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Development of Earthquake Mitigation E-Book for Disability Student

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ABSTRACT

This study aims to describe the development of an ebook on earthquake disaster mitigation, analyze the feasibility level of an ebook on earthquake disaster mitigation, and analyze the practicality of an ebook on earthquake disaster mitigation. This development research (RnD) study uses the ADDIE development model. Teachers and students from Klaten Regency's elementary school served as research subjects. The information was gathered using a questionnaire technique. Quantitative data include feasibility and practicality validation values, which refer to a five-interval Likert scale. The data analysis technique uses quantitative descriptive methods to validate feasibility and practicality. Test the validity of the data using member checks. This study shows that the E-book Earthquake Disaster Mitigation, the Canva website designing its ebook, and the software Flip PDF Professional convert PDF into links. Through the assessments of material and media experts, the ebook obtained an average feasibility score of 90% for material experts who showed "very feasible." Meanwhile, media experts received an average score of 93.1%, indicating "very feasible based on the material, presentation, language, and graphics previously analyzed, " so the ebook is suitable. The ebook received an average practice score of 94.7% in a practitioner's test assessment of thirteen representatives of special education teachers from Klaten Regency, indicating a "very practical" result. The e-development books are tailored to the previously identified needs, making them appropriate for children with special needs.

Keywords
E-book
Disaster mitigation
Earthquake
Persons with disabilities

Introduction

Earthquakes are natural disasters caused by the elastic strain energy released by rocks in the lithosphere. The greater the amount of energy released, the stronger the earthquake. Earthquakes are common in Indonesia. Due to Indonesia's geographical location is traversed by three major tectonic plate confluences, including the Indo-Australian Plate, the Eurasian Plate, and the Pacific Plate, making Indonesia prone to earthquakes. Indonesia is a seismically active region, with 3,486 earthquakes measuring more than 6.0 on the Richter scale between 1976 and 2006 [1]. Another factor is Indonesia's large number of active volcanoes. In Indonesia, there are 129 volcanoes [2]. Because the ring of fire traverses Indonesia, the country is riddled with volcanoes. Because of the ring of fire, several areas near the mountain may be affected by earthquakes caused by volcanic activity. The Klaten Regency area is one of those areas.

The Klaten Regency area is prone to earthquakes due to plate tectonics, and it is also prone to volcanic disasters due to its proximity to Mount Merapi. Ganwarno is one of the Klaten Regency sub-districts frequently affected by earthquakes. Klaten's location on an active fault and close to a volcano, Gantiwarno, is commonly affected by volcanic eruptions and earthquakes. According to history, the earthquake in 2006 was the worst disaster in the Klaten Regency area. The disaster claimed the lives of 1,064 people and injured.

Aside from the victims who died, the earthquake caused significant property damage, including damage to homes, schools, and businesses and triggering landslides, fires, and traffic accidents. Klaten Regency has a population of 1,260,506 people, according to the Central Bureau of Statistics [3] results of the 2020 Population Census, with 627,600 men and 632,906 women. According to the Regulation of the Regent of Klaten Number 28 of 2016, the high risk of disaster in the Klaten Regency area endangers human life, particularly in disaster-prone groups. Persons with disabilities are one of the vulnerable groups that are under threat.

According to the Law of the Republic of Indonesia No. 19 of 2011 on the Ratification of the Rights of Persons with Disabilities, a disability is defined as a person who has physical, mental, intellectual, or sensory limitations for an extended period, making it difficult to interact with the environment and attitudes of society, making it difficult to participate fully and effectively on an equal rights basis. Because of the difficulties encountered, the disaster risk is exceptionally high. According to BPS data, there are currently 2,808 people in Klaten Regency

who have three disabilities, which include physical disabilities, visual disabilities, mental disabilities, deaf disabilities, and multiple disabilities. People with disabilities are at high risk when a disaster occurs due to their physical limitations and abilities and limited access to the physical environment, information, and communication in society.

Efforts to reduce casualties, specifically the presence of disaster management. Disaster mitigation is an essential component of disaster management. According to Article 1 point 9 of the Law of the Republic of Indonesia Number 24 of 2007, mitigation is a series of efforts that can be made to reduce disaster risk, both through physical development and awareness, as well as increased capacity to face disaster threats [4]. To reduce the risk of earthquakes, the general public and vulnerable groups, particularly people with disabilities, can engage in mitigation.

