

Ular Tajir: A Flood-Themed Snakes and Ladders Game for Teaching Flood Mitigation to Elementary School Students

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Keywords:	Abstract
flooding; learning outcomes; disaster mitigation; snakes and ladders; ular tajir	<i>This study addresses the urgent need for innovative educational tools to enhance flood disaster mitigation literacy among elementary students. We developed Ular Tajir, a Snakes and Ladders-based game, to improve students' understanding of mitigation strategies and learning outcomes. Employing the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) and a quasi-experimental design, the research involved 124 purposively sampled fourth-grade students in Sintang, West Kalimantan. Data were collected through questionnaires, knowledge assessments, and documentation. Results demonstrated three key outcomes: (1) High feasibility scores from expert validations (97% from media experts, 95% from material experts), confirming the tool's readiness for educational use; (2) Statistically significant improvements in students' mitigation comprehension ($p = 0.000 < 0.05$) across both limited and large-scale trials; and (3) Progressive enhancement of learning outcomes, with peak performance observed during the second trial session. The findings underscore the efficacy of Ular Tajir as an engaging, play-based pedagogical tool for disaster education. This study advocates for integrating interactive, game-driven approaches into curricula to foster both conceptual mastery and practical preparedness in flood-prone communities.</i>

INTRODUCTION

Background of the Study

Indonesia's geographical position at the convergence of three tectonic plates—the Eurasian, Pacific, and Indo-Australian plates—renders it highly vulnerable to natural disasters (Utami & Mustari,

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2020). Data from the National Agency for Disaster Countermeasure (Badan Nasional Penanggulangan Bencana or BNPB) reveals 3,058 recorded disaster events in 2021 (Dihni, 2021), with floods constituting the most frequent occurrence (1,288 incidents, 42.1% of total cases). Further analysis of the Indonesia Disaster Information Database (DIBI, 2021) highlights Kalimantan as a region particularly prone to floods and forest/land fires during the same period. The heightened disaster risk is compounded by Indonesia's climatic conditions, where intense seasonal rainfall exacerbates flood frequency, underscoring the urgency for targeted mitigation strategies.

Sintang Regency in West Kalimantan Province faces recurrent and severe flooding, with Ramadhan (2021) reporting inundations across 12 sub-districts—including Kayan Hulu, Sintang, Sepauk, and Kelam Permai—during recent events. Floodwaters submerged homes, roads, and critical infrastructure, paralyzing mobility and severely disrupting daily life. The crisis extended to education, as schools in affected areas suspended operations, halting learning and compounding academic setbacks for students.

Disaster mitigation encompasses structural and non-structural strategies to reduce disaster risks. Structural measures involve physical interventions (e.g., flood barriers, drainage systems), while non-structural approaches focus on policy, education, and community preparedness. Integrating disaster mitigation into school curricula represents a vital non-structural strategy, equipping students with the knowledge, skills, and proactive mindset needed to prevent, respond to, and recover from disasters.

Field observations, however, revealed a critical gap: students in Sintang lack systematic education on flood preparedness. Schools often respond reactively, canceling classes during floods rather than fostering resilience. This ad hoc approach exacerbates learning losses and leaves students unprepared to act safely during emergencies. To address this, schools in flood-prone regions must prioritize anticipatory education, embedding flood mitigation principles into lessons. Such initiatives would empower students to implement pre-disaster planning, informed decision-making during crises, and effective post-flood recovery—transforming them from passive victims into proactive agents of community resilience.

Problem of The Study

Disaster literacy is a cornerstone of community resilience, particularly as local populations serve as primary stakeholders in mitigating and responding to crises. Effective risk reduction hinges on a community's ability to identify vulnerabilities and implement context-specific actions across all disaster phases—preparation, response, and recovery. This imperative is amplified for vulnerable demographics, such as children, who often lack the awareness and agency to navigate recurring disasters (Suarmika & Utama, 2017).

Hayudityas (2020) emphasizes that disaster mitigation education holds particular urgency for students in high-risk regions. Schools, as hubs of knowledge dissemination, offer a strategic avenue to institutionalize such education. By embedding disaster preparedness into curricula, students and their communities can cultivate adaptive capacities to anticipate, manage, and recover from crises (Astini & Pradnya, 2017). However, a needs analysis conducted during pre-observation at State Elementary School Sintang (January 31, 2022) revealed critical gaps: (1) no integration of flood mitigation content into lessons, and (2) a lack of educational tools (e.g., Snakes and Ladders games) to reinforce disaster literacy. Figure 1 illustrates the school's location within Sintang's flood-prone zone, contextualizing its vulnerability and aligning with the study's focus on high-risk educational environments.



Figure 1: Post flood school (a) at state elementary school Sungai Ringin (a), at state elementary school Sungai Kawat (b), at state elementary school Mengkurai (c), and at state elementary school Sintang.

Efforts that could be made by using learning media. Learning media has the use of clarifying the limitations of space, time, sensory power, such as objects that are too large that could be replaced with pictures or models. Concept that is too broad could be visualized in the form of an image (Wedyawati et al., 2020). The existence of educational games in learning makes students feel that the activity they are doing is playing games, but actually they are learning based on what the teacher had planned before (Maryana et al., 2018). The learning media of the flood snake and ladder game with the concept of learning while playing makes students more active, creative and happy in learning. In this flood snake and ladder game there are challenge questions and information related to flood disaster mitigation actions, indirect experience in games that can be used to train the development of mitigation understanding and improve student response in disaster risk reduction efforts.

Research's State of the Art

It is essential to master the concept of integrating disaster education into the learning process, as this is a specific skill that must be acquired by both teachers and students in disaster-prone areas. Wedyawati & Lisa (2018) stated that flood disaster mitigation is a series of specific preparedness actions undertaken before a flood occurs to reduce the risks associated with the disaster. Actions categorized as specific preparedness for flood disaster mitigation include: 1) flood detection and warning systems, 2) conducting flood awareness programs, 3) creating flood hazard maps, and 4) developing master plans for floodplain land management. Meanwhile, risk reduction actions in flood disaster mitigation include building canals, levees, reservoirs, flood barriers, and controlling erosion.

Disaster mitigation education is crucial for students given Indonesia's vulnerability to disasters. It needs to be implemented in schools, particularly in the learning process, to empower students to develop preparedness and resilience against disasters. Including disaster-related material as a mandatory subject at every grade level, especially in elementary schools located in high-risk areas, is expected to create a generation that is resilient and responsive to disasters. Moreover, students can develop motivation, skills, and knowledge to take action in reducing disaster risks through educational activities. Disaster education that can be implemented in elementary schools includes disaster mitigation using educational media.

