Research Paper

Socio-Disaster Puzzle Media as an Educational Innovation for Disaster Learning in Social Studies for Deaf Students

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ABSTRACT

Semarang City is classified as a region with a high level of vulnerability to flood disasters, influenced by its geographical conditions, climate change, and suboptimal environmental management. This situation necessitates a structured strategy to enhance literacy and awareness of disaster mitigation from an early age, including among students with special needs such as those with hearing impairments. Therefore, the implementation of inclusive and responsive education that addresses special needs is crucial to ensuring equitable disaster preparedness across all segments of society. This study aims to examine the effectiveness of the Puzzle Socio Disaster media in increasing flood disaster mitigation awareness among hearing-impaired students in the context of Social Studies (IPS) education. This research adopts a quantitative approach with a quasi-experimental design, incorporating both pre-test and post-test procedures. The subjects of the study were hearing-impaired students at the junior secondary school (SMP) level, divided into an experimental group and a control group. The Puzzle Socio Disaster media was developed as a visual and kinesthetic learning aid designed to convey basic flood disaster mitigation concepts in an interactive and engaging manner. The data collection instrument consisted of a disaster mitigation awareness questionnaire, which had undergone validity and reliability testing. The analysis results revealed a significant increase in flood disaster mitigation awareness scores in the experimental group following the use of the Puzzle Socio Disaster media, compared to the control group. These findings indicate that learning media designed with inclusivity in mind can enhance the understanding of disaster-related content among hearing-impaired students more effectively. In conclusion, the Puzzle Socio Disaster media serves as an effective and inclusive educational tool for fostering flood disaster mitigation awareness among hearing-impaired students. Integrating this media into Social Studies instruction in inclusive schools represents a pedagogical innovation that supports the strengthening of disaster education and contributes to the achievement of sustainable development goals.

Keywords: disaster mitigation, hearing-impaired students, inclusive media, Puzzle Socio Disaster, Social Studies learning, flood

INTRODUCTION

Semarang City is one of the regions in Indonesia that is highly vulnerable to flood disasters. The primary factors contributing to this high risk include its geographical condition prone to inundation, unstable climate change, and suboptimal

environmental management. Flooding not only causes physical damage and economic losses but also endangers the safety and well-being of the community, especially vulnerable groups such as persons with disabilities. Therefore, planned and comprehensive disaster mitigation efforts are necessary to reduce adverse impacts while enhancing community preparedness (Ferani Mulianingsih, 2024).

One important strategic measure is through inclusive disaster mitigation education, particularly for students with special needs such as the hearing impaired. Inclusive education aims to provide equal learning access with approaches tailored to the unique needs of each student. In this context, the utilization of visual and interactive learning media is crucial to ensure that disaster-related materials can be effectively received by hearing-impaired students, who have limitations in verbal communication (Ferani, 2024).

The Social Studies subject plays a significant role in fostering social and environmental awareness, including disaster mitigation (Mulianingsih et al., 2023). With appropriate learning methods, students can be actively engaged in understanding and implementing disaster preparedness measures in their daily lives. However, the lack of learning media specifically designed for hearing-impaired students remains an obstacle in optimizing disaster mitigation education in inclusive schools.

This study offers novelty through the development of a visually and kinesthetically inclusive thematic puzzle-based learning media specifically designed for deaf students in the context of flood disaster mitigation education within Social Studies. The media goes beyond simple visual presentation by enabling hands-on interaction, enhancing both cognitive and motor engagement. Additionally, the study integrates Bandura's Social Cognitive Theory into the media design, promoting a learning process that is interactive, reflective, and contextually relevant. No previous research has specifically explored the effectiveness of puzzle-based media in improving disaster mitigation literacy among deaf students in Social Studies education, making this study a significant pedagogical innovation in both inclusive and disaster education.

This study aims to evaluate the effectiveness of using the Puzzle Socio Disaster media as a learning aid to enhance flood mitigation awareness among hearing-impaired students at the junior high school level. This study introduces an innovation through the development of interactive and inclusive educational media, which is expected to support the comprehensive improvement of disaster literacy. Thus, the findings of this research are anticipated to contribute significantly to the development of an adaptive and equitable disaster mitigation learning model for all community groups.