Ref. [5] revealed that in October 2012, it established a Disaster Risk Reduction (DRR) network with six other organizations for disaster prevention and risk reduction. This network also requests that people with disabilities participate in efforts to prevent and reduce disaster risk to make disaster-prone communities more resilient. To get to this point in the policy-making process, working groups empower people with disabilities and ensure. In this regard, the government is implementing Disaster Risk Reduction (DRR) policies for people with disabilities. This policy is outlined in Klaten Regency Regional Regulation Number 2 of 2011, which addresses the equality, independence, and well-being of people with disabilities. Problems were discovered while implementing this policy: recipients of DRR materials needed help understanding how to access the materials. According to the National Consortium on Rights for Disabled People [6], there are six issues: disability-sensitive disaster preparedness programs have not been maximized; minimal participation of persons with disabilities in disaster risk reduction (DRR) education; materials or teaching materials in DRR learning are inaccessible to persons with disabilities; persons with disabilities delay in self-rescue; and specific data collection.

To address the issue of inadequate DRR education and material accessibility, the Klaten government issued a Disaster Learning Guide in the Klaten Regency, as stated in Klaten Regent Regulation 6 of 2014 [7]. COVID-19's existence has caused many changes, one of which is in the learning system, which is e-learning. Not only is e-learning used, but learning is also tailored to the age of the students, such as by creating interactive and enjoyable learning media. According to what happened in the field, learning is more experience-based, monotonous, and does not use existing technology. It is consistent with Ref. [8], who states that the problem in learning is a need for more teacher preparation and education in learning management, so educators use experience-based, immersive, and action-oriented activities. There are

numerous techniques for conveying enjoyable and non-monotonous learning, such as using media, games, books, and songs tailored to students' needs.

Ref. [9] demonstrated with a score of 89.84% that integrating thematic teaching materials with ebook media is feasible in building elementary school students' multicultural knowledge. According to Ref. [10], the developed book on earthquake disaster mitigation has exciting and informative pictures; the language used is short, clear, and easy to understand; this book provides knowledge and motivation for children to be ready and prepared for disasters.

According to Ref. [11], 100% of students and 98.30% of teachers chose the need to develop an earthquake disaster mitigation ebook for children with disabilities in their needs analysis. As a result, the researchers created an earthquake disaster mitigation ebook for primary school-aged children with disabilities. According to Ref. [12], developing a risk reduction program that considers the unique needs of people with disabilities requires using accessible media for people with disabilities, depending on the type of disability. Based on the problems described, a teaching material that assists persons with disabilities in elementary schools in accessing and understanding earthquake disaster mitigation material for DRR education that will benefit persons with disabilities in primary schools is required.

Literature Review

A. E-Book Development

Books reinforce educators' teachings and motivate student learning [13]. Teaching materials aim to enhance students' competencies sequentially. Ebooks, digital versions of written books, also encompass learning databases [14]. Ebooks present digital information, including text, images, audio, and video. They typically include sections like introduction, body, and conclusion, covering elements such as title pages, tables of contents, and figure lists. E-contents comprise core competencies, materials, videos, practice questions, and competency tests. The last section includes a glossary, bibliography, index, and attachments [15]. Interactive media for earthquake disasters, developed by Ref. [16], received positive validation. However, it needs more outreach to students with special needs. Ref. [17] research suggests that developing ebooks enhances students' authoritarian attitudes, resulting in effective outcomes. Ref. [18] study reveals improved learning outcomes through ebooks based on message design principles. The experimental class demonstrated higher N-gain than the control class, indicating superior learning in volcano disaster mitigation. Ref. [19] asserts that picture storybooks effectively teach elementary students about mitigation. A study by Ref. [11] highlights the necessity of an earthquake disaster mitigation ebook for children with disabilities in Klaten, with high agreement among students and teachers.

B. Disabilities

The inability of humans to do something correctly is generally defined as a disability. According to the World Health Organization, disability is the inability to perform an activity or set of activities as an average person would. This would occur due to conditions of loss or disability, including psychological, physiological, and anatomical structure or function loss [20]. Physical disabilities, mental disabilities, intellectual disabilities, sensory disabilities, and developmental disabilities are examples of disabilities [21]. Researchers will concentrate on people with physical disabilities, such as the deaf/speech, blind, and quadriplegic, in this study. This is because ebook development is constrained by its users, precisely the three types of physical disabilities.