Ular Tajir (Snakes and Ladders for Flood Mitigation) is a game that combines education and disaster mitigation education. This game uses a snakes and ladders board, pawns, dice, and involves more than one player. It has been adapted into an educational game by modifying its design and rules to incorporate themes related to flood mitigation. Ular Tajir is expected to foster disaster preparedness in children from an early age. The game also attracts greater attention and full concentration from children, engages them interactively, and offers an adventure filled with challenges and problem-solving opportunities. This provides positive stimulation, allowing children to actively participate and

develop an interest in the learning process. The Ular Tajir game employs a learning through play approach. By playing Ular Tajir, elementary school students can indirectly enhance their understanding of disaster mitigation, particularly flood disaster mitigation.

According to Setyowati (2019), disaster mitigation understanding in schools refers to the thought process and practical efforts to reduce or eliminate all forms of disaster risks. This prioritizes the learning process or other educational activities, enabling students to actively develop a culture of preparedness in facing potential disaster threats. Disaster awareness understanding is developed based on the following indicators (see Table 1):

Table 1. Flood disaster mitigation understanding indicators (Wedyawati et al.,2020)

Aspects	Indicators	Descriptor
Before the flood disaster occurred	Definition of flood	Getting to know the meaning
	Types of floods	Getting to know the types of floods
	Map of flooded areas	Know safe places when floods occur
	Causes of flooding	Recognizing the cause
	Flood disaster prevention	1. Recognize useful objects when floods occur. 2. Know the evacuation route in the event of a flood disaster. 3. Able to practice (simulate) self-rescue skills when a flood disaster occurs. 4. Doing community service work cleaning waterways.
In the event of a flood	The process of flooding	1. Find the nearest and safe self-rescue location. 2. Avoid dangerous places when floods occur
	Rescue mechanisms by individuals, communities and governments	1. Recognize the way/mechanism to save yourself during floods. 2. Recognize how to help the family/victim to a safe place.
	Actions when a flood occurs	1. Using or utilizing useful objects in the event of a flood for self-rescue. 2. Able to secure valuables and important documents to a safe place
Actions After the flood	The impact of floods	Able to maintain health.

Since disaster education will be integrated into science learning for students, another component that will improve is students' learning outcomes. Learning outcomes refer to the abilities students possess after participating in the learning process, encompassing cognitive, affective, and psychomotor domains. The instrument used to measure students' learning outcomes is a multiple-choice test instrument.

Further, Wedyawati et al., (2017), found that using an integrated science learning model for disaster mitigation improved student learning outcomes. Wedyawati et al., (2020) developed a fire mitigation game for fourth-grade elementary school students, and Salombe (2021), assessed the learning outcomes of using a Snakes and Ladders game in elementary school social studies subjects.

Based on the results of other research and the author's sustainability research on disaster mitigation education that has produced various game-based learning media that are integrated with the understanding of disaster mitigation, this study continues to make different game media on the

types of natural disasters. There has been previous research on the creation of game media with the type of fire natural disaster and this research focuses on the type of flood natural disaster that will be carried out in elementary schools that are categorized as prone to flood disasters in the city of Sintang.

Gap Study & Objective

Utami & Mustari (2020) stated that the delivery of disaster related material, particularly disaster mitigation, was effective when utilizing the disaster mitigation snakes and ladders game (Perut Sincan). Researchers were able to use games commonly played by children and turned them into media for delivering disaster information. Wedyawati et al., (2020) developed a game-based media for delivering disaster information to elementary school students called the Fire Disaster Mitigation Game (Gamikar). The game was effective in improving students' understanding of disaster mitigation as well as enhancing their learning outcomes. Students' acceptance response was positive, and the product was very well received by users. This was also in line with the research by Wedyawati et al., (2020) who implemented the Gamikar with elementary school students and found an increase in disaster mitigation understanding, and students enjoyed the learning and playing activities. Disaster information was indeed integrated into subjects, especially science, as there was a significant difference in learning outcomes between the experimental class using integrated science books and the control class using regular science books.

Mitigation education was essential for elementary school students, as there was limited research on the development of Snakes and Ladders media for flood disaster mitigation education. Based on this background, the aim of the research was to describe the development of the Flood Snakes and Ladders game (Ular Tajir) and its impact on students' understanding of flood disaster mitigation as well as their learning outcomes. This media served as a solution for teachers to effectively teach flood disaster mitigation material in a way that was both engaging and easy to understand.

According to Hayudityas (2020), disaster mitigation education is highly necessary for students living in disaster-prone countries. Schools play a crucial role and serve as an effective medium for disseminating disaster knowledge before, during, and after a disaster (Astini & Pradnya, 2017). In line with the mandate of the preamble to the 1945 Constitution of the Republic of Indonesia in its fourth paragraph, the state is responsible for protecting all Indonesian people and the entire homeland of Indonesia. Efforts to deliver disaster-related information can be made by integrating disaster materials into various school subjects to reduce risks when prevention and mitigation efforts are not yet functioning effectively. With disaster mitigation education integrated into school subjects, students are expected to acquire knowledge, understanding, preparedness, and skills to prevent, detect, and anticipate potential disasters.

The presence of educational games in learning allows students to feel that the activities they are engaged in are merely playing games, while in fact, they are learning as planned by the teacher (Maryana et al., 2018). The flood snakes and ladders game as a learning medium, with the concept of learning through play, makes students more active, creative, and happy while learning (Tsai et al., 2015). In this flood snakes and ladders game, there are challenges in the form of questions and information related to flood disaster mitigation actions. Indirectly, the experiences gained from the game can be used to train the development of disaster mitigation understanding and improve students' responses in efforts to reduce disaster risks.

Based on previous research, the researcher will conduct a study on the development of the Flood Snakes and Ladders Game (Ular Tajir) to enhance elementary school students' understanding of flood disaster mitigation and their learning outcomes. It is hoped that after using Ular Tajir, students will demonstrate improved understanding of flood disaster mitigation and better learning outcomes.

METHOD

Type and Design

The design of this research is Research and Development (R&D) referring to the ADDIE design, namely analysis, design, development, implementation and evaluation. Ni'mah & Rusnilawati (2023) claim in an educational setting, the goal of research and development is to produce products that can be applied in learning. The development procedure can be seen in Figure 2 (Richey, & Klein, 2007). The trial design used a quasi-experimental design with a nonequivalent control group design.

