Research Article

ASIAB Chatbot for Disaster Mitigation Learning at Madrasah Ibtidaiyah

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ABSTRACT

Learning Disaster mitigation in schools is an essential concern of the government in forming a character of preparedness and resilience for students to face disasters. According to technological developments, adequate learning media is also important for independent learning. Therefore, this study aimed to develop disaster mitigation learning media for Madrasah Ibtidaiyah (Islamic Elementary School) students using AI chatbot technology. The Research and Development method with the ADDIE model was adopted, consisting of five stages, namely Analysis, Design, Development, Implementation, and Evaluation. The product was validated by media and material experts as excellent, with percentages of 98.3% and 93.95% respectively. Product validation was carried out using questionnaires, while assessments were based on several indicators, namely attractive, easy-to-understand, technical standards, and material suitability. Furthermore, practicality and effectiveness tests were conducted on teachers and students, with scores above 80%, suggesting very good usability. Practical and effective indicators were based on attractiveness, ease of use, increased motivation, and ease of assessment. In conclusion, The ASIAB chatbot was found to be highly suitable for learning by providing an innovative method to disaster mitigation education through the integration of AI chatbot technology. In addition, the ASIAB chatbot provided a validated and reliable tool that meets high standards of usability and educational effectiveness, as evidenced by high validation scores from both media and material experts. This technology also showed practicality and effectiveness in real classroom settings, thereby providing a scalable solution that can be implemented widely to enhance disaster preparedness education across Indonesian schools.

Keywords: Chatbot; Disaster; Primary School; Artificial Intelligence

INTRODUCTION

Natural disasters are a severe threat to human life and the sustainability of society. Indonesia is a country with geographical diversity and extreme weather, resulting in a higher frequency of natural disasters such as floods, earthquakes, landslides, and volcanic eruptions (CFE-DM, 2021). Geographically, Indonesia is an archipelagic country at the confluence of the tectonic plates of Asia, Australia, India, and the Pacific Ocean. In eastern and southern Indonesia, there is a volcanic route stretching from Sumatra to the islands of Java, Nusa Tenggara, and Sulawesi. The trail consists of volcanic mountains and lowlands partially covered by swamps. This geographical situation provides excellent potential but also increases the risk of disasters, such as volcanic eruptions, earthquakes, tsunamis, floods, and landslides. A previous survey showed that Indonesia had a high earthquake risk of up to 10 times compared to the United States (BNPB, 2022).

Indonesia has a tropical climate with two seasons, namely hot and rainy, consisting of extreme weather, temperature, and wind direction variations. In addition, topographic conditions and physically and chemically changing rock variations also contribute to the existence of fertile soil. Hydrometeorological hazards can impact floods, landslides, forest fires, and droughts. Environmental damage also tends to increase with time and human activities. This condition has implications for the increasing frequency and intensity of disasters, such as droughts, floods, and landslides that often occur in various regions of Indonesia (BNPB, 2022).

According to BNPB data, the average number of disasters in Indonesia from 2008 to 2022 was 4153 events, with a high number of affected victims. Samodro (2020) stated that 30% of the victims in the 2020 disaster were children. Natural disasters also damage school buildings, affecting millions of students. More than 15,300 schools have been damaged by natural disasters in the last 15 years, disrupting the learning of about 12 million students. The Ministry of Education and Culture, with the National Disaster Management Agency (BNPB), also affirmed that 37,408 schools are located in disaster-prone areas (Permana, 2024). The high risk of this disaster requires serious efforts, including disaster mitigation education, especially in schools (Kastolani & Mainaki, 2018).

Madrasah Ibtidaiyah, as an elementary-level educational institution in the Islamic education system in Indonesia, plays an important role in forming the character and scholarship of students. However, the understanding and disaster mitigation skills of students are often inadequate. The teachings on disaster mitigation in Madrasah Ibtidaiyah are still limited to SSB (*Sekolah Siaga Bencana*) target schools and do not cover all schools in Indonesia. Teaching methods can be in the form of training, books, games, and simulations (Wihyanti, 2020) or demonstrations (Salsabila & Dinda, 2021), which are local and limited. In addition, many schools have not been maximized in providing disaster education due to limited facilities and infrastructure as well as learning media (Rahady & Kurniawan, 2023).

The development of the digital era and information technology is increasing. AI Chatbot technology has become an innovative solution to improve interactive and exciting learning. This tool is easily accessible through gadgets and internet networks (Hikmawati et al., 2023). Chatbot-AI is a computer program that can interact with users in human language, provide information, answer questions, and provide assistance related to specific topics (Cunningham-nelson et al., 2019). The use of chatbot-AI in the context of disaster mitigation learning in Madrasah Ibtidaiyah has excellent potential to increase student understanding (Okonkwo & Ade-Ibijola, 2021), build awareness of disaster threats, and train appropriate action skills during disasters.

The geographical condition of Sumenep Regency is in the form of islands that are prone to natural disasters, namely tornadoes, storms, high waves of seawater, tidal floods, and droughts (Fawaidi & Krisiandi, 2022). In January 2023, only 24 of 334 villages in Sumenep Regency, accounting for 7%, were designated as Destana (Desa Tangguh Bencana-Disaster Resilient Villages) by the Disaster Management Agency (BPBD) of East Java Regency and Province (Warid, 2023). Therefore, disaster development and education focused more on Destana. At the same time, the remaining 93% have not received intensive disaster education from the government, including in the school environment. This condition necessitates the provision of disaster education materials to the entire community.