C. Earthquake Disaster Mitigation

Disaster mitigation is a life skill for students whose homes are prone to disasters [19]. As a result, disaster mitigation is a requirement that is met based on the student's circumstances. An earthquake occurs when the earth shakes due to plate collisions, fault activity (fault), volcanic activity, or rock debris. Ref. [22] defines earthquake disaster mitigation as "efforts to reduce the effects of earthquakes."

Methods

A. Contexts

This study took the form of development research or R&D (Research and Development), intending to produce an ebook on Earthquake Disaster Mitigation learning in SLB across Klaten Regency. Ref. [23] defines R&D research as the discovery, development, and validation of products developed through research stages. The Earthquake Disaster Mitigation E-book for Children with Disabilities developed in this study is an electronic book for earthquake disaster mitigation material based on technological development. Validation by expert validators (lecturers who are experts in their fields) and practitioner validators can determine the level of eligibility (disability school teachers). Finally, after testing, the product can be applied or applied through research application.

The research uses the R&D or research and development types, with the development model through the ADDIE stages developed by Ref. [24] for the ADDIE Stage, including analysis, design, development, implementation, and evaluation.

B. Participant

The Earthquake Disaster Mitigation E-book for Children with Disabilities was researched and developed in 13 special schools in Klaten Regency. Students from 13 Klaten special schools were sampled for research to collect data for producing the Earthquake Disaster Mitigation E-book for Children with Disabilities.

C. Data Analysis

This formula is used to calculate the average value.

$$y:X= (\sum x)/(\sum xmax) \times 100\% \quad (1)$$

Remark: X = average value, $\sum x$ = total value, $\sum x$ max = maximum number

After obtaining the average value, the results of the quantitative descriptive analysis were converted into qualitative data using the eligibility criteria table according to Ref. [25] in Table 1 below.

Table 1. Product Validity Level Criteria

Score Percentage	Level of validity
81.0 % - 100.0 %	Very worth it
61.0 % - 80.0 %	Worthy
41.0 % - 60.0 %	Currently
21.0 % - 40.0 %	Not feasible
0.0 % - 20.0 %	Very unworthy

Results

The E-book, exported from the Canva website, includes a cover, preface, table of contents, instructions for use, character introduction, materials, quizzes, evaluation, bibliography, and author's biodata. The ebook is designed to be disability-friendly as a development aid by supplementing sign language audio and video modes. It is loaded to allow students to comprehend earthquake disaster mitigation material. Figure 5 shows a display of E-book products.

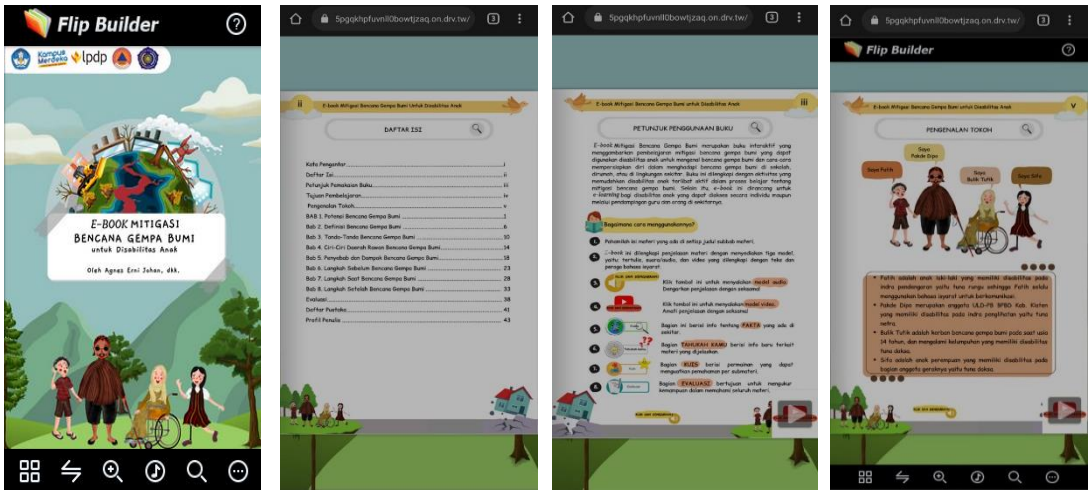

Fig. 1. Display of E-Book Products

Figure 1 depicts the book's preface, which includes the cover, table of contents, usage instructions, and character introductions. The characters of this book are displayed on the cover as one big family. The first character is Uncle Dipo, who has a visual impairment; the second is Aunt Tutik, who has a disability caused by the 2006 earthquake; the third is Fatih,

who has a hearing disability; and the final is Syifa, a disabled girl. The table of contents and instructions for use are also included in the preface and explain the completeness of the ebook with sign language sound and video facilities.