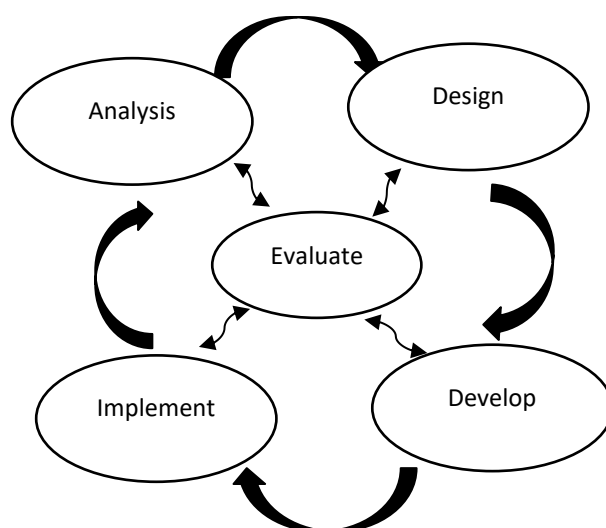


Figure 2. Stages of the ADDIE model

Analysis

The activities carried out included an analysis of the field conditions in which the product was tested, as well as an analysis of previous research on the snakes and ladders game.

Design

The activities consisted of planning and compiling the snakes and ladders media products for grade IV elementary school students, starting from collecting materials to be developed, choosing the right design, and preparing questions and regulations that would be developed in the snakes and ladders game for flood disaster mitigation.

Development

In this stage, the activities were the initial product development and validation by media experts and material experts who were original in their fields.

Implementation

At the implementation stage, the product, which had been deemed feasible by experts, was tested. The trial was conducted in two phases: a limited-scale trial and a wide-scale trial. The limited-scale trial was carried out with fourth-grade students at state elementary School Sungai Ringin. The results of this trial were used to assess the validity and reliability of the instruments. The wide-scale trial was conducted with fourth-grade students from four schools: state elementary School Sungai Kawat, state elementary School Sintang, state elementary School Mengkurai, and state elementary School Sintang.

Evaluate

The evaluation stage involves quantitative data analysis to determine the product's effectiveness and conduct hypothesis testing. This stage also includes an analysis of product acceptance by users, namely teachers and students. The results from both the quantitative and qualitative analyses serve as a basis for revising the product. This ensures that the final product is more feasible, effective, and ready for the dissemination stage. The evaluation stage of user responses was carried out with questionnaires from teachers and students (the product users) regarding the Ular Tajir game.

Data and Data Sources

The data in this study were qualitative data, namely the results of suggestions and input from media and material expert validators, and quantitative data, namely the assessments of media experts and material expert validators, results of disaster mitigation understanding tests, learning outcomes tests for Theme 8 Sub-theme 1, and student and teacher response questionnaire results. In this research, the subjects were 124 grade IV students of the Sintang city state elementary school for the 2021/2022 academic year. The sources of data in this research were: 1) validation of questionnaires filled out by media experts and material experts; 2) the results of the understanding of flood disaster mitigation tests; 3) learning outcomes test for Theme 8 Sub-theme 1; 4) small group practical tests at state elementary school Sungai Ringin and large-scale practical tests at state elementary school Sungai Kawat, state elementary school Sintang, state elementary school Mengkurai, and state elementary school Sintang; 5) user response questionnaire to Ular Tajir.

Data Collection Technique

Questionnaire

The validation sheet is used as an instrument to collect expert validation data which is used as comments and suggestions from experts for product improvement. Student response questionnaires were used to collect data regarding student responses to the snake and ladder game in the learning process. Students can provide suggestions based on learning experiences using learning media.

Flood Disaster Mitigation Understanding Test and Learning Outcome Test

The understanding test for flood disaster mitigation and learning outcomes in this research was designed to determine students' understanding and learning outcomes after using the developed Snakes and Ladders game media.

1. Analysis of the Instrument Trial: The instrument was tested to assess its validity, reliability, discriminatory power, and level of difficulty.
2. Prerequisite Test: Normality test is used to determine whether the data follows a normal distribution. To test normality, the Liliefors test was used with the help of SPSS 18. The significance test criteria are as follows: if sig. > 0.05, the data is normally distributed. If sig. < 0.05, the data is not normally distributed. The Homogeneity test assesses the equality of variances. The significance test criteria are: If sig. > 0.05, the data is not homogeneous. If sig. < 0.05, the data then it is not homogeneous.
3. Hypothesis testing. If the data is normally distributed, a One-Way Anova statistical test is conducted. If the data is not normally distributed, non-parametric statistical tests are used for hypothesis tests. The significance test criteria are if sig. < 0.05, the null hypothesis (H_0) is rejected and the alternative hypothesis (H_a) is accepted. If sig > 0.05, the null hypothesis (H_0) is accepted and the alternative hypothesis (H_a) is rejected.

Documentation

Documentation is used as data that supports research data in the form of written data or archives as well as pictures or photos that exist in the field during the process.

Data Analysis

The product validity assessment involves media experts and material experts who are qualified in their respective fields. Additionally, the product's practicality is assessed in two stages: a limited-scale test and a wide-scale test. Data analysis of expert assessment questionnaires and product user responses is conducted using the percentage formula. After calculating the percentage value of the expert assessments, the results are categorized according to Table 2. Similarly, the percentage value of user responses is analyzed and categorized according to Table 3.

$$\% = \frac{F}{N} \times 100$$

Explanation:

% = percentage result

F = total score

N = the total number of total scores

Table 2. Expert research analysis percentage criteria

Expert Assessment Criteria Interval	Criteria
81%≤NP≤100%	Very Worthy
61%≤NP≤80%	Worthy
41%≤NP≤60%	Decent Enough
21%≤NP≤40%	Not Feasible
NP≤21%	Very unworthy

Source: Arikunto (2014)

Table 3. User response analysis percentage criteria

User Response Criteria Interval	Kriteria
91-100%	Very Good
61-90%	Good
41-60%	Enough
11-40%	Less
0-10%	Very Less

Source: Arikunto (2014)

RESULTS

Results will be presented according to the stages of the ADDIE development model as follows:

Analyzing

The needs analysis included a thorough evaluation of field conditions. Researchers conducted direct interviews with the state elementary school's principal on January 31, 2022. Their observations indicated that the school, located in Kapuas Kanan Hulu, is in a flood-prone area because of its proximity to a watershed. Moreover, the students have not received any education on flood disaster

mitigation, and the lack of integrated learning media has limited the teachers' ability to effectively deliver lessons on this critical subject.

The instructional material was derived from the Teaching Module for the Integration of Flood Risk Reduction, developed by the Curriculum Centre of the Research and Development Agency within the Ministry of National Education. This module covers key aspects of flood preparedness, response, and recovery, specifically designed for fourth-grade primary school students. The flood-related content was analyzed and seamlessly integrated into the syllabus and lesson plans, ensuring alignment with the selected curriculum's Basic Competencies. The chosen Basic Competency, drawn from Bahasa Indonesia, was combined with flood disaster themes under the unit "Theme 8: My Living Area," tailored for fourth-grade primary school students.