Previous studies has shown very positive results regarding the use of chatbots in learning, such as Nuraini et al. (2023) which developed chatbots for natural and artificial appearance materials in Indonesia. Selvina et al. (2023) used chatbots in the respiratory system material of living things. Both were developed for elementary school-aged children. Furthermore, UNESCO used chatbots in disaster mitigation learning in the form of AI Chatbot (UNESCO, 2021). The smartphone app developed by UNESCO and Japanese partners used the AI Chatbot as an interactive tool that helped residents connect with local authorities in preparation, response, and disaster recovery. Through this application, users can receive early warnings about imminent disaster threats and report the level during the occurrence. Chatbots allow governments to take appropriate preventive measures in disaster mitigation and preparedness in advance, monitor disaster levels, and assist those affected. In addition, the app allows the government to communicate with victims in the affected areas to provide the necessary support. Research on

chatbot development for disaster material was also conducted by Boné (2020); Srivastava & Kumar (2022); Urbanelli et al. (2022). The Chatbot developed by this study was more complex and connected to various data and information centers. The aim of this development is more effective and efficient disaster prevention and management because information occurs in real-time.

Despite this widespread investigation, no research was concerned about Chatbots related to disaster education, especially for Madrasah Ibtidaiyah students. The main purpose was as a medium of disaster mitigation education related to the type, causes, response, and what to do after a disaster. Considering the explanation, this research aimed to design innovative and effective disaster mitigation learning media based on AI chatbot technology for Madrasah Ibtidaiyah. This research is expected to address existing challenges and improve students' understanding, awareness, and skills in dealing with natural disasters. Therefore, informative facilities in chatbot media for educational technology developers teachers, and related parties to improve disaster mitigation education in Madrasah Ibtidaiyah Sumenep Regency will be provided. The disaster mitigation chatbot will be accessible to all parts of Indonesia, including Madrasah Ibtidaiyah students in the Sumenep Regency. With this background, this research must be carried out to support the development of disaster mitigation education in Madrasah Ibtidaiyah by utilizing innovative and effective chatbot-AI technology.

METHODS

The Research and Development (R&D) model, which was quite popular in developing a product and testing the products made was applied (Sugiono, 2015). This research produced Disaster Mitigation learning media using chatbot technology for Madrasah Ibtidaiyah under the ASIAB Chatbot program. Furthermore, the ADDIE research model was adopted, consisting of five stages, namely Analysis, Design, Development, Implementation, and Evaluation. **Analysis**: This initial stage analyzed the needs and content of research through a literature review and interviews with Madrasah Ibtidaiyah public and private teachers of Sumenep Regency. **Design**: The next stage formulated the design and structure of the chatbot product and was displayed in the form of a storyboard. **Development**: This includes developing a chatbot product based on the design created through the smojo.ai website. The data needed for product development were collected through interviews, documentation, and validation questionnaires to 2 media and 2 material experts. The preparation of instruments research was based on guidelines (Arthana & Dewi, 2005) consisting of 3 sub-variables, namely Chatbot Media Traction, Understanding, and Technical standards. Each had indicators developed by the research according to the target of the instrument. The targeted material (Table 1) and media experts (Table 2), as well as teachers and students.

Table 1. Material Expert Validation Test Instrument

Variable	Sub Variables	Sub Sub Variable	Indicator
Cha-Bott Media Development	Chatbot Media Traction	Chatbot View	Attractive cover and frame design The use of multimedia according to the user's target
	Understanding	Material Description	The material is following the learning objectives The explanation of the material is easy to understand
		Material Evaluation	The evaluation question items are appropriate and clear Efficient and effective in assessment Questions in the game according to the target and material Time duration as per user goals
	Technical standards	Grammar	Languages used according to the user's target The language used according to PEUBI
		Guide	The instructions for operating the Chatbot are clear Chatbot is easy to use

Table 2. Media Expert Validation Test Instrument

Variable	Sub Variables	Sub Sub Variable	Indicator
Chatbot Media Development	Chatbot Media Traction	Chatbot View	Attractive cover and frame design The images used are interesting The animations used are interesting Backsound used accordingly Audio/narrator in Chatbot according to material
	Understanding	Material Description	The explanation of the material is easy to understand
		Material Evaluation	The evaluation question items are appropriate and clear Efficient and effective in assessment Questions in the game according to the target and material
	Technical standards	Grammar	Languages used according to the user's target The storyboard has been appropriate and interesting
		Layout	Layout images and animations accordingly Format fonts (type and size) accordingly The instructions for operating the Chatbot are clear Chatbot is easy to use Chatbots are easy to redevelop

Implementation: After the validation by media and material experts, the next step was to apply chatbot-AI technology to teachers and students of Madrasah Ibtidaiyah in Sumenep, both state and private schools. Three samples were selected based on an analysis of natural disasters that have occurred in the area of the educational institution, including Madrasah Ibtidaiyah Negeri 1, Negeri 3, and Darul Ulum Sumenep. The first step in applying chatbot-AI technology to teachers with a total of 30 samples was to test the practicality and effectiveness of chatbot-AI in implementing the learning process (Table 3). The next stage was a small group trial for 10 students and a large group for 30 students of Madrasah Ibtidaiyah Sumenep (Table 4).