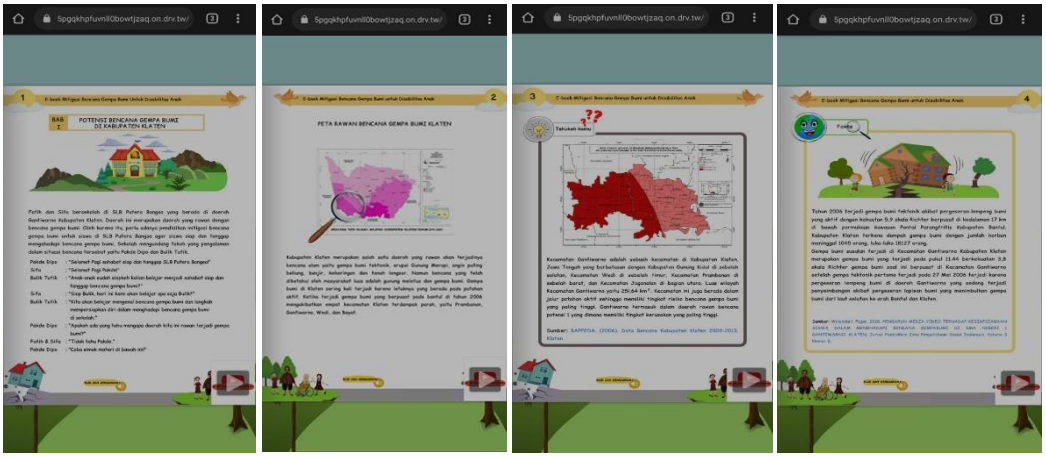

Fig. 2. E-book presentation of earthquake material

Earthquake material includes theories about earthquakes, their causes, and mitigation. The earthquake material discussion is contextually based and delivered in a communicative and interactive.

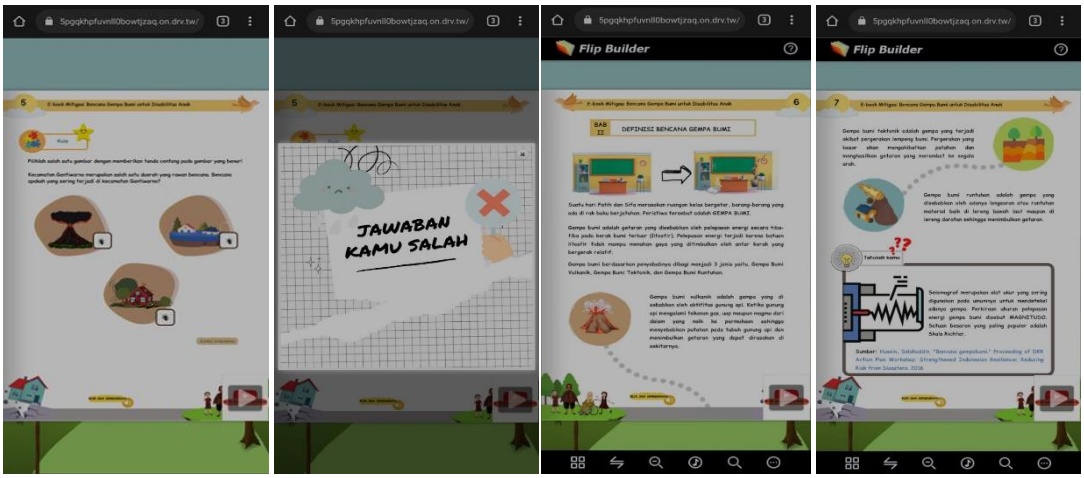

Fig. 3. Presentation of Enrichment and Assessment

This ebook is enriched with the facts of a phenomenon and knowledge updates from the news or other books. The evaluation comprises quizzes, individual activities, group activities, and evaluation questions. This ebook is enriched with the facts of a phenomenon and knowledge updates from the news or other books. The evaluation comprises quizzes, individual activities, group activities, and evaluation questions.