LITERATURE REVIEW
The Vulnerability of Semarang City to Flood Disasters
Semarang City is one of the regions with a high vulnerability to flood disasters. This vulnerability is caused by several interrelated factors that amplify the risk of flooding in the city. First, geographically, Semarang is located on lowlands and directly borders the Java Sea. This position makes Semarang highly susceptible to tidal flooding (also known as rob flooding), which occurs due to rising sea levels that seep into the land, especially during high tides or large ocean waves. This geographical condition makes Semarang prone to seawater overflow that directly impacts residential areas and infrastructure (Mulianingsih, Semarang, et al., 2025).

Second, the global climate change phenomenon, which has led to a significant increase in the intensity and frequency of rainfall, further exacerbates the flooding situation. High rainfall within a short period causes rivers and drainage systems, which are unable to accommodate the water volume optimally, to overflow. Third, ineffective environmental management also greatly contributes to the flood risk. For

instance, the existing drainage systems are insufficient to quickly channel water, and rapid urbanization has reduced water absorption areas due to the conversion of green spaces into residential and commercial zones. Additionally, the accumulation of waste in water channels causes blockages that slow down water flow, thereby increasing the likelihood of flooding (Ferani Mulianingsih, 2023).

Given these conditions, a comprehensive and integrated disaster mitigation strategy is required, which not only focuses on infrastructure improvement but also on raising community awareness and preparedness. The role of various stakeholders, ranging from government, local communities, to the education sector, is crucial in establishing an effective disaster response system (Nurainun Apriani Idris et al., 2024). Moreover, vulnerable groups such as children and students with special needs must receive special attention to ensure their protection and adequate preparedness in facing the frequent flood threats in Semarang.

Inclusive Education and Disaster Preparedness

Inclusive education plays a crucial role in ensuring that every child, including those with special needs such as hearing impairments, receives equal opportunities to access quality and equitable education. Education approach that is sensitive to special needs not only aims to improve students' academic achievements but also serves to develop their social awareness and prepare their ability to face various life challenges, including the potential for natural disasters. In other words, inclusive education has a dual function, namely as a means to enhance knowledge as well as to strengthen the mental and social readiness of children with special needs. Therefore, it is essential to integrate disaster mitigation literacy early into the school curriculum (Ferani Mulianingsih A. P., 2024). The introduction of disaster mitigation material must be conducted through learning

methods that are friendly and easy to understand, so that students with hearing impairments or other special needs can still access and comprehend the information effectively. Through this approach, children not only acquire theoretical knowledge but also practical skills that are useful in dealing with emergency or disaster situations. This awareness and skill set will become valuable assets formed from early childhood, enabling them to be better prepared and resilient when facing disaster risks in the future (Rokhmat et al., 2024). Thus, inclusive education that incorporates disaster mitigation aspects becomes a vital foundation in building an inclusive and resilient society.

Puzzle Media as a Learning Medium

Puzzle-based learning media is an educational tool that offers numerous advantages, particularly as an interactive and enjoyable means of visual and kinesthetic learning. By utilizing puzzles, students are not merely passive recipients of information but are actively engaged in the learning process through problem-solving activities. This process stimulates students' creativity as they must devise methods and strategies to assemble puzzle pieces into a coherent whole. Moreover, puzzles deepen students' understanding of often abstract and complex concepts by enabling them to directly observe the relationships among elements in a concrete visual form.

Puzzle media is also highly effective in supporting the learning process for hearing-impaired students, who tend to rely more heavily on their visual and tactile senses to receive information. This multisensory learning experience significantly aids their comprehension compared to conventional methods that predominantly emphasize audio-verbal aspects (Rika Widianita, 2023).