Table 3. Questionnaire Instrument for Teachers

Sub Variables	Sub Sub Variable	Indicator
Media Traction	CHATBOT view	Attractive cover and frame design
		The images used are interesting.
		The animations used are engaging.
		The back sound used accordingly.
		Audio/narrator in Chatbot according to material
Understanding	Material Description	The material is following the learning objectives.
		The explanation of the material is easy to understand
		The evaluation question items are appropriate and clear.
		Questions in the game according to the target and material
		Time duration as per user goals
Technical Standards	Grammar	Use of easy-to-understand language
		The language used according to PEUBI.
		Languages used according to the user's target
	Effectiveness	Effective and efficient in material delivery
		Effective and efficient in delivering value
		Chatbot is easy to use

Table 4. Questionnaire Instrument for Students

Sub Variables	Sub Sub Variable	Indicator
Media Traction	CHATBOT view	Attractiveness of frame design
		Image interest
		Interesting animation
		Back sound appeal
		Clarity of Narrator Audio
Understanding	Material Description	Clarity of the content of the material presented
		It is easy to understand the content of the material.
Technical Standards	Grammar	Use of easy-to-understand language
	Motivation	Giving a sense of fun in lessons
	Independence	Easy to use in self-paced learning

Evaluation: In this final stage, the chatbot product was evaluated for necessary improvements. The results will be material for the final stage of development until the formation of disaster mitigation learning media products using chatbot-AI technology that is feasible to use.

Data Analysis Techniques. Descriptive analysis was conducted on the results of assessment questionnaires through individual trials (material experts, media experts, and students), small and large group trials, as well as interviews with material experts and media experts. The description of this percentage was processed by frequency divided by the number of respondents and multiplied by 100% (Sudjana, 2013). After the calculation, analysis was conducted by dividing the frequency of answers to each alternative chosen by 100%, and the next stage was consulted with the assessment criteria (Table 5). Guidelines for the interpretation of analysis results were established.

Table 5. The assessment criteria

Percentage Range	Criterion	Information
76% - 100%	Excellent	Ready for use in learning activity (no revisions)
56% - 75%	Good enough	Ready for use in learning activity (no revisions)
40% - 55%	Not Good	Revision
<40%	Bad	Revision

Calculation results within the range of 76% - 100%, indicate a feasible medium for teaching and learning and did not need to be revised. However, when the calculation value was 0% - 56%, the media was declared less feasible, and revision was needed. This research procedure can be understood more succinctly in the framework at Figure 1.
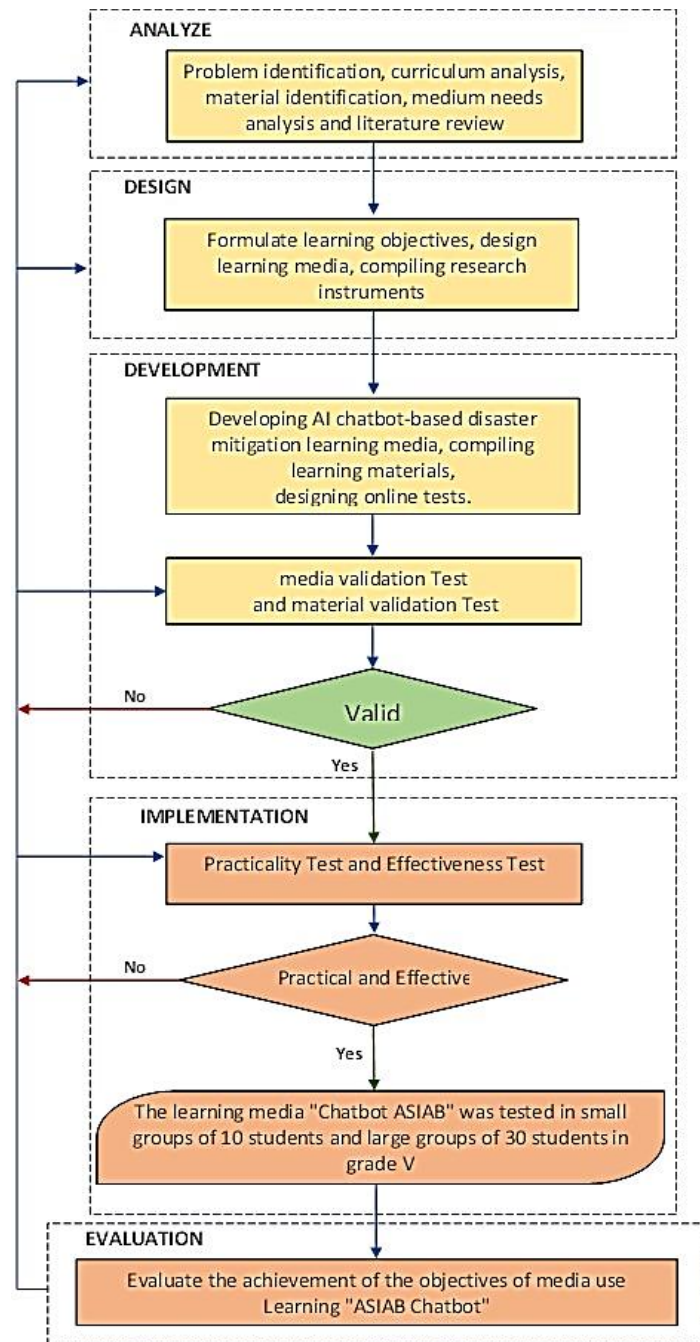
Figure 1. Research Framework

RESULTS AND DISCUSSION

The results and discussions were described directly based on the sequence of procedures, namely Analysis, Design, Development, Implementation, and Evaluation. This process developed disaster mitigation learning media products for Madrasah Ibtidaiyah students based on AI Chatbot Technology.