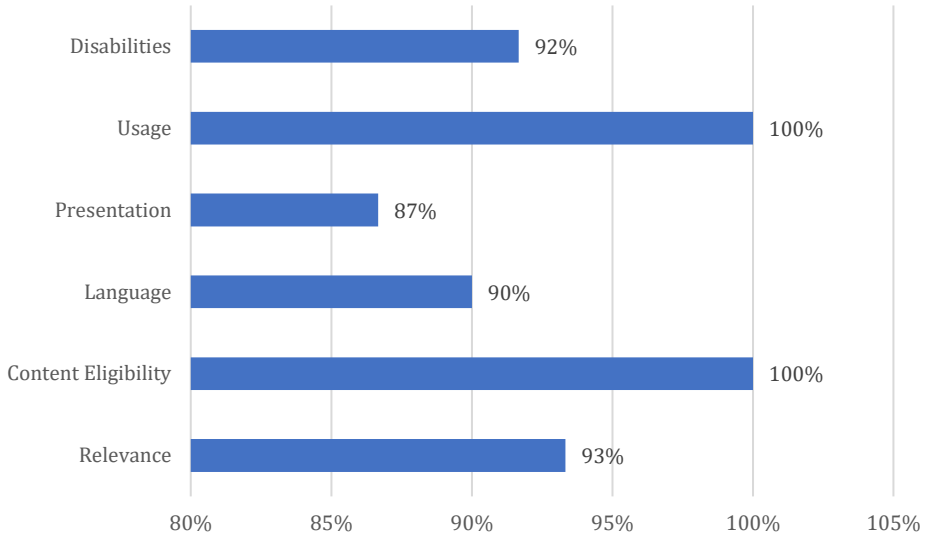

Fig. 4. Material Expert Validation Result

The results of the expert material validation revealed that usage and content eligibility received a score of 100%, followed by the elements of relevance, disabilities, and all aspects of the presentation at 87%. Overall, the expert validation results indicated that it was very valid.

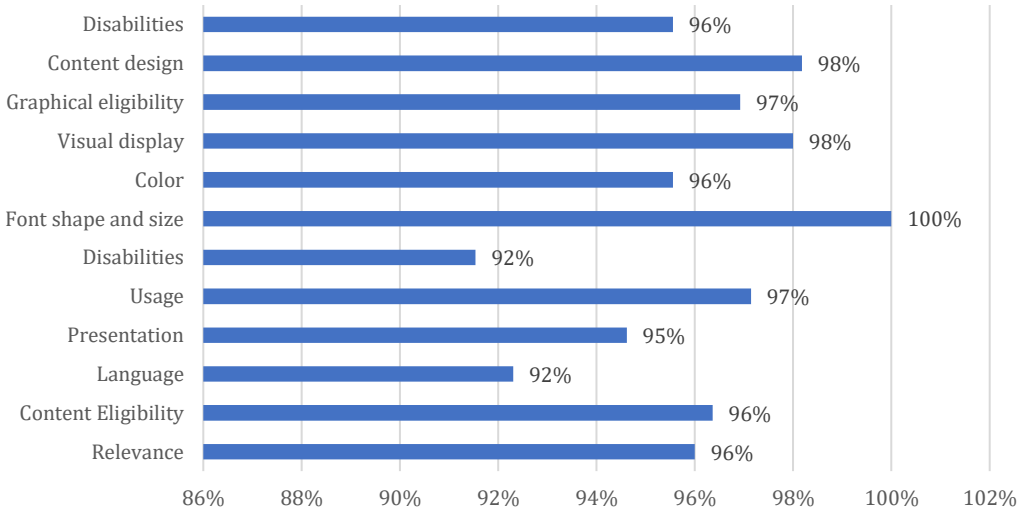

Fig. 5. Teacher Validation Result

Figure 5 shows teacher validation results, which indicate that the e-book product is in the very worth it category because it ranges between 81% to 100% in all aspects, including content design, visual display, font shape and size, usage, language, and relevance as shown di figure 5 above.

Discussion

The e-book is outlined as a link for reference in IT-based learning in elementary and special schools. It makes it easier for students and educators to use the ebook anytime from

any location. This ebook teaching material is packaged as a link that Android smartphones and PCs connected to the internet network can access. The cover, preface, table of contents, instructions for using the book, learning objectives, and introduction to characters comprise the first section of the ebook.

