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Development of Encyclopedia-Based Natural Disaster Mitigation Teaching Material Supplements in Geography Learning in Senior High School

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Abstract

The objectives of this study are (1) to develop encyclopedia-based natural disaster mitigation teaching material supplements in geography learning in Senior High School, (2) to measure the level of validity of encyclopedia-based natural disaster mitigation teaching material development in geography learning in Senior High School, and (3) to measure the level of practicality of encyclopedia-based natural disaster mitigation teaching material development in geography learning in Senior High School. This research is a type of research and development (R&D). The model used is the ADDIE model with five stages namely analysis, design, development, implementation and evaluation. The instruments used in this research are product validity and practicality instruments. The results of this study are 1) products that are declared valid based on product validity tests conducted by 3 expert validators namely; learning design experts, material / content experts, and linguists with an average assessment score from the three validators of 4, 74 and are in the valid category, 2) products that are declared practical based on product practicality tests conducted by 14 test subjects namely students in class XII SMA Negeri 3 Takalar and 1 practitioner namely geography subject teacher with a percentage of assessment response of 86%. Thus it can be concluded that the encyclopedia-based natural disaster mitigation teaching materials developed are valid and practical. Natural disaster mitigation teaching materials that have been declared valid and practical can then be used in learning geography in high schools, especially on natural disaster mitigation material.

Keywords: Encyclopedia teaching materials, natural disaster mitigation.

1. Introduction

Indonesia is an archipelago with a very high potential for natural disasters, especially earthquakes, volcanic eruptions and tsunamis, because it is located at the confluence of three earth plates (Suryaningsih, 2017). In addition, Indonesia is also often affected by natural disasters caused by climate change. The impact of climate change is widely felt because it occurs in various sectors covering various aspects of life, including agriculture, infrastructure, forestry, health, transportation, tourism, energy and social. Potential disasters related to climate change also occupy almost 80% of the various natural disasters in the world (Sultonulhuda, et al., 2013; Goma et al., 2022). The potential losses caused by these disasters can be reduced through mitigation. Nursaban, et al. (2010) explained that mitigation is defined as an effort to reduce and prevent the risk of loss of life and property through both structural and non-structural approaches. Sugiharyanto, et al. (2014). Nonstructural mitigation is a non-physical disaster risk reduction effort such as policy, community empowerment and involvement, institutional strengthening, and awareness.

Community involvement in disaster mitigation efforts needs to be carried out in the form of providing knowledge, understanding, preparedness and skills to the community, both for the school community and the wider community. This community empowerment is carried out to prevent, detect and anticipate earlier about various kinds of disasters, especially in places that are prone to disasters. School community involvement in the form of empowering students can be done by integrating knowledge about disaster mitigation in learning, especially Geography social studies

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learning. The form of integration can be in the form of integrating the disaster curriculum in the geography learning curriculum accompanied by the provision of learning resources on disaster mitigation.

In order to find out the needs of students, initial observations were made at SMA Negeri 3 Takalar. The results of the survey conducted through interviews with Geography teachers in February 2023 found the facts that; (1) students' knowledge of disasters and disaster mitigation is still limited to the types of disasters and there is no more detailed explanation of what form of mitigation, (2) the teaching materials used are package books, and students are also free to use other books and sometimes access the internet to find materials using the internet and sometimes use LKPD, (3) The weaknesses of the teaching materials used so far are too theoretical, and not too contextual, such as disasters that are presented too generally so that students do not understand their relevance to the daily lives of students. (4) Students are less motivated by the teaching materials available because they are less interesting because the book is still mostly dominated by text.

The achievement of learning objectives can take place effectively and efficiently if supported by the existence of learning resources for students such as student supplement books. student supplement books are books that complement the weaknesses of the main book or books that assist in the teaching and learning process, because in the main book, not all subject matter can be contained so it is necessary to have a supporting book that can facilitate understanding of student concepts so that learning objectives can be achieved optimally (Ariffudin, 2011; Hasriyanti, 2019; Pratiwi et al., 2021; Syarif et al., 2023).

Learner supplement books as an important component to improve learning motivation and student learning outcomes and have enormous benefits including; providing direct and concrete learning experiences to learners, providing accurate and up-to-date information, and providing positive motivation if properly organized and planned for utilization (Rena, 2014).

