



Development of a Fluid Material Pocket Book to Improve Understanding Flood Disaster Mitigation

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Abstract: Research has been carried out on the development of a pocket book on flood mitigation physics. The aims of this research are: to produce a decent pocket book on flood mitigation physics, to produce a practical pocket book, and to increase understanding student disaster. The subject of this research was the development of a pocket book on flood mitigation physics, while the test subjects were 28 students in class XI Science at SMA Negeri 12 Makassar. The development model used in this research is the 4D model. The instruments used were pocket book validation sheets, practitioner assessment questionnaires (educators/teachers), and flood disaster understanding test instruments. The eligibility criteria for pocket books are seen from the aspect of their validity. The practicality criteria are seen from practitioners' assessments, and the effectiveness criteria are seen from increasing students' understanding of disasters. Based on the results of the analysis, conclusions were drawn: the pocket book on flood mitigation physics that was developed was declared valid and suitable for use with minor revisions; pocket book is in the very good category; Students' ability to understand disasters analyzed using N-gain obtained an average value of 0.57, which is in the high category. This means that there is an increase in students' ability to understand flood disasters. In this way, the pocket book on physics for flood disaster mitigation that has been developed can increase students' understanding of disasters.

Keywords: Disaster mitigation; Fluids; Pocket book

Introduction

Indonesia is an archipelagic country located on the equator, between the continents of Asia and Australia, between the Indian Ocean and the Pacific Ocean, between the meeting of three earth plates, namely the Eurasian Plate, the Pacific Plate, and the Indo-Australian Plate, and is located on a volcanic track. active (ring of fire). These geographical conditions cause Indonesia is very vulnerable to natural disasters, such as earthquakes, volcanic eruptions, tsunamis, floods, landslides, droughts and tornadoes (Rasyid et al., 2022). One of the natural disasters that often occurs in Indonesia is floods (Amsori et al., 2018; Novianti & Utari, 2021; Hidayat et al., 2021; Hariyono et al., 2023). Flooding is a form of natural phenomenon that occurs due to high rainfall intensity where there is excess water that cannot be accommodated by the blocking network

of an area (Venelia et al., 2021). This condition has an impact on the emergence of inundation in the area which can be detrimental to the community (Sholihah et al., 2020). Natural factors in the form of rainfall that occurs above normal also greatly influence the occurrence of flood disasters (Kundzewicz et al., 2014; Liu et al., 2023; Zain et al., 2021).

Apart from that, human factors also influence the occurrence of flood disasters, such as throwing rubbish into rivers, building settlements on riverbanks, inappropriate land use and so on (Wicaksono et al., 2022; Ardiansyah et al., 2021; Sugianto et al., 2022). One of the cities in Indonesia that has a high frequency of flooding is Makassar City, South Sulawesi (Halim et al., 2019). Living in conditions that are vulnerable to disasters makes it important to be able to survive the consequences and impacts of disasters, for example by knowing the signs of a disaster, preventing disease by

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maintaining personal and environmental health, and knowing the route to a safe place or how to save yourself when it occurs. disaster. Disaster mitigation is very important in carrying out activities before a disaster occurs which is expected to reduce the impact or risk of flood disasters. According to Law Number 24 of 2007 concerning Disaster Management, the definition of mitigation is a series of efforts to reduce the risk of disaster, both through physical development and awareness and increasing the ability to face the threat of disaster (Triastari et al., 2021; Partini & Hidayat, 2024; Supartono et al., 2022).

Preparedness in facing flood disasters must be implemented immediately, one of which is through formal education in schools in the form of implementing mitigation education through the development of teaching materials related to flood disaster mitigation. As one of the schools in Makassar which is located in an environment that is prone to flooding. SMA Negeri 12 Makassar was the aim of this research. In line with this, the learning media at SMA Negeri 12 Makassar only contains basic material and concepts which still lack application, especially those related to disaster mitigation. To maximize this research, it is necessary to use media or learning tools that are capable of presenting physics material containing flood disaster mitigation. The formation of this flood can be explained in terms of physics concepts, namely the fluid concept (Dalimunthe et al., 2019).

Currently, various types of media are developing that can be used in learning, one of which is print media (Kruikemeier et al., 2018). Print media is media whose final product is print, for example books, magazines, bulletins and so on. Pocket books are included as supplementary books, reference books or alternative books that teachers can use in presenting lesson material. Pocket books are considered efficient in explaining flood disaster mitigation material because they will not be burdensome for students, because pocket books are small books that contain a lot of material in a concise and clear form according to the material being taught (Kalombe & Phiri, 2019). They also have an attractive design so that students who read them are certainly interested and easy to use. understand the flood mitigation material contained in the pocket book. Based on the description above, the research title taken in this research is "Development of a pocket book on fluid materials to increase understanding of flood disaster mitigation".