The e-contents book includes eight materials: the potential for earthquake disasters in Klaten Regency, the definition of an earthquake disaster, signs of an earthquake disaster, characteristics of earthquake-prone areas, actions before an earthquake occurs, actions when a disaster occurs, earthquakes, and earthquake disasters. Each chapter of the book contains facts, trivia, and quizzes. The facts in this ebook describe events or things that occur in the environment surrounding students. Do you know how to share new information discovered by students? Both are capable of generating meaningful learning situations. According to Ref. [26], contextual learning can connect students' knowledge and its application in everyday life.

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All information related to events in the environment around students is educational. Furthermore, there are quizzes in each material to keep students from becoming fixated on the material. After they receive the material, they will be confronted with quizzes to reinforce their understanding. The presence of quizzes transforms ebook products into an interactive medium. In other words, students can learn by discovering and exploring their knowledge. It is consistent with Ref. [27] finding that interactive ebooks are practical in the learning process, with a 30% cognitive value to 70% psychomotor value, indicating that the average student learning outcome exceeds the learning completion criteria. Ref. [28] emphasized that disaster mitigation programs packaged with interactive models impact students and the community's understanding and attitudes toward preventing natural disasters and what can be done when these disasters occur. Learning experiences, such as the ability to collaborate, communicate, and interpret an event, can be provided by interactive models.

The final section of this ebook includes an evaluation, bibliography, and author biodata. The e-book was developed to make it easier for students to understand earthquake disaster

mitigation material with updates compared to existing ones, including factual information, three modes (text, audio, video), and adaptation to the needs of persons with disabilities. The Earthquake Disaster Mitigation E-book for Children with Disabilities is a teaching tool for online and offline learning. This product's development aims to make earthquake disaster mitigation material more accessible and more manageable for students with disabilities in primary school to understand. According to Ref. [11] research, 100% of students and 98.30% of teachers agreed that an earthquake disaster mitigation ebook was necessary. Furthermore, this development is a researcher's effort to assist the Klaten Regency government in reducing the threat of victims due to the Klaten earthquake disaster, particularly for people with disabilities. The development of the Earthquake Disaster Mitigation E-book for Children with Disabilities is packaged in terms of material adapted to some of the essential competencies of the disaster curriculum in the Klaten Regency disaster guide for elementary schools, which was approved by the Klaten Regency Government [7].

The ebook is designed to be attractive and adapted to the needs of students with disabilities so that students can easily understand earthquake disaster mitigation material that the ebook can use to motivate students to learn. It is in line with the opinion of Ref. [13] that educators need to use exciting teaching materials to encourage students to learn. One of the attractivenesses of this ebook is the existence of illustrations and pictures that support the material so that students can more easily understand it.

The development of this E-book in terms of media is very concerned with visual appearances, such as images. Pictures can motivate students, as Ref. [13] stated. Ref. [29] supports that picture books are essential for acquiring new vocabulary, understanding concepts, and providing student media lessons. It is confirmed by Ref. [18] that pictures are the fastest method for gaining understanding.

Providing illustrations that describe events in their surroundings and language that is simple to understand demonstrates that the product is capable of concretizing students' understanding of the lesson. It is supported by Piaget's learning theory, which states that between the ages of 7 and 12, elementary school-aged children enter the concrete operational stage. At this stage, the child can think logically about something substantial. Adapting to children's abilities and development needs is also essential in learning, particularly for disabled children. According to Ref. [30], the learning process is successful if carried out following the stages of student development.

This ebook was created as an interactive teaching tool so that students can use it independently or with the assistance of others. According to Ref. [31], ebooks can increase student independence in learning by 80% on average. The availability of three ebook modes,

including text, audio, and video, can help students with disabilities use ebooks independently and according to their needs.

The material in the ebook is based on the Klaten Regency disaster guide and is aligned with students' essential competencies. Furthermore, the material's preparation is tailored to the needs of students with disabilities, as has been done in previous research, to ensure that the disaster mitigation material's contents are appropriate. Ref. [32] stated that in the development of the ebook, the content suitability aspect obtained an average value of 96.67%, which is said to be very valid in terms of content because the product developed is based on the applicable curriculum, the correct theory, and the material presented according to the range of students. The language used is simple to understand, avoids double meanings, employs Enhanced Indonesian Spelling rules, and is age-appropriate so that children can easily understand the material in the ebook. It is consistent with Ref. [33], who discovered that when writing material and selecting diction, it is critical to ensure that elementary school students easily understand it. The presentation of quiz questions about disaster-prone environments can help students with disabilities strengthen their learning materials and objectives. The material is prepared to be interesting and helpful to the participants using the ebook independently and for children who learn quickly or slowly. Appropriate sign language, clear articulation, and intonation can make this ebook disability-friendly, attracting interest and assisting children with disabilities in learning independently.