Based on material analysis conducted by analyzing the content standards of Geography subjects in high school, it was found that one of the basic competencies that must be possessed by class XI students is the cognitive basic competency 3.7 Analyze the types and management of natural disasters through education, local wisdom, and the use of modern technology and basic competency 4.7 Make sketches, plans, and / or maps of potential disasters in the local area and disaster mitigation strategies based on the m¹² (Ministry of Education and Culture, 2013). To achieve these basic competencies, it is considered appropriate to develop teaching material supplements in the form of encyclopedias that allow teachers and students to use them as learning resources in which there are explanations related to the subject matter that needs to be conveyed. the subject matter in question is Natural Disaster Mitigation (Types and characteristics of natural disasters, Disaster management cycle, Distribution of natural disaster prone areas in Indonesia, Institutions that play a role in natural disaster management, Community participation in natural disaster mitigation in Indonesia).

2. Research Method and Materials

This research is a development research (Research and Development). The research will be conducted in April 2023 at SMA Negeri 3 Takalar. The development³ of encyclopedia-based natural disaster mitigation teaching material supplements in geography learning refers to the ADDIE development model. This model consists of five main stages, namely: (1) analyze, (2) design, (3) development, (4) implementation, and (5) evaluation (Branch, 2009). The test subjects in this study were students of class XII SMA Negeri 3 Takalar consisting of 14 students and 1 geography teacher of SMA Negeri 3 Takalar. Research instruments are tools used to obtain data during research. The research instruments used are validity and practicality instruments. The data analysis technique used to process data on the results of the development of encyclopedia-based natural disaster mitigation teaching material supplements in geography learning, namely by using descriptive analysis which refers to (Sugiyono, 2010). This analysis is used to process data obtained in the form of analysis of research questionnaire criteria scores, which use a Likert scale. Assessment of encyclopedia-based natural disaster mitigation teaching material supplements, the data analysis technique used in this research is descriptive analysis, namely by calculating the average score of each assessment aspect contained in the validation sheet. The practicality of encyclopedia-based natural disaster mitigation teaching material supplements is measured based on the assessment results from students and geography subject teachers at SMA Negeri 3 Takalar.

3. Results and Discussion

The development of teaching material supplements uses an educational product development model developed by Branch (2009), namely the ADDIE model. This model refers to the stages carried out in the product development process, namely *Analysis, Design, Development, Implementation, and Evaluation*. This model is very suitable for use in developing a teaching material supplement, the development stages are more detailed, simple, clear and dynamic.

Analysis is the first stage in product development with the ADDIE model. Analysis is a stage of analyzing existing problems in the field, needs analysis, task analysis for the product development process. The problem in the field is the limited teaching materials that can be used by teachers and students as a reference in the geography learning process on natural disaster mitigation material. Sometimes students find it difficult to accept the material provided by the teacher if the teacher only provides an illustration or shadow of the material content being studied. Teachers are also difficult to provide an overview to students about the content of the material being studied due to the limitations of relevant and practical textbooks as a teacher's guide. Natural disaster mitigation material is material that has a high level of difficulty because the material content presented should be equipped with several images or illustrations that can be seen directly by students.

Based on the results of the analysis, it can be found that the problem in the field is the limited handbooks for teachers and students that can be used as teaching materials in the geography learning process. Reference books such as encyclopedias are suitable teaching material supplements to meet the needs of teachers and students in supporting the geography learning process of natural disaster mitigation material. The prototype which is the output and this research is a teaching material supplement in printed form. This is in line with Abdul (2008) that teaching material supplements are in an unlimited form whether in the form of print, video, soft instruments, or a combination of several forms that can be used by students and teachers. The teaching material supplement product is a reference book that combines textbooks and encyclopedias, the prototype in this study is named the Natural Disaster Mitigation Encyclopedia.

Based on the results of problem analysis, researchers can determine the characteristics of natural disaster mitigation encyclopedia. Furthermore, a needs analysis was carried out to prepare everything needed in the process of developing a natural disaster mitigation encyclopedia. The needs in the development of natural disaster mitigation encyclopedia are assessment instruments, natural disaster mitigation encyclopedia design and natural disaster mitigation encyclopedia material. The results of the analysis of the natural disaster mitigation encyclopedia design according to Table 4 are the structure of the natural disaster mitigation encyclopedia made in accordance with the method of making reference books. The structure of the natural disaster mitigation encyclopedia consists of a cover, title page, book identity, preface, table of contents, contents, bibliography, and biography. Layout and graphic design are made as attractive as possible using the Coreldraw X7 application. The results of the material analysis of the natural disaster mitigation encyclopedia are in accordance with the preparation of the material in the natural disaster mitigation encyclopedia referring to the syllabus of Permendikbud No.24 of 2016. The material content to be studied consists of material about the definition and concept of disaster mitigation, types of natural disasters and the mitigation process in dealing with disasters, as well as the importance of disaster potential maps as one of the strategies in reducing the risk and impact of natural disasters.