In the context of Social Studies (Ilmu Pengetahuan Sosial) education, especially on the topic of disaster mitigation, the use of puzzle media allows students to gain a tangible understanding of the steps and

actions required during disaster situations. Well-designed puzzles can depict detailed disaster scenarios, enabling students to visualize mitigation processes such as evacuation, rescue, and risk management (Mulianingsih, Suharini, et al., 2025). Consequently, the learning experience is not only theoretical but also practical and relevant to daily life. This approach makes learning more engaging, effective, and inclusive, particularly for students with special needs, while simultaneously enhancing their awareness of the importance of disaster preparedness.

Social Studies (IPS) and Disaster Mitigation

Integrating disaster mitigation material into the Social Sciences (IPS) learning curriculum is a very strategic and crucial step to increase disaster awareness and preparedness among students. By systematically including topics related to disaster mitigation in the learning process, students not only gain theoretical knowledge, but also understand directly how disasters can impact the lives of their communities and the environment around them (Mulianingsih & Hardati, 2018).

IPS learning that is aligned with the National Council for the Social Studies (NCSS) standards and designed contextually is very important so that the material presented can be relevant to real conditions in the students' environment (Ginanjar & Nisa, 2022). For example, topics regarding types of natural disasters, causes of disasters, and mitigation steps that can be taken by individuals and communities can be linked to students' daily experiences. This makes learning livelier and more meaningful, while fostering a sense of concern and awareness of the importance of disaster preparedness.

In addition to the cognitive aspect that emphasizes understanding concepts and information, the learning approach must also accommodate the affective and psychomotor dimensions (Lestari & Mulianingsih, 2020). The affective aspect includes a positive attitude and awareness of the need to be alert to potential disasters, while the psychomotor aspect focuses on practical skills that can be used when facing a disaster situation, such as evacuation, first aid, and the use of emergency communication tools. The use of interactive learning media such as simulations, videos, and educational games is one effective way to involve all of these dimensions comprehensively (Amirah Zahra Muthi et al., 2023).

Thus, this comprehensive and interactive social studies learning approach not only provides knowledge, but also forms the character of students who are ready, responsive, and responsible in facing disasters, so that they can minimize the risks and impacts that may occur in the future.

Learning Characteristics of Deaf Students

Deaf students possess distinct learning needs that differ from those of typical learners. This difference stems from their hearing limitations, which lead them to rely heavily on visual perception and direct experiences to comprehend information and learning materials. Their dependence on visual media constitutes a primary aspect of their learning process (Y. I. Kurniawan et al., 2022). Therefore, learning approaches tailored to their specific learning styles must be carefully and systematically designed. Instructional strategies that integrate visual elements (such as images, videos, and infographics), kinesthetic components (through physical activities or hands-on practice), and meaningful interaction (such as discussions using sign language or other assistive communication tools) are essential for creating effective learning experiences (Fathimah et al., 2024).

The importance of these strategies lies not only in the optimal delivery of information but also in efforts to build strong conceptual understanding and enhance the learning motivation of deaf students. Learning media designed inclusively taking into account the unique characteristics and communication

needs of deaf students play a central role in creating an equitable and supportive learning environment(Sholeh, 2020). The development of such media represents a concrete step toward realizing fair and non-discriminatory education for all, including students with special needs. Consequently, the success of the learning process should not be measured solely by academic achievement, but also by the extent to which deaf students feel valued, engaged, and able to develop their full potential. Thus, it is crucial for educators and curriculum developers to continually adapt teaching approaches to meet the needs of deaf students within the framework of inclusive education(Siregar & Ananda, 2023).

Application of Bandura's Social Cognitive Theory in Designing Activity-Oriented Educational Media

The Social Cognitive Theory developed by Albert Bandura emphasizes that learning is not merely a passive process, but occurs through mechanisms of observation, imitation, and the active engagement of individuals within their environment (Yanuardianto, 2019). Within this framework, individuals acquire new knowledge and skills by observing the behaviors of others, understanding the consequences of those behaviors, and then replicating them in appropriate contexts. A key aspect of this theory is the concept of reciprocal determinism, which refers to the dynamic and reciprocal interaction between the individual, the social environment, and behavior. Therefore, effective learning requires a social context that fosters active and reflective participation.