Design

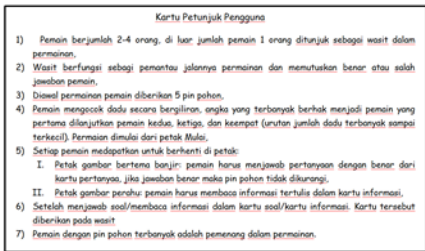
In the design phase, the researcher developed the product intended for implementation. This process involved several stages: establishing learning objectives, developing assessment instruments, and designing the Ular Tajir game as an educational medium. The product content comprises pre-disaster preparedness material—covering the definition of floods, types of floods, maps of flood-prone areas, causes of floods, and strategies for disaster prevention—which enables students to identify and understand everyday hazardous situations. It also addresses appropriate actions during disasters, detailing the flooding process, rescue mechanisms employed by individuals, communities, and government agencies, as well as suitable responses during flood events. This section is designed to familiarise students with the necessary equipment, resources, and responsible behaviours required to ensure their own safety, that of their families, and the protection of valuable possessions—for example, the simple yet critical act of switching off the electricity supply. Finally, the post-disaster content focuses on the impacts of flooding, with the objective of helping students recognise actions to avoid after a flood, such as washing utensils with floodwater or consuming water and food contaminated by flood exposure. The researcher subsequently drafted the educational content for inclusion in the syllabus and lesson plans, alongside the development of research instruments.

In general, the game of Snakes and Ladders is a medium that uses three main components: a token, a dice, and a Snakes and Ladders board. The gameplay in Snakes and Ladders generally starts with determining the order of players, from the first player to the last player, and this order will continue throughout the game. The rules of the game are as follows: 1) if the player lands on a ladder in the game, they are allowed to move up to the designated position. 2) if the player lands on a snake in the game, they will move down to the designated position according to the tail of the snake. 3) the winner of the game is the player who reaches the finish position the fastest. In this Flood Snakes and Ladders game, there are rules that must be followed by each player.

The rules of the Ular Tajir game are as follows: 1) The number of players is between 2 and 4, with one additional person appointed as the referee. 2) The referee functions as the monitor of the game and decides whether the players' answers are correct or incorrect. 3) At the beginning of the game, each player is given 5 tree pins. 4) Players take turns rolling the dice, with the highest roll determining the first player, followed by the second, third, and fourth players (in order of the highest to the lowest dice roll). The game begins at the Start square. 5) Each player must stop on a square according to the following: Flood-themed square: The player must answer a question correctly from the question card. If the answer is correct, the tree pin is not deducted. Boat square: The player must read the information on the information card. Snake square: The player on the snake's head must move backward following the snake's tail. Ladder square: The player must move upward following the direction of the ladder. 6) The player with the most tree pins at the end of the game is the winner. The

detailed design of *Ular Tajir*, including the names of the items, materials, item sizes, and item shapes, was presented in Table 4.

Table 4. Ular Tajir specifications

Name	Specifications	Pictures
Board game	material: A3 colored	
Elementary students token	material: Mica size: 2x4 cm, colored	
Tree token	material: Buffalo size: 6x6 cm, colored	
Dice	size: 2x2 cm colored	
Game Box	Material: carton size 22 x 12 x 7 cm and colored	
User instruction cards	material: Buffalo size: 11x19 cm colored	
Question Card, Answer card	Material: Buffalo Size: 5x9 cm, Colored	
Flood Disaster Mitigation Information Card	material: Buffalo size: 5 x 9 cm colored	

Development

The development stage is Ular Tajir creation. The media is made according to the previously planned design. After all the necessary materials are collected, then the media is made according to the design of the media to be made. The researcher first simulated the use of the product and validated it by media and material experts.

Analysis of learning media validation data

The validation carried out by media experts on the Ular Tajir game media consists of several aspects, namely aspects of media efficiency, media accuracy, aesthetics, media resilience, and safety aspects for students. The results of media expert validation can be seen in Table 5.

Table 5. Media expert assessment results

Assessed aspects	Validators			
	I		II	
	Score	%	Score	%
Media Efficiency	20	100%	20	100%
Media Accuracy	20	100%	20	100%
Aesthetics	25	100%	25	100%
Media Resilience	3	60%	5	100%
Safety for Learners	3	60%	5	100%
Score	71	1420	75	1500
Percentage	95%		100%	
Number of Scores	146			
Average percentage	97%			
Criteria	Very Worthy			

Source: (Processed Data by Researchers)

Analysis of learning material validation data

Aspects of the material validation assessment consist of aspects of content feasibility, aspects of presentation feasibility, and contextual aspects carried out by validator I and validator II. The results of material expert validation can be seen in Table 6.

Table 6. Material expert assessment results

Table 5: Material expert assessment results					
Assessed aspects		Validators			
		I		II	
		Score	%	Score	%
Aspects of Content Eligibility		37	92%	38	95%
Aspects of Presentation Feasibility		23	92%	25	100%
Contextual Assessment Aspects		5	100%	5	100%
Score		65	1300	68	1360
Percentage		93%		97%	
Number of Scores		133			
Average percentage		95%			
Criteria		Very Worthy			

Source: (Processed Data by Researchers)

The suggestions from media experts regarding the product were that the materials used should be durable, not easily damaged, and safe for elementary school students. Meanwhile, the input from material experts regarding the media was that the content should be more contextual, and

attention should be given to disaster indicators to ensure it is holistically integrated into the material. In the presentation of the game and material, it was hoped that the school learning time would be taken into account. The revision of the Ular Tajir game was a step taken based on expert validity analysis. Several changes were made to some items of the Ular Tajir game to improve the understanding of flood disaster mitigation and learning outcomes for students in Theme 8 for grade IV Elementary School. These revisions included: replacing the pawns, which were originally made of carton with mica, replacing the dice, which were originally made of cardboard, with commercially available plastic dice; and redesigning the game box to be smaller than before to make it easier to carry. The number of tree pins was increased to meet the needs.

Implementation

The implementation stage was carried out after the media was completed, and then it was implemented with grade IV students. The trial design used a quasi-experiment of the Pretest-Posttest Group Design with a nonequivalent control group design. The experimental and control groups were selected randomly and were then given both pretests and posttest. Rusnilawati et al., (2023) claim if the two groups are stated to have significant differences, then the two groups are not recommended as research subjects, and class re-election will be carried out for the treatment (X) and control (C) groups. Here are the results of the data analysis, namely:

Understanding Flood Disaster Mitigation

Limited scale trial result

Results of the normality test on students' understanding of flood disaster mitigation in the experimental and control groups.

Table 7: Results of the Normality Test in a Limited Scale Study

School	Group	Tests	Sig	Result
State Elementary School	Eksperiment	<i>Pretes</i>	0,200>0,05	normally
		<i>Posttest</i>	0,200>0,05	normally
Sungai Ringin	control	<i>Pretes</i>	0,200>0,05	normally
		<i>Posttest</i>	0,200>0,05	normally

Source: (Processed Data by Researchers)

Based on Table 7 of the normality test, it was found that the pretest and posttest results of the experimental and control groups were normally distributed. The homogeneity test results showed that the posttest value was $0.751 > 0.05$, meaning H_0 was accepted at state elementary school Sungai Ringin, indicating that the data is homogeneous.