Furthermore, the researchers conducted a task analysis to create a natural disaster mitigation encyclopedia. The results of the task analysis are work procedures and instrument making and the making of a natural disaster mitigation encyclopedia. Instrument making consists of steps namely instrument making, instrument determination, target determination, goal determination, determination of assessment indicators, determination of statement items, preparation, revision and evaluation. The work procedure for making a natural disaster mitigation encyclopedia consists of 6 work steps, namely *installation, preparation, editing, inserting, converting and finishing*.

Design is the second stage after conducting the analysis stage. The design stage is known as the design stage. Researchers made a design (*blue print*) of the instrument and natural disaster mitigation encyclopedia, researchers made the design in accordance with the characteristics of the product that became the needs of students in the learning process. Researchers also designed the natural disaster mitigation encyclopedia assessment instrument. Association of American Publishers (APP) (2012) revealed that teaching materials must meet the quality of content and attractive design. Therefore, the focus of the design in the development of natural disaster mitigation teaching material supplements is in terms of design and material for natural disaster mitigation teaching material supplements. As a support to assess the prototype 1 produced, a research instrument is needed so that a design is needed for the

instrument that will be used to assess the natural disaster mitigation encyclopedia. The *output* in the design stage is an assessment instrument and prototype 1, namely a natural disaster mitigation encyclopedia in book form.

Based on the results of the research, it shows that the validation of the products developed has the following values:

Table 1. Data on Validation Results for Prototype 1 Learning Design Aspects

No.	Aspects	Score	Category
1.	Completeness of Assessment	3.66	Moderately Valid
2.	Feasibility of Graphics	3.91	Moderately Valid
Average		3.78	Moderately Valid

The results in Table 1 show that the data validation results for the prototype 1 aspect of learning design have an average score of 3.78 with a moderately valid category. The validation results for prototype 1 aspects of the material/content are in table 2.

Table 2. Data on the Results of Validation of Prototype 1 Aspects of Material / Content

No.	Aspects	Score	Category
1.	Completeness of material	5	Highly Valid
2.	Breadth of material	4.5	Valid
3.	Depth of material	4	Valid
4.	Accuracy and correctness of the material	5	Highly Valid
5.	Principle accuracy	5	Highly Valid
6.	Accuracy of examples, facts, and illustrations	4	Valid
7.	Compliance with the development of science and technology	5	Highly Valid
8.	Current features, examples, and references	5	Highly Valid
9.	Linkages between concepts	4	Valid
10.	Enrichment	3	Moderately Valid
Average		4.45	Valid

The score in table 2 shows that the validation of prototype 1 on the material/content aspect is in table 2, which is 4.45 with a valid category.

Table 3. Data on the Results of Validation of Prototype 1 Language Aspects

No.	Aspects	Score	Category
1.	Conformity with language rules	4	Valid
2.	Consistency of paragraph structure	4	Valid
3.	Translation digestibility	3.75	Moderately Valid
4.	Coherence and connectedness of thought	4	Valid
5.	Conformity with correct Indonesian language	3.66	Moderately Valid
Average		3.88	Moderately Valid

The results in table 3 show that the validation data on prototype 1 of the linguistic aspect has a score of 3.88 in the valid category.

Table 4. Summary of Prototype 1 Validation Results Data

No.	Aspects	Score	Category
1.	Design of teaching materials	3.78	Moderately Valid
2.	Material/content of teaching materials	4.45	Valid
3.	Language of teaching materials	3.88	Moderately Valid
Average		4.03	Valid

The score in table 4 shows that the summary of the data validation results of prototype 1 with categories and a valid average score of 4.03.

There are two assessment instruments used, namely product assessment instruments used to assess product validity, and product practicality assessment instruments used to assess the practicality of natural disaster mitigation teaching material supplements. The targets of the research instruments are expert lecturers to assess research instruments, expert lecturers in the field of learning design to assess the learning design of natural disaster mitigation teaching material supplements, expert lecturers in the field of material to assess the material of natural disaster mitigation teaching material supplements, linguist lecturers to assess grammar in the design of natural disaster mitigation teaching material supplements, and trial subjects namely students of class XII SMA Negeri 3 Takalar and practitioners namely geography teachers who teach in class XII SMAN 1 Takalar.