Analysis Stage. At this stage, interviews and questionnaires were distributed to 30 Madrasah Ibtidaiyah teachers regarding the urgency of natural disaster material and disaster mitigation learning media.

Table 6. Results of the Needs Analysis Questionnaire

Indicator	Needs Analysis (%)
The Importance of Material on Natural Disasters	93.3%
The Importance of Learning Media about Natural Disasters	90%

A total of 28 teachers, accounting for 93.3% stated that natural disaster mitigation materials are essential for MI Sumenep Regency students. The interview results showed that teachers realized the potential for certain natural disasters in Sumenep district (Table 6). Therefore, disaster mitigation education needs to be given from an early age. Similarly, 25 of 30 teachers, accounting for 90% agreed that learning media is required to deliver natural disaster mitigation materials. Because the school has not provided particular time and programs for disaster mitigation learning, adequate media can make the learning process more effective. Based on the results of the questionnaire, the teacher agreed that the media should be accessible to students at all times and in every location. Besides, the media should use technology and attract students to learn as Digital Disaster Mitigation Learning must be interactive.

This finding is in line with previous study by Samarakkody et al. (2023) which showed that support applications can be used in learning to improve the skills and outcomes of self-directed, autonomous, and motivated students with good digital literacy and time management skills. This interactive learning method enables users to enhance understanding and apply knowledge of disaster prevention through practical and scenario-based dialogues as explained by Xue et al. (2023). This research leveraged AI Chatbot technology to develop engaging learning media that meets the desired criteria. The technology offers interactivity, flexibility for both independent and classroom learning, and is particularly appealing to Madrasah Ibtidaiyah students. Furthermore, content analysis was conducted by identifying Elementary School / Madrasah Ibtidaiyah independent curricula that support learning objectives and competency achievements related to natural disaster mitigation material. The ASIAB chatbot includes material under the elementary school curriculum, with one listed in the 5th-grade Natural and Social Sciences (IPAS) lesson material.

Design Stage. The design stage was based on the needs analysis results, ensuring that learning media for natural disaster mitigation using AI Chatbot technology was designed to meet the needs of Madrasah Ibtidaiyah students. The design was expressed in the form of a storyboard, as shown in Table 7.

Table 7. Storyboard Chatbot ASIAB

Frame Chatbot	Information
Opening	At the opening, the user is welcome, and then there is a "Start" button to start.
Bridging	In this section, there is interaction with the user through user identity questions.
Main menu	The menu section contains a selection of natural disaster materials using the Hero character as an avatar in each type of natural disaster. **Hero Adi** – Expert on erupting mountain disasters **Hero Seno** – Earthquake disaster expert **Hero Intan** – Tornado disaster expert **Hero Arum** – Tsunami disaster expert **Hero Banyu** – Flood expert The five hero names if the first letter is shortened to "ASIAB". Each hero button contains disaster mitigation materials before, during, and after a disaster. In addition, there are empathy materials and also exercises to test understanding.
Closing	In this section, there is an appreciation to users who have reached the end of each material and an invitation to explore other hero characters to learn about other types of disasters.

Development Stage. Based on the storyboard (Figure 2), the Chatbot was developed on the smojo.ai website using the acita template with significant modifications (Dewi, 2021). This was followed by validation by media and material experts (Table 8).
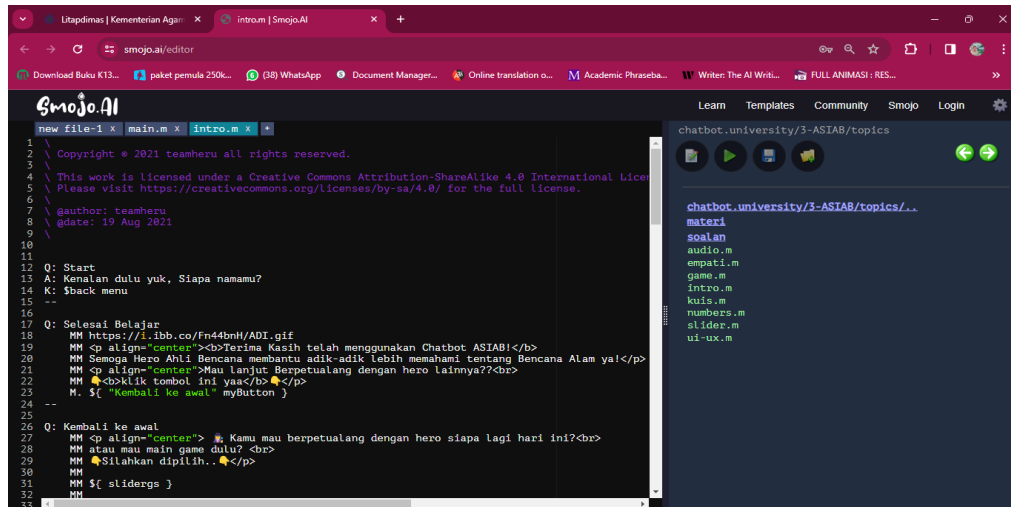

