | Comment |
|---|---|
| Motor experts (n= 3) | - There needs to be a combination of jumping and running<br>- There needs to be a combination of crawling and running<br>- Adjust the form of movement to the child's developmental level |
| Early childhood education experts (n=3) | - Use song media that contains rescue guides when a disaster occurs<br>- Make the program more fun |
| School practitioner experts (n=3) | - Add program instructions<br>- Clarity of instructions<br>- There needs to be a program evaluation sheet |

The reliability of the program was analyzed using SPSS 20, the results of the calculations obtained a Cronbach's Alpha score of 1,000 which means the instrument is reliable. Of the 7 fun physical games disaster mitigation learning programs, all programs were declared reliable. More clear details can be seen in table 4.

**Table 4.** Reliability Score by Using Cronbach's Alpha

| Reliability Statistics | |
|---|---|
| Cronbach's Alpha | N of Items |
| 1,000 | 25 |

In this research, students' statements were also assessedtodisaster fun physical games program. Purposeful assessmentto determine the response of students to program development.There are seven questions conducted through interviews. The interview method was chosen because kindergarten students were not yet able to read. The seven statements include students' feelings and responsesdisaster fun physical games program. More detailed assessment details can be seen in table 5.

**Table 5.** Assessment of Student Responses to the Program Fun Physical Games Disaster

| No | Question | N | Number of Answers | | Percentage (%) | | SD |
|---|---|---|---|---|---|---|---|
| | | | Yes | No | Yes | No | |
| 1 | Item 1 | 140 | 137 | 3 | 97.86% | 2.14% | 0.14 |
| 2 | Item 2 | 140 | 130 | 10 | 92.86% | 7.14% | 0.25 |
| 3 | Item 3 | 140 | 125 | 15 | 89.29% | 10.71% | 0.31 |
| 4 | Item 4 | 140 | 136 | 4 | 97.14% | 2.86% | 0.16 |
| 5 | Item 5 | 140 | 135 | 5 | 96.43% | 3.57% | 0.18 |
| 6 | Item 6 | 140 | 130 | 10 | 92.86% | 7.14% | 0.25 |
| 7 | Item 7 | 140 | 132 | 8 | 94.29% | 5.71% | 0.23 |
| | $\bar{x}$ | 140 | 134.28 | 5.71 | 96% | 4% | 0.21 |

**Discussion**

The important role of physical fun games in learning disaster mitigation is the main highlight in this research. The development of a disaster mitigation learning program for kindergarten students through Physical Fun Games has a significant positive impact in the context of children's safety and preparedness for potential disasters. Learning activities through Physical Fun Games not only increase student involvement, but also provide direct experience that deepens their understanding of disaster mitigation concepts. Students' activeness in simple disaster simulations and interactive games not only strengthens their practical skills, but also creates a positive learning experience (Heliani et al., 2014; Tuswadi & Hayashi, 2014). Students' enthusiasm during

physical activities and games shows that this learning method can be adapted well in the kindergarten curriculum. The implication is the need to continue to maintain this interesting approach in order to maintain student interest and participation in disaster mitigation programs (Maciej Serda et al., 2013; Mazumder et al., 2023).

Disasters have physical and psychological effects. The survey found that children affected by disasters experienced trauma (Mikulecký et al., 2023; Yendrizal et al., 2023). Another study showed that children affected by disasters showed symptoms of PTSD, even two years after the disaster (Sakurai et al., 2020; Seddighi et al., 2022). There is some research that analyze the successes, innovations and challenges of school safety and disaster education (disaster risk as part of the curriculum) (Maciej Serda et al., 2013). This analysis shows how efforts are handled differently by each country, although most of them are in line with the Comprehensive School Safety Framework and the Sendai Framework. Disaster education emphasizes how children can overcome their disaster experiences, move on from the disaster, and graduate to lessons learned in preparation for the next disaster (Seddighi et al., 2020; Suarmika et al., 2022). Program experiences impact a student's willingness to contribute to society for the long term. Program disaster preparedness and mitigation behaviors help develop children as “change agents” to create disaster-resilient communities (Ihsan et al., 2023; Noviana et al., 2023). Education is part of the entire disaster cycle as an integrated and inclusive step to prevent and reduce risks related to disasters (Mikulecký et al., 2023; Raungratanaamporn et al., 2014). Disaster risk knowledge is not only limited to disaster prevention, mitigation, preparedness and response but must also include disaster recovery and rehabilitation (Seddighi et al., 2022; Vidranski, 2015).

The positive response from students to the physical fun games mitigation program provides an indication that disaster mitigation learning can be integrated effectively into the kindergarten curriculum. The joy and enthusiasm of students during physical activities and games shows that this approach is not only educational but also creates a positive and motivating learning atmosphere. However, there are several challenges faced in implementing this program (Chansarn, 2014; Kousky, 2016) challenges that arise such as limited resources and curriculum development. Further attention is needed to ensure the long-term sustainability and effectiveness of these disaster mitigation programs. In this context, it is necessary to carry out continuous evaluation and adjustment of the program so that it can meet student needs and dynamics effectively. As places of pastoral care, schools can also provide or access appropriate personnel to meet student needs (Mutch, 2019, 2023). Media Learning that is developed according to needs can make it easier for students to understand the learning context (Nelson et al., 2022). Care is needed in developing learning because children have different tendencies based on gender and region (Bakhtiar, 2014; Famelia et al., 2018). This research contributes to our understanding of the integration of disaster mitigation learning at the kindergarten level, while highlighting the potential and challenges in adopting approaches that involve physical activity and play. The implications of these learning outcomes create a basis for the development of more effective and sustainable disaster mitigation education strategies at the children's education level.

## Conclusions

The research results show that the disaster mitigation learning program through Physical Fun Games has proven to be effective as an interesting and interactive approach for kindergarten students. By combining learning with physical activities, children can be more actively involved and understand the concept of disaster mitigation in a fun way. Through well-designed Physical Fun Games, this program can increase student involvement and their learning motivation regarding disaster mitigation. Physical activity allows them to learn while playing, creating a positive learning environment and awakening their interest in disaster issues. Kindergarten students who take part in this program experience improved emergency skills, including knowledge of evacuation routes, how to use safety equipment, and actions to take in emergency situations. This shows that Physical Fun Games can be an effective means of providing practical skills related to disaster mitigation. The success of the physical fun games mitigation program highlights the importance of continuous evaluation and continued development. Including input from teachers, parents, and students in the evaluation process can help adapt programs to better suit children's needs and development. With this program, it is hoped that kindergarten students can become agents of change in building a culture of safety and disaster mitigation in their environment.

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