Hypothesis testing on the understanding of flood disaster mitigation between experimental and control group students in the pretest and posttest is shown in the following Table 8.

Table 8. Hypothesis test results understanding limited-scale

School	Sig	Level of Significant	Information
State Elementary School Sungai Ringin	0,000	0,05	0,000<0,05

Source: (Processed Data by Researchers)

The results of the SPSS 18 program-assisted hypothesis test in the pretest and posttest in the experimental class and control class at the State Elementary School Sungai Ringin of $0.000 < 0.05$,

meaning that there is a significant effect of using Ular Tajir media on students' understanding of flood disaster mitigation in the initial measurement (pretest) and the final measurement (posttest) between the experimental class and the control class.

Results of wide-scale trials

Based on Table 9 of the normality test calculations for the large-scale trial data are as follows:

Table 9. The results of the large-scale normality test

Schools	Groups	Tests	Sig	Information
State Elementary School Sungai Kawat	Eksperiment	<i>Pretest</i>	0,200>0,05	normally
		<i>Posttest</i>	0,200>0,05	normally
	Control	<i>Pretest</i>	0,200>0,05	normally
		<i>Posttest</i>	0,200>0,05	normally
State Elementary School Sintang	Eksperiment	<i>Pretest</i>	0,094>0,05	normally
		<i>Posttest</i>	0,200>0,05	normally
	Control	<i>Pretest</i>	0,094>0,05	normally
		<i>Posttest</i>	0,124>0,05	normally
State Elementary School Mengkurai	Eksperiment	<i>Pretest</i>	0,200>0,05	normally
		<i>Posttest</i>	0,200>0,05	normally
	Control	<i>Pretest</i>	0,200>0,05	normally
		<i>Posttest</i>	0,200>0,05	normally
State Elementary School Sintang	Eksperiment	<i>Pretest</i>	0,200>0,05	normally
		<i>Posttest</i>	0,200>0,05	normally
	Control	<i>Pretest</i>	0,200>0,05	normally
		<i>Posttest</i>	0,200>0,05	normally

Source: (Processed Data by Researchers)

The results of the normality test calculations using SPSS version 18 showed that the data for each test in each school, both in the experimental group and the control group, were all normally distributed. The results of the homogeneity test for the experimental and control classes are as follows:

Table 10. The results of the large-scale homogeneity tests

Schools	<i>Posttest</i>	Sig	information
State Elementary School Sungai Kawat	Eksperiment	8>0,05	Homogeneous
	control		
State Elementary School Sintang	Eksperiment	6>0,05	Homogeneous
	control		
State Elementary School Mengkurai	Eksperiment	0>0,05	Homogeneous
	control		
State Elementary School Sintang	Eksperiment	1>0,05	Homogeneous
	control		

Source: (Processed Data by Researchers)

Based on Table 10 of the homogeneity test for the experiment and control groups, it was concluded that all the data obtained were homogeneous. Hypothesis testing on understanding of flood

disaster mitigation between experimental and control group students at pretest and posttest can be seen in the following Table 11.

Table 11. Results of hypothesis test

Schools	Sig	Level of Significant	information
State Elementary School Sungai Kawat	0,002	0,05	0,002<0,05
State Elementary School Sintang	0,000	0,05	0,000<0,05
State Elementary School Mengkurai	0,000	0,05	0,000<0,05
State Elementary School Sintang	0,000	0,05	0,000<0,05

Source: (Processed Data by Researchers)

Based on the results of the hypothesis test, a significance value of <0.005 , it was concluded that there was a significant effect of using the Ular Tajir media on students' understanding of flood disaster mitigation at the initial measurement (pretest) and final measurement (posttest) between the experiment class and the control class in a large-scale trial.

Learning Outcomes Theme 8

Limited scale trial results

The results of hypothesis testing for the pretest and posttest showed that at State Elementary School Sungai Ringin, with a value of $0,000 < 0,05$, H_0 was rejected, and H_a was accepted. This indicates a significant effect of using the Ular Tajir media on students' learning outcomes. The assessment in the experimental group at State Elementary School 16 Sungai Ringin during the first and second meetings had an average score of 84,38. The psychomotor scores in the experiment group during the first and second meetings had an average score of 79,81.

Wide-scale trial results

Table 12. Hypothesis test results learning outcomes

School	Sig	Level of Significant	Information
State Elementary School sungai Kawat	0,000	0,05	0,000<0,05
State Elementary School Sintang	0,003	0,05	0,003<0,05
State Elementary School Mengkurai	0,012	0,05	0,012<0,05
State Elementary School Sintang	0,000	0,05	0,000<0,05

Source: (Processed Data by Researchers)

Based on Table 12 of the hypothesis test, it can be concluded that there is a significant effect of using Ular Tajir media on students' learning outcomes, as observed in the pretest and posttest between the experimental and control classes in the large-scale trial. The assessment at state elementary school Sungai Kawat in the experimental group during the first and second meetings had an average score of

85.42. At state elementary school Sintang, the experimental group during the first and second meetings had an average score of 84.90. At state elementary school Mengkurai, the experimental group during the first and second meetings had an average score of 82.64. At state elementary school Sintang, the experimental group during the first and second meetings had an average score of 81.25.

The Responses of Students and Teachers to the Ular Tajir Game

The students' responses to the use of the Ular Tajir game media to improve their understanding of flood disaster mitigation and learning outcomes for grade IV elementary school students were obtained using a questionnaire with "yes" and "no" answer options, which was given after the learning activities with the media were conducted. The results of the response questionnaire are presented in the following Table 13:

Table 13. The summary of the results from the user response questionnaire

Implementation	Students			Teachers		
	Amount obtained	Average	Category	Amount obtained	Average	Category
Small-scale	196	70	Good	67	88	Good
Big-scale	850	91	Very good	350	92	Very Good

Source: (Processed Data by Researchers)

The results of the average score analysis showed that there was an improvement in the students' cognitive learning outcomes in both the experimental and control classes. The average learning outcome score in the experimental class was higher than in the control class. Based on these results, even though flood disaster mitigation material was added, the students' learning outcomes improved, in line with similar research conducted by Wedyawati et al., (2017), which found that the integrated science learning model not only improved students' understanding of disaster management but also increased their learning outcomes. The improvement in the experimental class's learning outcomes was higher than that of the control class, which did not use the Ular Tajir.