Figure 2. Coding Process on the smojo.ai website

Table 8. The Result of Media Expert Validation

Variable	Sub Variables	Sub Sub Variable	Indicator	Score From Expert	
				1	2
Chatbot Media Development	Chatbot Media Traction	Chatbot View	Attractive cover and frame design	4	3
			The images used are interesting	4	3
			The animations used are interesting	4	4
			Back sound used accordingly	3	4
			Audio/narrator in Chatbot according to material	4	3
	Understanding	Material Description	The explanation of the material is easy to understand	4	4
		Material Evaluation	The evaluation question items are appropriate and clear	4	4
			Efficient and effective in assessment	4	4
			Questions in the game according to the target and material	4	4
	Technical standards	Grammar	Languages used according to the user's target	4	4
			The storyboard has been appropriate and interesting	4	4
		Layout	Layout images and animations accordingly	4	4
			Format fonts (type and size) accordingly	4	4
			The instructions for operating the Chatbot are clear	4	3
			Chatbot is easy to use	4	4
			Chatbots are easy to redevelop	4	4
			Percentage	**98.3%**	**93.95%**

The results of all aspects of the media expert trial 1 and 2 received a percentage score of 98.3% and 93.95%, respectively. These percentages were categorized as **Excellent**, as shown in Table 9.

Table 9. The result of Material Expert Validation

Variable	Sub Variables	Sub Sub Variable	Indicator	Score from Expert	
				1	2
Cha-Bott Media Development	Chatbot Media Traction	Chatbot View	Attractive cover and frame design	3	4
			The use of multimedia according to the user's target	3	4
	Understanding	Material Description	The material is following the learning objectives	3	4
			The explanation of the material is easy to understand	3	4
		Material Evaluation	The evaluation question items are appropriate and clear	3	4
			Efficient and effective in assessment	3	4
			Questions in the game according to the target and material	3	4
			Time duration as per user goals	3	4
	Technical standards	Grammar	Languages used according to the user's target	3	4
			The language used according to PEUBI	3	4
		Guide	The instructions for operating the Chatbot are clear	3	4
			Chatbot is easy to use	3	4
			Percentage	**75%**	**100%**

Material expert trial 1 received 75% in the **Good Enough** category. Meanwhile, material expert trial 2 got 100% in the **Excellent** category**.** In general, the average test results of media and materials were very good. **nImplementation Stage.** At this stage, the results of practicality and effectiveness tests are carried out. The results of the practicality and effectiveness trial received a percentage of a value of 92.78%, categorized as **Excellent** (Table 10).

Table 10. Results of the Practicality and Effectiveness Test of Media to 30 Teachers

Sub Variables	Sub Sub Variable	Indicator	Total Score
Media Traction	CHATBOT view	Attractive cover and frame design	108
		The images used are interesting.	114
		The animations used are engaging.	112
		Back sound used accordingly	113
		Audio/narrator in Chatbot according to material	113
Understanding	Material Description	The material is following the learning objectives.	108
		The explanation of the material is easy to understand	112
		The evaluation question items are appropriate and clear.	110
		Questions in the game according to the target and material	112
		Time duration as per user goals	112
Technical Standards	Grammar	Use of easy-to-understand language	116
		The language used according to PEUBI.	112
		Languages used according to the user's target	110
	Effectiveness	Effective and efficient in material delivery	107
		Effective and efficient in delivering value	112
		Chatbot is easy to use	113
		Percentage	**92.78%**

Table 11. Results of the Practicality and Effectiveness Test of Media to Students Group

Sub Variables	Sub Sub Variable	Indicator	Total Score	
			Small Group	Large Group
Media Traction	CHATBOT view	Attractiveness of frame design	31	102
		Image interest	32	103
		Interesting animation	36	101
		Back sound appeal	36	91
		Clarity of Narrator Audio	28	88
Understanding	Material Description	Clarity of the content of the material presented	36	96
		It is easy to understand the content of the material.	30	90
Technical Standards	Grammar	Use of easy-to-understand language	34	103
	Motivation	Giving a sense of fun in lessons	32	95
	Independence	Easy to use in self-paced learning	32	92
		Percentage	**82.8%**	**81.14%**

The feasibility of the media was tested based on the small and large groups, with results of 82.8% and 81.14% (Table 11), respectively, in the **Excellent category.** Based on these results, the ASIAB Chatbot media was very feasible to be used in learning without revision.