In its application to the field of education particularly in the use of instructional media interactive approaches become highly relevant. Learning media that enable students to directly interact with the material, such as educational games, simulations, or project-based activities, are capable of stimulating intrinsic motivation and deepening conceptual understanding (Putriani et al., 2023). One example is the use of activity-based media in Social Studies (Ilmu Pengetahuan Sosial/IPS) instruction, such as thematic puzzles. Such media not only encourage students' physical and mental engagement but also foster critical thinking, collaboration, and problem-solving skills in a cooperative setting (Kerebungu et al., 2023).

This approach aligns with the principles advocated by the National Council for the Social Studies (NCSS), which underscore the importance of active, meaningful, and contextual learning experiences. In the context of disaster mitigation education, the use of interactive media such as Social Studies puzzles can provide enjoyable learning experiences while simultaneously raising students' awareness of environmental risks in their surroundings (Risqiyah & Mulianingsih, 2022). Through direct experiences and active engagement in learning activities, students do not merely acquire knowledge but also develop attitudes and behaviors that are more sensitive to disaster mitigation efforts. Thus, the integration of Social Cognitive Theory into the design of instructional media can make a significant contribution to shaping a resilient younger generation environmentally aware and better prepared to face disaster-related challenges wisely (Adhiutama et al., 2020).

MATERIALS & METHODS
Research Approach and Design
This study employs a quantitative approach with a quasi-experimental design to evaluate the effectiveness of the "Puzzle Socio Disaster" learning media in enhancing flood disaster mitigation awareness among deaf students within the context of Social Studies (Ilmu Pengetahuan Sosial/IPS) education. The design involves two groups:
1. An experimental group, which receives the intervention through the use of the Puzzle Socio Disaster media during the learning process; and
2. A control group, which undergoes instruction without the use of the intervention media.

Both groups are assessed through pre-tests and post-tests to measure the extent of change in students' awareness of flood disaster mitigation as a result of the intervention.

Research Subjects

The study focuses on deaf students at the junior high school level enrolled in Sekolah Luar Biasa Negeri (Special Needs Public School) Semarang. The subjects are selected using purposive sampling, based on specific criteria. These include hearing impairment, cognitive comprehension levels, and visual-kinesthetic learning abilities that align with the characteristics of the developed instructional media.

Data Collection Techniques

Multiple data collection methods are employed to ensure the richness and accuracy of the information:

1. **Written Tests (Pre-test and Post-test):**
Administered to measure changes in students' knowledge and awareness regarding flood disaster mitigation before and after the instructional intervention. The test items are adapted to disaster awareness indicators tailored for deaf students.

2. **Direct Observation:**
Conducted during the learning process to record students' engagement, enthusiasm, and responses to the use of the Puzzle Socio Disaster media.

3. **Semi-Structured Interviews:**
Conducted with accompanying teachers and selected students to gather qualitative data on their perceptions of the instructional media, including the challenges and benefits in fostering an understanding of disaster mitigation concepts.

4. **Documentation:**
Includes the collection of activity logs, photos of the learning process, and video recordings as visual evidence to support observational and interview data.

Research Instruments

The main instruments used in this study include:

1. **Flood Disaster Mitigation Awareness Questionnaire:**
Developed based on disaster awareness indicators encompassing cognitive (knowledge), affective (attitude), and psychomotor (behavioral) domains. The questionnaire has undergone validity and reliability testing to ensure data accuracy.

2. **Puzzle Socio Disaster Media:**
A puzzle-based instructional medium specifically developed for deaf students. It integrates visual and kinesthetic learning approaches to suit the learning needs of students with special needs, particularly in understanding the stages of flood disaster mitigation.

Data Analysis Technique

Quantitative data from the pre-test and post-test results are analyzed using the paired sample t-test statistical method. This analysis aims to determine whether there is a statistically significant difference before and after the use of the Puzzle Socio Disaster media in both the experimental and control groups. The results of this analysis serve as the basis for evaluating the effectiveness of the media in enhancing flood disaster mitigation awareness among deaf students.