Evaluate

The evaluation stage is conducted to review each phase that has been completed, including student and teacher responses to the *Ular Tajir* game media. The results of the limited-scale trial involving 14 fourth-grade students showed an overall average of 70%. These results indicate that the developed media is categorized as good and is suitable for use in large-scale trials. The questionnaire analysis of student responses in the large-scale trial at state elementary school Sungai Kawat, at state elementary school Sintang, at state elementary school Mengkurai, and at state elementary school Sintang showed an overall average of 86%, categorized as good. Teacher responses, based on the limited-scale trial teacher response questionnaire, resulted in a percentage of 88%, which falls under the good criteria. Teacher responses in the large-scale trial showed an average percentage across all schools of 92%, categorized as very good. Based on the results of the student and teacher response questionnaires, it was concluded that the *Ular Tajir* game is feasible for use.

DISCUSSIONS

Floods are among the most formidable natural disasters, largely because of their profound adverse effects, such as the deterioration of raw water quality in affected areas. Research by Sholihah et al. (2020) highlights that flood-induced water contamination poses significant risks to human health. Effective mitigation can be achieved through disaster education and structured learning initiatives.

Hoffmann and Blecha (2020) contend that disaster education equips individuals with the knowledge, skills, and awareness necessary to prepare for and manage disasters proficiently. Moreover, such education indirectly enhances access to material, informational, and social resources that reduce vulnerability, while the dissemination of disaster-related knowledge strengthens community resilience.

It is essential for students to understand natural phenomena, particularly floods, in order to establish a robust foundation in disaster mitigation. Teachers play a pivotal role in integrating disaster risk reduction into educational media (Wedyawati & Lisa, 2017). One effective strategy to improve understanding of disaster mitigation is to align educational materials with curriculum standards. Wedyawati and Lisa (2018) propose that implementing an integrated science model for disaster mitigation involves several key steps: first, identifying disaster themes relevant to the local context; second, mapping curriculum standards and core competencies that incorporate disaster-related content; and third, developing a syllabus, along with corresponding lesson plans and student worksheets.

Prasetyo (2022) proposes an innovative model to enhance students' disaster mitigation literacy by embedding it within school subjects and drawing on local community wisdom. Unlike conventional disaster education frameworks, this approach employs creative media tools—such as comics, video games (Gampell et al., 2020), and board games—specifically crafted to teach disaster prevention strategies. Suharini et al. (2019) assert that disaster mitigation literacy can be woven into diverse subjects, including geography, economics, language, history, mathematics, and natural sciences, making it adaptable across all educational levels, from primary school to university. However, Gede et al. (2024) point out a critical gap: the absence of standardised methods for delivering disaster education. They note that current practices—encompassing training programmes, awareness campaigns, seminars, simulations, and exhibitions—frequently lack a cohesive and systematic framework.

In this study, the Ular Tajir game was developed to deepen students' understanding of flood disaster mitigation. The development process involved several key steps: reviewing indicators of disaster-related content, analysing suitable material for integration, designing visuals, adapting game rules, creating the game board, and preparing accompanying equipment. The game's visual elements, such as colours and imagery, were tailored to align with students' characteristics, following the guidelines outlined by Wedyawati and Lisa (2018). Visual components in educational media, including graphics, serve to engage attention, clarify complex ideas, and enhance retention. By incorporating flood-related imagery, the Ular Tajir game supports students in retaining disaster mitigation concepts over the long term.

The design of the Ular Tajir game prioritises practical feasibility, technical viability, and cost-effectiveness, aligning with Mahnun's (2012) feasibility criteria. Analysis of the product's feasibility demonstrates that Ular Tajir (Flood Snakes and Ladders) significantly enhances elementary school students' understanding of flood disaster mitigation. Quantitative evaluation of learning outcomes supports its effectiveness, revealing that experimental groups consistently outperformed control groups in both small- and large-scale trials. These results are consistent with Tatisina and Rukmini's (2019) findings, which highlight the ability of educational games to enhance students' knowledge and preparedness. Likewise, Astini and Pradnya (2017) showed that game-based interventions, such as the Si Kancil initiative, markedly improve disaster readiness.

The use of engaging media like Ular Tajir boosts student motivation and improves learning outcomes. This observation aligns with Wedyawati et al.'s (2017) research, which indicates that integrated science models not only deepen comprehension of disaster management but also enhance academic performance. Utami and Abdullah (2020) further affirm the suitability of snakes-and-ladders-based games for primary education, emphasising their effectiveness in promoting knowledge retention and preparedness.

Beyond the classroom, disaster education plays a vital role in reducing societal vulnerability. Heckman et al. (2018) argue that it enhances households' access to economic and informational resources, guides informed settlement decisions, and strengthens social capital. Similarly, Supriyadi et al. (2012) demonstrate that SETS-based disaster education—integrating science, environment, technology, and society—effectively fosters mitigation skills and resilience. However, Atmojo et al. (2023) note that research on SETS frameworks remains limited, underscoring the need for further empirical investigation.

Fostering disaster-responsive attitudes is crucial for students to effectively manage natural disasters (Wedyawati et al., 2021). Disaster mitigation serves as a comprehensive system that enables quick, accurate, and effective disaster management. Introducing disaster mitigation education at the elementary level, as suggested by Rofiah et al., (2021), helps instill deep knowledge and preparedness, minimizing potential disaster impacts. This aligns with proposals to integrate disaster mitigation literacy into school subjects and local community wisdom. Media tools such as comics, video games, and board games enhance the educational experience and ensure broader engagement (Prasetyo et al., 2022; Juhadi et al., 2021).

Despite the benefits, challenges remain in standardizing disaster education delivery methods. As noted by Gede et al., (2024), current approaches, including training programs, awareness campaigns, and simulations, often lack an integrated framework. Paton & Johnston (2021) and Shiwaku & Shaw (2008) stress that intensive disaster education and widespread dissemination of knowledge are critical for enhancing community capacity in disaster management. Effective disaster education improves cognitive abilities, problem-solving skills, and disaster management actions. However, Johnson et al., (2014) highlights that many studies face methodological limitations, and empirical evidence on the most effective disaster education programs remains scarce. Nevertheless, initiatives focused on improving disaster preparedness have demonstrated significant improvements in community resilience (Chou, Yang, & Ren, 2015).

Integrating disaster education into the curriculum ensures systematic learning. Wedyawati & Lisa (2018) emphasize selecting relevant disaster themes, mapping curriculum standards, and designing comprehensive syllabi. The SETS learning model proposed by Supriyadi et al (2012) effectively integrates science, environment, technology, and society to contextualize disaster education. This approach not only enhances students' understanding but also prepares them to face real-world challenges. Research by Wedyawati & Setyawan (2019) underscores the importance of SETS-based education in improving mitigation skills and resilience. Educational games have emerged as powerful tools for disaster education. The Ular Tajir game exemplifies how engaging media can improve understanding and retention of disaster concepts. Similar studies, such as those by Utami & Abdullah (2020), highlight the effectiveness of game-based learning in enhancing preparedness. Tatisina & Rukmini (2019) further demonstrate that educational games significantly impact students' knowledge and preparedness, providing a scalable solution for disaster education. Disaster education extends beyond individual learning outcomes. Heckman et al., (2018) emphasizes its role in reducing household vulnerability by providing access to resources and strengthening social capital. Integrating community wisdom, as suggested by Prasetyo (2022), ensures that disaster education remains relevant

and culturally appropriate. Combining traditional knowledge with modern educational tools fosters a holistic approach to disaster management.