Evaluation Stage. The stage was carried out by evaluating the product based on the acquisition of validation assessment results from material and media experts. This also includes the results of filling out questionnaires from product trials and practicality and effectiveness tests. Improvements were made to chatbot products based on suggestions or comments from material and media expert's validation. Some of these suggestions include (1) it is necessary to add a bibliography, (2) revising infographics into slides to facilitate reading, (3) adjusting the background to the disaster theme, and (4) adding instructions for use. Meanwhile, there was no improvement based on the results of product trials and tests of practicality and effectiveness.
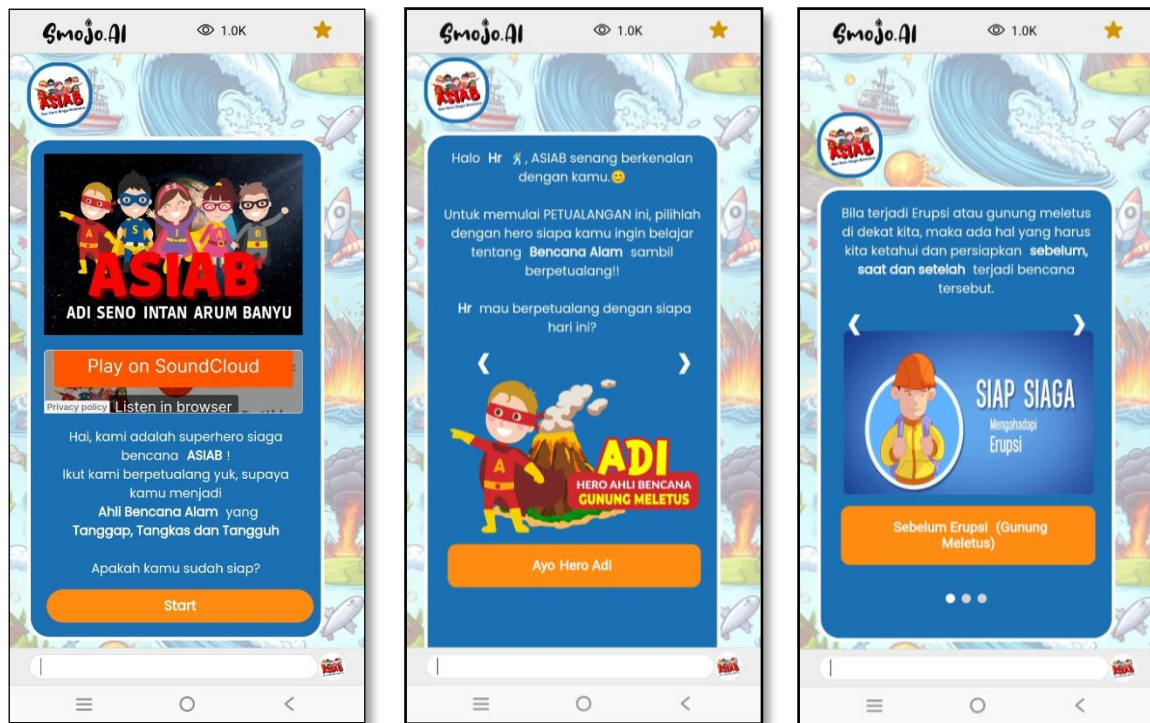

Figure 3. ASIAB Chatbot Display

The development stages resulted in ASIAB Chatbot products with categories suitable for learning natural disaster mitigation in Madrasah Ibtidaiyah. Learning media must be selected and used following the objectives, material, and characteristics of students. According to Arsyad, (2013); Barbara et al. (1994); and Syarif et al. (2024), learning media must also meet several criteria, such as relevance, readability, comprehension, attractiveness, and affordability. ASIAB chatbot has these criteria based on various tests that have been carried out. The criteria of the ASIAB Chatbot were an advantage and can support the effectiveness of self-learning, according to Thorat & Jadhav (2020); Nagarhalli et al. (2020) and Okonkwo & Ade-Ibijola (2021), thereby increasing students' understanding of the material.

The aim of disaster mitigation education in schools is to reduce risks and adverse effects by arming students with the information, awareness, and preparation to handle catastrophic situations (Annisa et al., 2022; Johnson et al., 2014). Understanding the many kinds of disasters, their origins, and their effects on both the environment and people is one of the many fundamental topics covered in this curriculum. Students also gain knowledge of prospective hazards, early warning indicators, and how to react effectively to oncoming crises (Septikasari et al., 2022).

Children were also taught preventative and mitigation tactics (Matunhay, 2022). Effective emergency response methods, such as evacuation protocols, first aid, and coordination with disaster management authorities, are also taught to the pupils. The emphasis on community participation gave students the ability to highlight possible risks, take part in mitigation activities, and work with institutions and government authorities (Widowati et al., 2021). Students gained an understanding of the importance of group action in reducing the effects of disasters by concentrating on community engagement.

Animated hero characters that depict different natural catastrophes are among the gamification aspects used by the ASIAB chatbot to offer these materials in an interactive and engaging manner. This method aimed to boost students' enthusiasm and drive to master the subject matter. Additionally, by offering consoling advice like praying, giving, volunteering, and preserving one's own health for the sake of others, the chatbot helps students to cultivate empathy for catastrophe victims in different contexts. This result is consistent with the report of Shoji et al. (2020) which showed that students who receive disaster mitigation education are more resilient in the face of trauma and exhibit a higher willingness to contribute to post-disaster recovery efforts.

Elementary schools carry out the integration of Disaster Risk Reduction (DRR) Education through several methods. First, the integration of DRR Education was incorporated into the curriculum to become an integral part of the material taught. Second, the integration of DRR Education was also incorporated into the Local Content, which includes disaster-related knowledge and skills relevant to the local area. Third, the integration of DRR Education was carried out through extracurricular activities, which became a space for students to learn and engage in activities related to disaster risk management outside of ordinary class hours. With these methods, it was hoped that DRR Education could be well integrated into the context of education in Primary Schools. ASIAB Chatbot was designed under the Islamic Elementary School/Madrasah Ibtidaiyah curriculum and can be used as digital disaster mitigation learning to be applied in synchronous or asynchronous learning. According to research results by Johnson et al. (2014), not all schools were able to implement these programs due to limited funds, human resources, and curriculum. Therefore, the existence of the ASIAB Chatbot was an effective and efficient alternative solution to become a learning medium for disaster mitigation at the technology-based Elementary School or Madrasah Ibtidaiyah level, especially for those experiencing limitations in facilities and infrastructure.