RESULT

This study employed a quasi-experimental design to investigate the effectiveness of the socio-disaster puzzle as a learning medium in increasing flood disaster mitigation awareness among deaf students at SLB Negeri Semarang. Effectiveness was assessed by comparing the learning outcomes of an experimental group and a control group. The experimental group received instruction using the socio-disaster puzzle integrated into social studies learning, whereas the control group received conventional instruction without any specific disaster mitigation media.

The research procedure began with the preparation phase, which involved the development of valid and reliable instruments to assess students' awareness of

flood disaster mitigation. The instrument used was a written test administered as both a pre-test and post-test. The pre-test measured the students' baseline awareness prior to the intervention. Subsequently, students in the experimental group engaged in a learning activity that involved assembling a puzzle to form an image depicting flood disaster mitigation efforts. Following the activity, students were given a post-test to evaluate the extent to which their disaster awareness had improved as a result of the intervention.

Data analysis was conducted using statistical methods, specifically the paired sample t-test, to compare the mean scores of the pre-test and post-test in order to determine the significance of any observed changes in awareness levels.

Effectiveness Assessment

The quasi-experimental approach was selected to facilitate an objective comparison between the experimental and control groups regarding flood disaster awareness. Data were collected through student questionnaires and written assessments administered before and after the intervention. In the experimental class, the socio-disaster puzzle was utilized as a disaster education tool, while the control class employed traditional instructional methods without any specific focus on flood disaster mitigation. The primary instruments consisted of pre-tests and post-tests designed to capture students' learning outcomes, with data analyzed quantitatively to assess the intervention's effectiveness.

Normality Test

Table 1. Tests of normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
pre.kontrol	.141	12	.200*	.971	12	.922
post.kontrol	.180	12	.200*	.940	12	.502
pre.eksperimen	.099	12	.200*	.989	12	.999
post.eksperimen	.177	12	.200*	.966	12	.869
a. Lilliefors Significance Correction						
*. This is a lower bound of the true significance.						

Normality test data, as presented in Table 1, were obtained from the pre-test and post-test results of both the experimental and control groups. The normality test was conducted for each research variable. Data are considered to be normally distributed if the significance value (Sig.) is greater than the significance level α = 0.05.

Based on the results of the normality test, the significance value for the post-test in the experimental group was 0.869, which is greater than 0.05. Similarly, the post-test data in the control group yielded a significance value of 0.502, which also exceeds 0.05. Therefore, it can be concluded that both the experimental and control group data are normally distributed.

Paired Sample t-Test Results

Table 2. t-Test Calculation

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	post.eksperimen	84.9167	12	2.35327	.67933
	pre.eksperimen	58.5000	12	2.39317	.69085
Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	post.kontrol	60.1667	12	2.55248	.73684
	pre.kontrol	58.4167	12	2.87492	.82992

Based on the results of the paired sample t-test, differences were observed between the pre-test and post-test scores in both the experimental and control groups. As shown in Table 2, the mean pre-test score in the experimental group was 58.50, while the post-test score increased to 84.92. This indicates a substantial improvement in the experimental group's performance (58.50 < 84.92), suggesting that the socio-disaster puzzle media had a positive impact on students' flood disaster mitigation awareness.

In the control group, the mean pre-test score was 58.42, and the post-test score was 60.17. Although there was a slight increase (58.42 < 60.17), the difference between the pre-test and post-test scores in the control group was minimal and not statistically significant. This suggests that conventional teaching methods without the use of specific disaster mitigation media did not result in a meaningful improvement in students' awareness.

Significance of the Differences (Paired Samples Test)

Table 3. *Paired Samples Test*

Paired Samples Test									
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	post.eksperimen - pre.eksperimen	26.41667	1.50504	.43447	25.46041	27.37292	60.802	11	.000

Paired Samples Test									
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	post.kontrol - pre.kontrol	1.75000	3.01888	.87148	-.16810	3.66810	2.008	11	.070

To determine whether the observed differences were statistically significant, the results of the paired samples t-test for both the experimental and control groups are presented in Table 3. In the experimental group, the significance value (Sig.) was 0.000, which is less than the threshold of 0.05. This indicates that the improvement from pre-test to post-test in the experimental group is statistically significant. In contrast, the control group yielded a significance value of 0.070, which is greater than 0.05, suggesting that the difference in scores was not statistically significant.