Method

Types of Research

This type of research is research and development which is used to produce new products and then

examine the effectiveness of these products. This research uses the Thiagarajan 4D development model (Usmeldi et al., 2017).

Research Design

The research design used in this research is a 4-D research model (four D models) which was adapted from Thiagarajan's 4D model. The 4D development model consists of four main stages, namely: Define, Design, Develop (development), Disseminate.

Research Subject

The subjects used in this research were physics subject teachers at SMA Negeri 12 Makassar and physics teachers from several schools in the city of Makassar, totaling 9 people from 9 different schools. Apart from that, there are 28 class XI students, especially class XI Science for the 2023/2024 academic year.

Instrument

The research instruments used in this research were validation sheets for teaching materials and validation sheets for practitioner assessment instruments, validation sheets for disaster understanding test instruments, practitioner assessment questionnaires and disaster understanding tests.

Research Procedure

Define Stage (Definition)

The purpose of this stage is to determine and define learning requirements. Determining and establishing learning requirements begins with an analysis of the objectives and limitations of the material to be developed. This stage includes: Initial-end analysis; student analysis; material analysis; goal analysis.

Result and Discussion

Validity Results of the Flood Disaster Mitigation Physics Pocket Book

Aspects of content validity assessed by the three experts are aspects of content suitability, presentation, language and graphics. The score obtained from the content validity coefficient analysis test of the expert agreement index using the Aiken's V index analysis is presented in Table 1.

In the content feasibility aspect, a validity index (V) was obtained with an average score of 0.72 and was in the valid category, then for the presentation aspect a validity index (V) was obtained with an average score of 0.78 and was in the valid category. For the language aspect, a validity index (V) was obtained with an average score of 0.69, which was in the valid category, and for the graphic aspect, a validity index (V) was

obtained with an average score of 0.73 and was in the valid category.

Table 1. Validity Analysis Test Contents of the Disaster Mitigation Physics Pocket Book

Aspect	Number of Validity		Category
	Item Scores	V	
Content Eligibility	13	0.72	Select
Feasibility of presentation	10.11	0.78	Select
Language Eligibility	12.44	0.69	Select
Graphic Feasibility	12.33	0.73	Select

Practitioners' Responses to the Pocket Book on Flood Disaster Mitigation Physics

Practitioner responses to the pocket book on flood disaster mitigation physics were obtained from practitioner assessment questionnaires, in this case physics teachers, on the pocket book on flood disaster mitigation physics. Each assessment component available on the practitioner assessment questionnaire sheet consists of 40 statements which are assessed using

a Likert scale with a score range of 1 to 4 according to the specified category. Practitioners' assessments of the pocket book on flood disaster mitigation physics include aspects of appropriateness of content, appropriateness of presentation, appropriateness of language, and appropriateness of graphics. The percentage of scores obtained from 10 teachers who gave an assessment of the pocket book on physics for flood disaster mitigation were grouped based on the criteria in Table 1. The results of the analysis of practitioners' assessments of the pocket book on physics for flood disaster mitigation can be seen in Table 2.

In the aspect of content suitability, an average score of 32.60 was obtained with a percentage of 81.50%. For the presentation aspect, an average score of 33.10 was obtained with a percentage of 82.74%. Meanwhile, in the language aspect, an average score of 32.4 was obtained with a percentage of 81%. And in the graphic aspect, an average score of 33.60 was obtained with a percentage of 84 %.

Table 2. Practitioner Assessment Scores on Pocket Books Flood Disaster Mitigation

Practitioner	Total Practitioner Assessment Scores for Each Aspect			
	Content Eligibility	Presentation	Language	Graphics
P1	33	35	34	33
P2	28	29	27	28
P3	28	29	26	28
P4	37	40	36	38
P5	34	36	35	36
P6	37	28	37	36
P7	28	30	27	30
P8	31	32	29	31
P9	36	36	37	38
P10	34	36	36	38
Average Score	32.60	33.10	32.40	33.60
Percentage	81.50 %	82.74 %	81 %	84 %
Category	Very good	Very good	Very good	Very good

Effectiveness of the Physics Pocket Book for Flood Disaster Mitigation

The effectiveness of the disaster mitigation pocket book can be measured using a flood disaster understanding test instrument given to class XI students at SMA Negeri 12 Makassar. The flood disaster understanding test was given to students before (pretest) and (posttest) after learning using a disaster mitigation pocket book. Each question given during the pretest and posttest is the same question presented randomly. To see students' flood disaster understanding test questions, see Appendix B5. To obtain the effectiveness of the disaster mitigation pocket book, it was analyzed using the N-gain score equation. The results of the N-Gain analysis can be seen in Table 3.