CONCLUSION

In conclusion, the chatbot product developed was interpreted as very feasible and suitable as a learning medium for disaster mitigation materials in Madrasah Ibtidaiyah. This chatbot product could help students learn more practically and interestingly, as well as covered a wide range due to online accessibility. Future research on chatbots in education could explore

various directions and extend beyond disaster mitigation to other subjects, such as math, science, language arts, or social studies, comparing effectiveness across these areas. A long-term study could examine the sustained impact and student engagement with chatbots. The demographic could extend beyond Madrasah Ibtidaiyah students to include various age groups and educational settings. Lastly, a comparative study could contrast chatbot-assisted learning with traditional methods, providing solid evidence of chatbot learning benefits.

ACKNOWLEDGMENTS

DECLARATIONS

Conflict of Interest
We declare no conflict of interest, financial or otherwise.

Ethical Approval
The research has been approved by the Research Committee of Institute of Kariman Wirayudha. All research was carried out in accordance with Institute of Kariman Wirayudha research ethics guidelines applicable when human participants are involved.

Informed Consent
On behalf of all authors, the corresponding author states that all participants have been given informed consent and agreed to take part in this study.

DATA AVAILABILITY

Data used to support the findings of this study are available from the corresponding author upon request.

REFERENCES

Annisa, M., Asrani, A., Serlinda, S., Kasih, S., & Maulana, S. (2022). Analysis of students' knowledge about natural disaster mitigation in wetland areas. *Journal of Innovation in Educational and Cultural Research*, *3*(1), 12-19. https://doi.org/10.46843/jiecr.v3i1.48

Arsyad, A. (2013). *Media Pembelajaran*. Raja Grafindo Persada.

Arthana, I. K., & Dewi, D. K. (2005). *Evaluasi Media Pembelajaran*. Teknologi Pendidikan-Universitas Negeri Surabaya.

Barbara, S. & Richey, R. C. (1994). *Instructional Technology: The Definition and Domain of the Field*. The Association for Educational Communications and Technology.

BNPB. (2022). Potensi Ancaman Bencana. Retrieved from https://bnpb.go.id/potensi-ancaman-bencana

Boné, J. M. B. (2020). Construction of a disaster-support dynamic knowledge chatbot. Thesis, ISCTE-Instituto Universitario de Lisboa (Portugal).

CFE-DM. (2021). Indonesia Disaster Management Reference Handbook (Issue December). *Center for Excellence in Disaster Management & Humanitarian Assistance*. https://doi.org/10.30875/1654f36e-es

Cunningham-Nelson, S., Boles, W., Trouton, L., & Margerison, E. (2019). A review of chatbots in education: practical steps forward. In *30th annual conference for the australasian association for engineering education (AAEE 2019): educators becoming agents of change: innovate, integrate, motivate* (pp. 299-306). Engineers Australia. https://eprints.qut.edu.au/134323/

Dewi, D. A. (2021). *Panduan Teknis Chatbot ACITA*. Retrieved from https://docplayer.info/228593067-Panduan-teknis-chatbot-acita.html

Fawaidi, A., & Krisiandi. (2022). *BPBD Ungkap Potensi Bencana di Sumenep, Angin Puting Beliung hingga Gelombang Tinggi*. Retrieved from https://surabaya.kompas.com/read/2022/10/28/212554278/bpbd-ungkap-potensi-bencana-di-sumenep-angin-puting-beliung-hingga.%0A

Hikmawati, N., Sufiyanto, M. I., & Jamilah, J. (2023). Konsep Dan Implementasi Kecerdasan Buatan (Artificial Intelligence) Dalam Manajemen Kurikulum SD/MI. *ABUYA: Jurnal Pendidikan Dasar, 1*(1), 1-16.

Johnson, V. A., Ronan, K. R., Johnston, D. M., & Peace, R. (2014). Implementing disaster preparedness education in New Zealand primary schools. *Disaster Prevention and Management: An International Journal, 23*(4), 370–380. https://doi.org/10.1108/DPM-09-2013-0151

Kastolani, W., & Mainaki, R. (2018). Does Educational Disaster Mitigation Need To Be Introduced In School? *SHS Web of Conferences, 42*, 00063. https://doi.org/10.1051/shsconf/20184200063

Matunhay, L. M. (2022). Disaster Preparedness and Sensitivity Level among Higher Education Institution Students. *International Journal of Disaster Management, 5*(2), 75-92. https://doi.org/10.24815/ijdm.v5i2.27150

Nagarhalli, T. P., Vaze, V., & Rana, N. K. (2020). A Review of Current Trends in the Development of Chatbot Systems. *6th International Conference on Advanced Computing and Communication Systems, ICACCS 2020*, 706–710. https://doi.org/10.1109/ICACCS48705.2020.9074420

Nuraini, A. S., Aeni, A. N., & Nugraha, D. (2023). Chatbot Chatbot: Materi Kenampakan Alam dan Buatan di Indonesia untuk Siswa Kelas V Sekolah Dasar. *MIMBAR PGSD Undiksha, 11*(1), 34-40. https://doi.org/10.23887/jjpgsd.v11i1.59153