Making natural disaster mitigation teaching material supplements through 5 work steps, namely *installation, preparation, editing, inserting, converting and finishing*. Installation is the process of installing the application used to create teaching material supplements for natural disaster mitigation. The applications installed according to Table 1 are Coreldraw X7 to design layouts and organize the layout of images, illustrations and materials. Photoshop to edit images and illustrations, Microsoft Publisher to organize the structure of the natural disaster mitigation encyclopedia and Adobe Reader to convert natural disaster mitigation encyclopedia files from JPG format to PDF format. The result of the installation is that all applications are installed properly and ready to use. *Preparation* is the process of preparing everything needed. The information needed in the preparation process is in accordance with the material, articles, data, images and illustrations. *Editing* is the process of editing all natural disaster mitigation encyclopedia content. The content of the natural disaster mitigation encyclopedia that is edited is layout, images, and illustrations. *Inserting* is the process of inserting material, layouts, and illustrations that have been edited. The result of the inserting process is all the content in the encyclopedia in JPG form. *Converting* is the process of combining all the content that has been produced at the *inserting* stage in PDF format. The result in the finishing stage is prototype 1, which is a natural disaster mitigation encyclopedia in printed form.

Development is the stage of developing natural disaster mitigation encyclopedia products based on the design that has been made. Subsequently, validation of prototype 1 was carried out. Validation 1 is the process of assessing the validity of prototype 1. Based on the results of validation 1, improvements were made to prototype 1 so that the product was produced in the form of prototype 2. The results of data analysis of product validity by three validators were 4.03. Based on the results of the data analysis, the natural disaster mitigation teaching material supplement product falls into the "valid" category and can be used to assess the practicality of the natural disaster mitigation encyclopedia according to Sugiyono (2010) that the validity of the research instrument can be said to be valid if the validator's assessment score is $4 \leq Va \leq 5$.

Researchers made revisions to prototype 1 in accordance with the suggestions given by expert validators on learning design, material and language supplements for natural disaster mitigation teaching materials. The result of the revision and improvement of the encyclopedia was prototype 2. Furthermore, researchers conducted validation 2 to assess the design and materials of prototype 2.

Table 5. Data on Validation Results of Prototype 2 Learning Design Aspects

No.	Aspects	Score	Category
1.	Completeness of Assessment	4.58	Valid
2.	Feasibility of Graphics	4.53	Valid
Average		4.55	Valid

The score in table 5 shows that the validation data on prototype 2 aspects of learning design has a score of 4.55 in the valid category.

Table 6. Data on the Results of Validation of Prototype 2 Material/Content Aspects

No.	Aspects	Score	Category
1.	Completeness of material	5	Highly Valid
2.	Breadth of material	5	Highly Valid
3.	Depth of material	5	Highly Valid
4.	Accuracy and correctness of the material	5	Highly Valid
5.	Principle accuracy	5	Highly Valid
6.	Accuracy of examples, facts, and illustrations	5	Highly Valid

No.	Aspects	Score	Category
7.	Compliance with the development of science and technology	5	Highly Valid
8.	Current features, examples, and references	5	Highly Valid
9.	Linkages between concepts	5	Highly Valid
10	Enrichment	4	Valid
Average		4.9	Valid

Table 6 shows that the validation data on prototype 2 aspects of the material/content has an average score of 4.9 in the valid category.

Table 7. Data on the Results of Validation of Prototype 2 Language Aspects

No.	Aspects	Score	Category
1.	Conformity with language rules	4.6	Valid
2.	Consistency of paragraph structure	5	Highly Valid
3.	Translation digestibility	5	Highly Valid
4.	Coherence and connectedness of thought	5	Highly Valid
5.	Conformity with correct Indonesian language	4.3	Valid
Average		4.79	Valid

The average score is in table 7, which is 4.79 with an average validation data on prototype 2 aspects of language with a valid category.

Table 8. Summary of Prototype 2 Validation Results Data

No.	Aspects	Score	Category
1.	Design of teaching materials	4.55	Valid
2.	Material / content of teaching materials	4.90	Valid
3.	Language of teaching materials	4.79	Valid
Average		4.74	Valid

Table 8 shows the average score of the data summary results of prototype 2 validation, which is 4.79 with a valid category.

The results of data analysis on the validity of the product by three validators were 4.74. Based on the results of the data analysis, the natural disaster mitigation encyclopedia product falls into the "valid" category and can be used to assess the practicality of natural disaster mitigation teaching material supplements according to Sugiyono (2010) that the validity of the research instrument can be said to be valid if the validator's assessment score is $4 \leq Va \leq 5$.