Table 3. Percentage of Participants' Comprehension N-Gain Score Educated in Class XI of SMA Negeri 12 Makassar

Criterion Interval	Category	Frequency	Percentage
$0.7 < g \leq 1.0$	Tall	15	53.57
$0.3 < g \leq 0.7$	Currently	8	28.67
$0.0 < g \leq 0.3$	Low	0	0
$g = 0.0$	No Increase Occurred	3	10.71
	There was a decline	2	7.14
Amount		28	100
Average N-Gain Score whole		0.57	57

The effectiveness of the disaster mitigation pocket book was obtained from the overall average pretest and posttest N-gain score of class so it can be concluded that

there is an increase in the understanding of class XI students at SMA Negeri 12 Makassar and that the disaster mitigation pocket book is effective for use in the learning process.

Discussion

The disaster mitigation pocket book that has been developed was assessed by three experts to measure the content validity of the teaching materials (Nurfitri et al., 2022; Shrotryia & Dhanda, 2019; Atmaja et al., 2021). Product content validity is carried out by inviting several experts to assess the product that has been designed (Pérez-Rivas et al., 2023; Koller et al., 2017; Santoyo-Sánchez et al., 2022). Each expert or specialist is asked to assess the product that has been created to determine the weaknesses and strengths of the product that has been designed (Herrada-Lores et al., 2022; Gunawan et al., 2018). There were four aspects assessed by the three experts, namely aspects of appropriateness of content, appropriateness of presentation, appropriateness of language, and appropriateness of graphics (Grieve et al., 2021; Brookhart, 2018). If the results of the expert assessment of these four aspects are valid, then the pocket book is declared valid. Pocket books that are declared valid are then revised according to criticism and suggestions from experts, and are ready to be tested (Saputra et al., 2018). The validation analysis that has been carried out is obtained as shown in Table 1 which states that the disaster mitigation Pocket Book is declared feasible to proceed to the trial stage (Suprpto et al., 2022).

The disaster mitigation physics pocket book, which was declared valid by experts, was then given to practitioners to assess the implementation and usefulness of the teaching materials developed (Ayub et al., 2021; Suprpto et al., 2021; Fauza et al., 2023). The results of the practitioner assessment analysis can be seen in Table 2. Based on the results of the practitioner assessment analysis, it was concluded that ten practitioners on average gave a very good assessment to the pocket book that was developed with a percentage above 80%. The results of this research are supported by practitioners' direct responses when assessing the teaching materials developed. The effectiveness of the disaster mitigation pocket book can be seen based on the increase in students' understanding which comes from the test results of class XI students at SMA Negeri 12 Makassar. The test was given before and after being given the disaster mitigation pocket book (Yasuda et al., 2018; Prastika et al., 2023).

Based on the results of the analysis of increasing students' understanding, there were 8 students who experienced an increase in the medium category with a percentage of 28.57% and 15 students experienced an increase in the high category with a percentage of

53.57%, and there were 3 students who did not experience an increase with a percentage of 10.71% and there were 2 students who experienced a decline with a percentage of 7.14%. Overall, the average pretest and posttest N-Gain score for the comprehension ability of class XI students at SMA Negeri 12 Makassar was 0.57 which was at medium category. The results of this research are in line with research by Riyansyah et al. (2023) and Noviana et al. (2020) that there was an increase in students' scores before and after using flood disaster mitigation learning media.

Conclusion

Based on the results of research and limited trials that have been carried out, it was concluded that the first flood disaster mitigation pocket book that was developed was in the valid category so that it could be used based on the results of expert agreement index analysis using the Aiken's V content validity coefficient and could be used as a learning resource in physics learning. Second, practitioners' responses to the pocket book on flood disaster mitigation are in the very good category. This shows that practitioners responded very well to the pocket book that was developed. Third, the effectiveness of pocket books is obtained from analyzing students' understanding using N-Gain which is in the medium category. This means that there is an increase in the understanding of class

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Author Contributions

H. M. A. : conceptualized the research idea, research methods, and analyzed the data. J and P. P guided the review and editing authors, supervised and validated the instruments used in the research.

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Conflict of Interest

The authors declare no conflict of interest.

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