Okonkwo, C. W., & Ade-Ibijola, A. (2021). Chatbots applications in education: A systematic review. *Computers and Education: Artificial Intelligence, 2*, 100033. https://doi.org/10.1016/j.caeai.2021.100033

Permana, Y. (2024). *15 Ribu Sekolah Rusak Akibat Bencana Alam, Belasan Juta Anak Terdampak*. Radar Banten, Utama. Retrieved from https://www.radarbanten.co.id/2024/04/21/15-ribu-sekolah-rusak-akibat-bencana-alam-belasan-juta-anak-terdampak/

Rahady, M. K., & Kurniawan, F. A. (2023). Kesiapsiagaan Sekolah SD Negeri 2 Sanden Kabupaten Bantul dalam menghadapi bencana alam gempabumi. *Indonesian Journal of Environment and Disaster, 2*(2), 165–177. https://doi.org/10.20961/ijed.v2i2.845

Salsabila, W. S., & Dinda, R. R. (2021). Pembelajaran Mitigasi Bencana di Sekolah Dasar dengan Metode Demonstrasi. *Proceedings Series on Social Sciences & Humanities, 1*, 115-120. https://doi.org/10.30595/pssh.v1i.83

Samarakkody, A., Senanayake, A. C., Malalgoda, C., Amaratunga, D., Haigh, R., Liyanage, C., ... & Shaw, R. (2023). Inclusivity in online and distance disaster education: A review of educators' views. *Progress in Disaster Science, 100298*. https://doi.org/10.1016/j.pdisas.2023.100298

Samodro, D. (2020). *BNPB katakan 31 persen korban bencana 2020 adalah anak-anak*. Retrieved from https://www.antaranews.com/berita/1326110/bnpb-katakan-31-persen-korban-bencana-2020-adalah-anak-anak

Selvina, O., Setyaningrum, V., & Atmaja, D. S. (2023). Pengembangan bahan ajar chatbot berbasis artificial intelligence pada materi sistem pernapasan makhluk hidup di Sekolah Dasar. *Muallimuna: Jurnal Madrasah Ibtidaiyah, 8*(2), 88–99. https://doi.org/10.31602/muallimuna.v8i1.10517

Septikasari, Z., Retnowati, H., & Wilujeng, I. (2022). Pendidikan Pencegahan dan Pengurangan Risiko Bencana (PRB) sebagai strategi ketahanan sekolah dasar dalam penanggulangan bencana. *Jurnal Ketahanan Nasional, 28*(1), 120. https://doi.org/10.22146/jkn.74412

Shoji, M., Takafuji, Y., & Harada, T. (2020). Formal education and disaster response of children: evidence from coastal villages in Indonesia. *Natural Hazards, 103*(2), 2183–2205. https://doi.org/10.1007/s11069-020-04077-7

Srivastava, S., & Kumar, R. (2022). Design and implementation of disaster management application using react-native. *Int Res J Modernization Eng Technol Sci, 4*(4), 2502-2509.

Sudjana, S. (2013). *Metode Statistika (Edisi 7)*. Tarsito.

Sugiono, S. (2015). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Alfabeta.

Syarif, E., Malik, A., Saputro, A., & Hasriyanti, H. (2024). Revolutionizing Education: Empowering Disaster Preparedness through Innovative Smart Teaching with e-Modules on FlipCreator Pro Platform. *Geosfera Indonesia, 9*(1), 56-66. https://doi.org/10.19184/geosi.v9i1.44640

Thorat, S. A., & Jadhav, V. (2020). A review on implementation issues of rule-based chatbot systems. In *Proceedings of the International Conference on Innovative Computing & Communications* (ICICC). https://doi.org/10.2139/ssrn.3567047

Unesco. (2021). AI Chatbot Training for Managing Disastersu Uganda. Retrieved from https://www.unesco.org/en/articles/ai-chatbot-training-managing-disasters-uganda

Urbanelli, A., Frisiello, A., Bruno, L., & Rossi, C. (2022). A Chatbot for citizens' awareness and engagement in disaster risk reduction. *SSRN Electronic Journal*. http://dx.doi.org/10.2139/ssrn.4510058

Warid, F. (2023). 24 desa di Sumenep Tangguh Bencana. Retrieved from https://www.rri.go.id/index.php/daerah/132135/24-desa-di-sumenep-tangguh-bencana

Widowati, E., Istiono, W., & Husodo, A. H. (2021). The development of Disaster Preparedness and Safety School model: A Confirmatory Factor Analysis. *International Journal of Disaster Risk Reduction, 53*, 102004. https://doi.org/10.1016/j.ijdrr.2020.102004

Wihyanti, R. (2020). Analisis Inovasi Pendidikan Kebencanaan di Sekolah di Indonesia. *Prosiding Seminar Nasional: Jaringan Penelitian (JARLIT) Cilacap "Menuju Cilacap 4.C (Creativity, Critical Thingking, Communication And Colaboration), 1*, 16–21.

Xue, Z., Xu, C., & Xu, X. (2023). Application of ChatGPT in natural disaster prevention and reduction. *Natural Hazards Research, 3*(3), 556–562. https://doi.org/10.1016/J.NHRES.2023.07.005