Based on these findings, it can be concluded that the use of the socio-disaster puzzle as a learning medium for flood disaster mitigation education is effective in fostering disaster awareness among students.

The results of this study provide evidence supporting the argument that disaster mitigation education models can enhance students' critical thinking skills, particularly in raising awareness of potential disasters in their environment. Furthermore, the findings are aligned with existing literature indicating that problem-based learning approaches can be effectively utilized by educators to instill critical thinking skills and improve student learning outcomes.

Semarang City is recognized as one of the regions with a very high vulnerability to flood disasters. Its geographical conditions and tropical climate, which frequently experience heavy rainfall, render the risk of

flooding a tangible threat to the community (Ferani Mulianingsih, 2024). Therefore, disaster mitigation approaches that are not only effective but also inclusive and adaptive are required, particularly for vulnerable groups such as students with special needs, including hearing-impaired students. This group has distinct learning characteristics, making a responsive learning approach crucial to enable them to gain an optimal understanding of disaster mitigation (Sukma et al., 2024).

This study emphasizes the urgency of implementing disaster mitigation education tailored to the special needs of hearing-impaired students through the use of appropriate and interactive learning media. One innovative media developed is the Puzzle Socio Disaster-based learning tool. This media combines visual and kinesthetic elements two critical aspects in teaching hearing-impaired students. Strong visualization aids clearer comprehension of information, while the kinesthetic approach provides hands-on learning experiences through puzzle manipulation activities that stimulate both physical and mental engagement (Dary & Mulianingsih, 2023).

Using a quasi-experimental method, the study found a significant increase in flood disaster mitigation awareness scores in the experimental group using the Puzzle Socio Disaster media compared to the control group that did not use the media. This indicates that the media not only enhances conceptual understanding of flood mitigation but also fosters early awareness of the importance of disaster preparedness among hearing-impaired students. Observations during the learning process showed high enthusiasm and active participation from students, signifying the success of the media in creating an enjoyable yet educational learning environment.

Cognitively, the use of the Puzzle Socio Disaster media effectively improved students' abilities to recognize early signs of impending floods and to systematically implement mitigation measures. This improvement was clearly reflected in the comparison between pre-test and post-test scores, which showed a significant difference. From a participatory perspective, the media enables students to interact directly with learning materials, making the learning process more lively and meaningful. The kinesthetic approach is particularly suitable for hearing-impaired students, who tend to grasp information more easily through physical experiences and manipulation of concrete objects rather than through abstract theory alone (Rika Widianita, 2023).

The findings of this study reinforce the argument that specially designed learning media that take into account the characteristics of students with special needs can significantly increase the effectiveness of the learning process. Moreover, such media can nurture early disaster mitigation awareness, which is a vital asset in building a more resilient and disaster-ready society. Therefore, integrating the Puzzle Socio Disaster media into the Social Studies curriculum in inclusive schools can represent a highly strategic pedagogical innovation (Jusuf Leiwakabessy & Liora Chrissa Pattiasina, 2023). This step not only strengthens disaster literacy among hearing-impaired students but also contributes to achieving sustainable development goals, especially in enhancing community resilience and preparedness on a broader scale.

In conclusion, the results of this study affirm that inclusive learning strategies employing interactive and multisensory media are essential in the context of disaster mitigation education. The Puzzle Socio Disaster media offers an effective and enjoyable alternative for hearing-impaired students to understand flood risks and the necessary mitigation steps. Consequently, this media not only provides equitable access to disaster education for special needs students but also reinforces comprehensive disaster mitigation efforts within the community. Innovations such as this are crucial as part of transforming

education to be inclusive and responsive to environmental challenges and future social needs (Nisa et al., 2020).