Flood disaster education plays an essential role in cultivating resilience and preparedness among students and communities. Innovative tools, such as the Ular Tajir.

CONCLUSION

The developed learning media is suitable for use in the learning process to deliver integrated flood disaster mitigation materials (Theme 8) for fourth-grade elementary school students. The media created in this study is based on the results of a needs analysis, which revealed that integrated flood disaster mitigation learning media were not yet available in the schools where the research was conducted. Therefore, this media serves as a solution for teachers to teach flood disaster mitigation materials more effectively and in a way that is easier for students to understand. The limitations of the Ular Tajir learning media are quite significant, as this media is currently only available in print form, which restricts its accessibility and versatility. Furthermore, it can only be developed around specific themes, particularly those related to disaster mitigation, which narrows its potential scope and application. The material within this learning media is specifically designed for fourth-grade elementary school students, with content that is tailored to fit within the framework of disaster education. This means that the media may not be suitable for students at different educational levels or those seeking a broader range of topics. Another major limitation is related to the distribution of the product. In order to effectively distribute and make this media widely available, substantial funding is required for its procurement and dissemination, which could present a barrier for schools or educational institutions with limited resources. The suggestions in this study emphasize several key actions that can be taken to improve the effectiveness of the learning media and its application in disaster mitigation education. Firstly, it is recommended that teachers implement the learning media that has been developed to assist in the delivery of flood disaster mitigation materials. This will enable students to engage in independent learning, fostering a deeper understanding of the subject matter. By doing so, students can acquire essential knowledge and skills related to flood disaster prevention and management, empowering them to take proactive steps in safeguarding themselves and their communities. Secondly, students should be encouraged to utilize the learning media developed independently, cultivating a sense of responsibility and initiative. This will better equip them to anticipate and respond to potential flooding events, enhancing their preparedness for future flood disaster mitigation efforts. Thirdly, it is vital for teachers, students, and researchers to collaborate with the Regional Disaster Management Agency (BPBD) as part of a broader strategy to prevent flooding.

References

- Ramadhan, B. (14 November 2021). Meski banjir surut, ribuan warga di Sintang masih mengungsi. Diakses pada 14 November 2023. <https://news.republika.co.id/berita/r2kb7q330/meski-banjir-surut-ribuan-warga-di-sintang-masih-mengungsi?>
- Arikunto. S. 2014. *Prosedur Penelitian*. Jakarta: Rineka Cipta
- Astini, P., & Pradnya, D. (2017). Edukasi dengan media permainan inisiatif si kancil meningkatkan kesiapsiagaan siswa dalam menghadapi bencana. *Jurnal Gema Keperawatan*, 10 (1) 46-50. <http://repository.poltekkes-denpasar.ac.id/6964/>.
- Atmojo, S. E., Rahmawati, R. D., & Anggriani, M. D. (2023). The impact of sets education on disaster education on student mitigation skills and resilience. *Nurture*, 17(3), 240–252. <https://doi.org/10.55951/nurture.v17i3.313>

- Chou, J., Yang, K., & Ren, T. (2015). Ex-post evaluation of preparedness education in disaster prevention, mitigation and response. *International Journal of Disaster Risk Reduction*, 12 188-201. <https://doi.org/10.1016/j.ijdr.2015.01.002>.
- DIBI. (2021). *Jumlah Kejadian Bencana di Wilayah Kalimantan Barat 2021*. Indonesia: BNPB. <https://dibi.bnpb.go.id/>.
- Dihni, V. (2021). *BNPB: Kejadian Bencana Alam Indonesia Capai 3.058 Sepanjang 2021*. Indonesia: BNPB.
- Gampell, A., Gailard, J., Parsons, M., & L.L. D'e. (2020). Serious disaster video games: an innovative approach to teaching and learning about disasters and disaster risk reduction. *J. Geog Volume 119 No. 5*, 159-170. <https://doi.org/10.1080/00221341.2020.1795225>
- Gede, I., Pradipta, I., Adiandari, A.M., Gede, P., Herlambang, D., & Kartika, M. (2024). Strengthening community disaster education for disaster mitigation. *Journal of Communication in Scientific Inquiry (JCSI)*, 5(2), 127-133. <https://doi.org/10.58915/jcsi.v5i2.1099>
- Hayudityas, B. (2020). Pentingnya penerapan pendidikan mitigasi bencana di sekolah untuk mengetahui kesiapsiagaan peserta didik. *Jurnal Edukasi Nonformal*, 9 (2) 94 - 102. <https://ummaspul.e-journal.id/JENFOL/article/view/407>.
- Heckman, J.J., Humphries, J.E., & Veramendi, G. (2018). Returns to education: The causal effects of education on earnings, health and smoking. *J. Polit. Econ*, 126, 197-246. <https://doi.org/10.1086/698760>
- Hoffmann, R., & Blecha, D. (2020). Education and disaster vulnerability in Southeast Asia: Evidence and policy implications. *Sustainability Volume 12 Number 4*, 1401. <https://doi.org/10.3390/su12041401>.
- Johnson, V., Ronan, K., Johnston, D., & Peace, R. (2014). Evaluations of disaster education programs for children: A methodological review. *International Journal of Disaster Risk Reduction*, 9 pp 107-123. <https://doi.org/10.1016/j.ijdr.2014.04.001>.
- Juhadi, N, H., Tri Hatmoko, E., Herlina, M., & Aroyandini, E. N. (2021). Developing a model for disaster education to improve students' disaster mitigation literacy. *Journal of disaster research*, 16(8), 1243-1256. <https://doi.org/10.20965/jdr.2021.p1243>
- Mahnun, N. (2012). Media pembelajaran (Kajian terhadap langkah-langkah Pemilihan media dan implementasinya dalam pembelajaran). *Jurnal Pemikiran Islam Vol 37*, <http://ejournal.uin-suska.ac.id/index.php/Anida/article/view/310>.
- Maryana, I., Candiasa, I., & Waluyo, D. (2018). Pengembangan game edukasi sebagai media pembelajaran deret bilangan. *Jurnal Pendidikan Matematika Undiksha*, 9 (2). <https://ejournal.undiksha.ac.id/index.php/JJPM/article/view/19890>.
- Ni'mah, L., & Rusnilawati. (2023). STEAM-Inquiry learning module assisted by live worksheet for multiplication material in elementary school. *Journal Profesi Pendidikan Dasar Vol 10 No. 3 pp 32-46*. <https://doi.org/10.23917/ppd.v10i3.5478>.
- Paton, D., & Johnston, D. (2021). Disaster and communities: vulnerability, resilience and preparedness. *Disaster Prevention and Management. Volume 10 Number 4*, pp 270-277. <https://doi.org/10.1108/EUM0000000005930>.
- Developing a model for disaster education to improve students' disaster mitigation literacy. *Journal of disaster research*, 16(8), 1243-1256. <https://doi.org/10.20965/jdr.2021.p1243>
- Richey, R.C., & Klein, J.D. (2007). Design and Development Research: Methods, Strategies, and Issues (1st ed.). Routledge. <https://doi.org/10.4324/9780203826034>
- Rofiah, N.H., Kawai, N., & Hayati, E. N. (2021). Key elements of disaster mitigation in inclusive school setting in the Indonesia context. *Jamba: Journal of Disaster Risk Studies*, 13 (1) 1159. <https://doi.org/10.4102/jamba.v13i1.1159>