Implementation is the real step to apply the natural disaster mitigation encyclopedia. The natural disaster mitigation encyclopedia has been declared valid and can be implemented in the learning process to see the level of practicality of the product. At this stage, a limited trial of the natural disaster mitigation encyclopedia was conducted. The result in this stage is that the test subjects/practitioners use the natural disaster mitigation teaching material supplement as a teaching material supplement in the geography learning process for natural disaster mitigation material in class XII IPS SMA Negeri 3 Takalar. Furthermore, the test subjects/practitioners assessed the natural disaster mitigation teaching material supplement from the aspect of the practicality of using the natural disaster mitigation encyclopedia in the learning process using the product practicality assessment instrument (Syarif et al., 2022).

Evaluation The evaluation stage is a process to see the success of the natural disaster mitigation encyclopedia developed, whether according to initial expectations or not. The results of the evaluation stage are data on the assessment of the practicality of natural disaster mitigation teaching material supplements by the test subjects/practitioners. The average percentage of teacher responses from five aspects of the assessment was 86% (very positive) so it can be concluded that the natural disaster mitigation teaching material supplement is practical. The results of the practicality test show that based on the responses of students and teachers, the natural disaster mitigation encyclopedia is practical.

Table 9. Data on Students' Response to the Encyclopedia

No.	Aspects	Average Score (%)	Description
1.	Concept Organization	84.2	Positive
2.	Constructivist Paradigm	83.7	Positive

No.	Aspects	Average Score (%)	Description
3.	Ease of Access	84.2	Positive
4.	Design	86.9	Very Positive
5.	Language	90	Very Positive
Average		85.8	Very Positive

Student response data to the encyclopedia in table 9 above has a score of 85.8 with a very positive statement.

Table 10. Data on Teacher's Response to Encyclopedia

No.	Aspects	Average Score (%)	Description
1	Learning Presentations	100	Very Positive
2	Material Feasibility	80	Positive
3	Constructivist Paradigm	90	Very Positive
4	Design	80	Positive
5	Language	80	Positive
Average		86	Very Positive

Table 10 shows that the teacher's response data to the encyclopedia has an average score of 86 which means very positive.

The availability of a valid and practical encyclopedia-based natural disaster mitigation teaching material supplement can be a reading material for students in learning material about natural disaster mitigation. According to Sugiyanto (2008), encyclopedias are reading materials that provide information about various things that cover various fields of science and are usually equipped with illustrations, pictures, and other media elements that can help understand concepts. The existence of these illustrations will make it easier for students to understand natural disaster mitigation material. Iskandar et al, (2016) mentioned that any explanation of material equipped with images will be easier to understand. In addition, material that is directly equipped with images will provide a more contextualized lesson. Edgar Dale proposed the concept of *cone of experience* which contains the principle that teaching materials in the form of images will make students gain a more meaningful learning experience than in verbal form (Susilana & Cepi, 2009).

One of the contextual forms of this research is an encyclopedia product that provides examples of natural disaster mitigation efforts based on local wisdom, this is in line with the results of Utari's research (2016) where students will connect what they learn with the reality they face in their daily lives by contextualizing learning in the classroom which can be done through instilling local wisdom values where students are, this is done to instill and pass on local cultures to students as the next generation of existing cultures.

In addition, the products of this research which are valid and practical are made using three basic approaches to geography, namely spatial, environmental and territorial approaches supported by an explanation of the importance of disaster potential maps as a strategy in mitigating natural disasters, this is in line with Purwanto's research (2011) which states that the use of a spatial approach will be more perfect and interesting for students, if presented using maps and images, as well as Saputra's research (2012) teaching materials prepared based on the integration of material objects with formal objects of geography certainly improve the quality of these teaching materials. Another advantage is that the encyclopedia is equipped with *full-color* images that make students learn contextually which can be done independently both in the classroom and outside the classroom.

This research is limited to producing a product in the form of a valid and practical natural disaster encyclopedia. The limitations of this research can also be a potential for further research to measure its effectiveness. According to Nieven (2007), a development product is said to be feasible if it fulfills three aspects, namely valid, practical, and effective. Various studies have shown that encyclopedias can improve students' understanding of the material being [23](#) lied (Cholifatur, 2015; Iskandar, et al., 2016). Similarly, the results of Vanessa's research (2013) found that the encyclopedia is a complete source of information and can broaden the horizons of its readers.

4. Conclusion

The conclusion of this study on the development of educational material supplements for natural disaster prevention shows that the study has achieved its objectives. The main objective of this study was to create a new educational supplement that meets certain criteria, specifically a natural disaster mitigation encyclopedia. Based on the results

achieved at all stages of development, it can be concluded that the objectives have been achieved. Overall, the successful development of a natural disaster teaching material supplement, specifically a valid and practical natural disaster encyclopedia, means the realization of the research objectives. This food supplement can contribute significantly to educational efforts to raise awareness, improve preparedness, and promote effective responses to reduce the impact of natural disasters.

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