DISCUSSION

Semarang City is one of the regions highly vulnerable to flood disasters. This high vulnerability is caused by several key interacting factors. Geographically, Semarang is located in a coastal and lowland area, conditions that naturally increase the risk of waterlogging during periods of heavy rainfall (Egbelakin et al., 2023). Moreover, global climate change exacerbates this situation by increasing the frequency and intensity of extreme, unpredictable rainfall events. In addition, environmental management in Semarang is still suboptimal; this is evident from the inefficiency of the drainage system, the narrowing of water catchment areas due to rapid urbanization, and inadequate waste and garbage management, all of which worsen the flood risk. This complex condition necessitates a comprehensive and integrated disaster mitigation strategy encompassing all aspects of community life, one of which is the education sector (E. Kurniawan et al., 2021).

Education plays a strategic role in shaping disaster mitigation awareness and capacity from an early age (Mulianingsih et al., 2023). This study highlights the importance of disaster mitigation literacy, particularly for students with special needs, such as hearing-impaired students. This group often faces difficulties accessing information delivered through conventional methods, especially those relying on verbal or audio communication. Therefore, an adaptive and inclusive learning approach is required to enable them to acquire knowledge effectively and equitably.

This study developed a learning media called Puzzle Socio Disaster, which combines visual and kinesthetic elements as tools to deliver flood disaster mitigation materials interactively and engagingly. This media is well-suited to the learning characteristics of hearing-impaired students,

who rely more on visual stimuli and physical touch. Through puzzle pieces that must be assembled, students do not merely receive information passively but actively participate in the learning process, making the material easier to understand and remember.

The research results show that the use of the Puzzle Socio Disaster media significantly improves disaster mitigation awareness and understanding among hearing-impaired students in the experimental group. These findings align with inclusive learning principles, emphasizing the importance of adapting media and teaching methods to reach all students, including those with special needs. Thus, this media not only serves as an information delivery tool but also encourages active student involvement, consistent with Albert Bandura's social cognitive learning theory. Bandura asserts that learning is not a passive activity but occurs through observation, imitation, and active engagement of individuals within their social context. Within the framework of reciprocal determinism, the dynamic interaction between individuals, social environment, and behavior greatly determines learning success (Sholeh, 2019). The Puzzle Socio Disaster media creates a social context that supports active and reflective participation, thereby making learning more meaningful.

The integration of this media into Social Studies (Ilmu Pengetahuan Sosial, IPS) learning in inclusive schools represents an important pedagogical innovation. IPS, as an integrative subject, not only delivers academic content but also social values and disaster preparedness relevant to students' real-life experiences. With media responsive to the diverse learning needs of students, disaster education can be implemented equitably and fairly, supporting sustainable development goals that emphasize inclusivity and community resilience (Rahmah, 2018).

Practically, the research confirms that Social Studies learning can be a strategic space to integrate inclusive disaster education in

accordance with the National Council for the Social Studies (NCSS) framework. Therefore, teachers and curriculum developers are encouraged to adopt innovative learning media such as Puzzle Socio Disaster to ensure that all students, including hearing-impaired students, have equal access to disaster mitigation knowledge. Training and mentoring for teachers in utilizing this media are also crucial supporting factors for the successful implementation of inclusive disaster education in schools.

CONCLUSION

Semarang City is a region highly vulnerable to flood disasters, influenced by factors such as geographic characteristics, the impact of climate change, and suboptimal environmental management. This condition necessitates efforts to enhance literacy and awareness of disaster mitigation from an early age, particularly for special needs groups such as hearing-impaired students. This study demonstrates that the use of an innovative learning media called Puzzle Socio Disaster, designed to be inclusive and interactive, is effective in improving the understanding and awareness of flood disaster mitigation among hearing-impaired junior high school students. Through a quasi-experimental approach, it was found that students who utilized this media showed a significant increase in disaster mitigation knowledge compared to the control group that did not use the media. Therefore, the implementation of Puzzle Socio Disaster media in Social Studies learning at inclusive schools represents not only a relevant pedagogical innovation but also holds the potential to strengthen overall disaster preparedness. This approach can make an important contribution to supporting inclusive sustainable development by ensuring that all societal segments, including special needs groups, have equal access to disaster mitigation education and self-protection.

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