- Supriyadi, Rusilowati, A., Linuwih, S., Binadja, A., & Salawane, C. (2019). Science environment technology and society approach learning to improve natural disaster mitigation literacy. *Journal of Physics: Conference Series*, 1387(1), 12119. <https://doi.org/10.1088/1742-6596/1387/1/012119>
- Rusnilawati, Ali, S., & Hanapi, M. (2023). Impact of attitude category on problem solving skills: an experiment within a flipped learning model with STEAM approach. *Journal Profesi Pendidikan Dasar*, Vol 10 (1) pp 51-71. <https://doi.org/10.23917/ppd.v10i1.4267>.
- Salombe, Y. (2021). Penggunaan permainan ular tangga terhadap hasil belajar mata pelajaran IPS siswa sekolah dasar. *Jurnal Pendidikan Guru Sekolah Dasar*, 2 (1) 62-67. <https://ummaspul.e-journal.id/MGR/article/download/1724/567>.
- Setyowati, D. (2019). *Pendidikan Kebencanaan*. Semarang: Universitas Negeri Semarang.
- Shiwaku, K. & Shaw, R. (2008). Proactive co-learning: A new paradigm in disaster education. *Disaster Prevention and Management: An International Journal*, 17(2), 183-198. <https://doi.org/10.1108/09653560810872497>.
- Sholihah, Q., Kuncoro, W., Wahyuni, S., Suwandi, S.P. & Feditasari, E.D. (2020). The analysis of the causes of flood disasters and their impacts in the perspective of environmental law. *IOP Conferences Series Earth and Environmental Science*, (p. Volume 437). 012056. <https://doi.org/10.1088/1755-1315/437/1/012056>.
- Suarmika, P., & Utama, E. (2017). Pendidikan mitigasi bencana di sekolah dasar. *Jurnal Pendidikan Dasar Indonesia*, 2(2) 18-24. <https://journal.stkip singkawang.ac.id/index.php/JPDI/article/view/327/0>.
- Suharini, E., Meliana, D.P., Sanjoto, T.B., & Kurniawan, E. (2019) Suharini, E., Meliana, D., Sanjoto, T., & Kurniawan, E. (2019). The Strategy of disaster mitigation literacy through problem-based learning (PBL) in the school prone to tidal floods. *In 1st International Conference on Environment and Sustainability Issues, Semarang*. <http://dx.doi.org/10.4108/eai.18-7-2019.2290156>
- Tatisina, O., & Rukmini, A. (2019). Pengembangan media ular tangga modifikasi beri jawaban padaku untuk keterampilan membaca teks cerita fiksi siswa kelas IV sekolah dasar. *JPGSD 7* (5), 3491-3500. <https://ejournal.unesa.ac.id/index.php/jurnal-penelitian-pgsd/article/view/29159>
- Tsai, M. H., Wen, M. C., Chang, Y. L., & Kang, S. C. (2015). Game-based education for disaster prevention. *AI & Society*, 30, 463-475. <https://doi.org/10.1007/s00146-014-0562-7>
- Utami, I., & Abdullah, M. (2020). Pengembangan media ular tangga dalam pembelajaran tema daerah tempat tinggalku peserta didik kelas IV Sekolah Dasar. *Jurnal Penelitian Pendidikan Guru Sekolah Dasar 8* (3). <https://ejournal.unesa.ac.id/index.php/jurnal-penelitian-pgsd/article/view/35321>
- Utami, S., & Mustari, H. (2020). Perut sisan (snakes and ladders game of disaster mitigation) as a disaster education learning medium. *Seminar Nasional Manajemen Bencana PSB Volume 3 Number 1* (pp. 76-82). Indonesia: <https://jurnal.uns.ac.id/SHES/article/view/45015>.
- Wedyawati, N., & Lisa, Y. (2017). Pengembangan model buku ajar IPA terpadu mitigasi bencana bagi Sekolah Dasar Kabupaten Sintang Kalimantan Barat. *Prosiding Seminar Nasional Hasil penelitian dan Pengabdian Kepada Masyarakat 2* (pp. 285-290). Jawa Timur: Universitas PGRI Ronggolawe Tuban. <http://prosiding.unirow.ac.id/index.php/SNasPPM/article/view/123>.
- Wedyawati, N., Lisa, Y., & Selimayati, S. (2017). Pengaruh model pembelajaran IPA terintegrasi mitigasi bencana terhadap hasil belajar. *Jurnal Edukasi*, Volume 15 Nomor 2. <https://journal.ikipgripta.ac.id/index.php/edukasi/article/view/636>.
- Wedyawati, N., & Lisa, Y. (2018). *Pembelajaran IPA di Sekolah Dasar*. Yogyakarta: Deepublish.

- Wedyawati, N., & Setyawan, A. (2019). Fire mitigation boardgame for elementary student at sintang region. *Proceedings of the 2nd International Conference on Social Sciences and Interdisciplinary Studies (formerly ICCSSIS)*. EAI: Medan, North Sumatera, Indonesia. <http://dx.doi.org/10.4108/eai.24-10-2019.2290556>.
- Wedyawati, N., Setyawan, A., Dike, D., & Lisa, Y. (2020). Design of gamikar (game mitigasi kebakaran) for high-grade elementary students. *Journal of Advanced Research in Dynamical and Control Systems presents Peer-reviewed survey and original research articles*, 12, 176-185. <http://dx.doi.org/10.5373/JARDCS/V12SP7/20202096>
- Wedyawati, N., Setyawan, A. E., Kurniati, A., & Sirhi, S. (2021). Application Design of Gamikar (GAMIKAR) to Improve Understanding of Fire Mitigation Elementary School Students. In *Proceeding* (pp. 279-285). <https://journal.kapin.org/index.php/Proceeding/article/view/42>