In terms of size, type, and text placement, the developed letter designs follow the needs of students with disabilities. Ref. [32] strengthens it by stating that in the feasibility aspect of presenting the ebook, an average score of 98.61% is obtained, which means it is valid. Good presentation means fulfilling the requirements in constructing sentences and using symbols. The colors used in each design are chosen based on the preferences of students with disabilities. The images used are adjusted for attractiveness, placement, and adaptation to the ebook cover. The illustrations used are proportional. In their research, Ref. [19] validated the development of picture books with media validity results of 86.90 in material and 85.33. Both values are included in the outstanding category because the storybooks developed are excellent and exciting, and the language used is easy for students to understand; storybooks can make students excited and enthusiastic; storybooks motivate them to learn; story books are appropriate for disaster-prone school environments. The content design is packaged according to the needs of students, from layout, paragraphs, placement of illustrations, and placement of titles adjusted so that it does not interfere with students' understanding of the material.

Furthermore, the audio and video quality is straightforward for students with disabilities, which motivates students to learn. The criteria for clear audio must be met. According to Ref. [34], there are criteria for audio media that must have related elements, such as the language used is easy to understand, short, and innovative. Applying these criteria results in audio media assisting blind children in learning. The development of audio media can aid blind students in their education because it is tailored to the elements that audio media must include. Based on the twelve aspects of assessment by the teacher, it shows that the strength of the ebook is the compatibility between the ebook and the needs of ebook users so that the finished product can meet the needs of students. Ebooks help people with disabilities easily understand earthquake disaster mitigation material.

Conclusion

The product developed in this research and development is called the Earthquake Disaster Mitigation E-book for Children with Disabilities, which is packaged as a link that can be used to study earthquake disaster mitigation materials. This ebook was developed with the help of the Canva website and the Flip PDF Professional software. The ebook can be accessed by smartphones and PCs connected to the internet network, which contains several display components: cover, preface, table of contents, instructions for using the book, learning objectives, character introduction, materials, quizzes, evaluation, bibliography, and author bio. There are eight complete material offerings with text mode, audio mode, video mode, quizzes, and information around. The ebook was developed in text, audio, and video modes, making it easier for people with disabilities to understand earthquake disaster mitigation material.

The product validation results of the Earthquake Disaster Mitigation E-book for Children with Disabilities were stated to be very valid regarding material and media. The average obtained in terms of material is 90.09% in terms of material. The average obtained in terms of media is 88.97%. Development that follows the needs of students with disabilities is the strength of this ebook, both in preparing the material and its suitability with the Klaten District disaster curriculum and learning objectives. In addition, the development of this ebook has integrated text, audio, and video modes that are disability-friendly, starting from the cover, contents, and illustrations to the cover.

The practical results were obtained through a limited trial of the Earthquake Disaster Mitigation E-book product for Children with Disabilities, carried out by thirteen teachers representing SLB throughout the District. Klaten shows an average value of 93.82%. These results show "very practical" results when interpreted into qualitative data. Based on the practicality test results, the Earthquake Disaster Mitigation E-book product for Children with

Disabilities is practical and ready to be implemented in learning about earthquake disaster mitigation for children of primary school age.

Limitations and Implications

The development of the Earthquake Disaster Mitigation E-book for Children with Disabilities faces certain limitations, including dependence on internet connectivity for access, challenges in creating user-friendly features for the blind, accessibility for specific disabilities (deaf/speech, blind, and quadriplegic), and limited outreach efforts. In terms of implications for research and development:

- The E-book, tailored for primary school-aged children with disabilities, serves as a valuable resource for educators delivering Disaster Risk Education, aiding the government in mitigating the impact of earthquake threats on vulnerable populations.
- With adaptability for both distance and face-to-face learning, the E-book can be accessed through smartphones and PCs with internet connectivity.
- Prepared for implementation in various Special Schools across the Klaten Regency, the E-book contributes to widespread accessibility.
- Targeting primary school-aged children with disabilities, the E-book represents an innovative approach to Disaster Risk Education, aligning with the evolving needs of disabled children and technological advancements.

Conflict of Interest

There is no conflict of interest.

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