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Development of Multimodal Mathematics and Indonesian Language Books for Elementary School Learning in Bandung Barat

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ABSTRACT

This study aims to (1) develop multimodal mathematics and Indonesian language books for learning in elementary schools, (2) determine the feasibility level of multimodal mathematics and Indonesian books for learning in elementary schools. This study used the Borg and Gall development model research method which consisted of (1) preliminary study, (2) initial product development, (3) expert validation and product revision, (4) limited field trials and product revision, (5) test try the field and the final product. The resulting product is an Android-based learning media in the form of multimodal books for learning mathematics and Indonesian in elementary schools with the subject, integer arithmetic operations, mixed integer arithmetic operations, determining mixed arithmetic operations with whole numbers, looking for main ideas and writing poetry in elementary schools. Based on the formulation of the problem, research results, and discussion, the results of this study can be concluded that (1) the development of Multimodal Book considered several product characteristics, namely, (a) students play an active role, (b) precise and consistent language, (c) music selection, background, buttons, types, colors, attractive letters, (d) animations and images support elementary school students' understanding, (2) multimodal Mathematics and Indonesian Language Books for Elementary School Learning are appropriate to use and can improve the learning of Mathematics and Indonesian Language for Elementary School students in West Bandung Regency.

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1. INTRODUCTION

The existence of the covid 19 pandemic requires educational actors to change the direction of the learning system from conventional (face-to-face) to online learning. During the covid 19 pandemic, learning was carried out online by utilizing e-learning. Until the end of 2020, the implementation of learning is fully online. (Trenholm & Peschke, 2020). This is also the case in mathematics learning. Based

on Law No. 20 of 2003, mathematics is an important subject in the world of education which is a subject that must be applied and developed to students starting from primary education to secondary education or secondary education (Surya, 2019). The existence of covid-19 requires a media development that can be used anytime and anywhere so that students can learn anytime and anywhere. This is so that students can learn the material after the teacher explains in the classroom. This is important so that students are able to improve their abilities. This is the starting point for why technology-based media development is important. Because most students at the secondary level are active smart phone users.

Teachers have an important role in implementing learning in accordance with learning objectives, in the education unit level curriculum (KTSP) educators are advised to be able to determine a model and steps in learning mathematics that can determine student skills when the learning process takes place on mathematics material that can involve students actively both physically, mentally and socially in learning activities, therefore the assessment of learning achievement in KTSP must include cognitive, affective and psychomotor aspects (Sugiarti & Arcana, 2018). There are still students who think that learning math is a difficult lesson, resulting in a decrease in student achievement at school. According to Arifin (2020) stated that difficulty in learning is a sign that appears in students which shows that students' achievement in learning is low. Even from the results of preliminary studies that have been carried out, there are still students who have difficulty in solving math or Indonesian language problems, where students have obstacles, namely when the teacher explains students are not listening because the teacher's voice is too small and cannot be heard by students. This obstacle is in line with the opinion of Mulyono (Arifin, 2020) stated that students' learning difficulties can be influenced by their lack of knowledge, not listening well when the material is being explained, or lacking in other skills such as speaking and thinking broadly.

One alternative to online learning is utilizing e-learning. E-learning is a learning concept that in the process utilizes the development of information and communication technology (Fitriani & Nurjannah, 2019). Educators are required to create or present interactive learning media to increase student learning motivation. Asnawir (Legendari & Raharji, 2016) states that the National Education Association (NEA) defines media as a tool that can be used for its usefulness, such as can be: seen, heard, read and made according to needs, which are used properly in a process of teaching and learning activities, which can affect the effectiveness of instructional programs. One of the media that can be used for learning is by using multimodal book media. Multimodal is a term used to refer to the way people communicate by using different modes at the same time (Gunther Kress & Van Leeuwen, 1996), which is defined as the use of multiple semiotic modes in the design of a product, or a semiotic event simultaneously, and in some way these modes are combined to reinforce, complement, or be in a particular arrangement (G Kress & Van Leeuwen, 2001). Commonly used modes are language, images, music speech and communication. So it can be concluded that multimodal book is a learning media that refers to a way of communicating using two or more different modes simultaneously, be it language and images or so on.

Mathematics learning in elementary schools is not only aimed at improving students' ability to count or apply formulas / procedures in solving routine problems, but also at improving students' ability to solve problems, both mathematical problems and other problems that use mathematics to solve them. This ability is very necessary for students, related to the need for students to solve problems they face in everyday life and be able to develop themselves. Therefore, problem solving skills need to get special attention in the process of learning mathematics from the most basic formal education level, namely in elementary school. This statement is supported by National Council of Supervisors of Mathematics (NCTM, 2000) that "learning to solve problems is the principal reason for studying mathematics" and the National Council of Teachers of Mathematics (that problem solving must be the focus of the curriculum. Therefore, learning in elementary schools (SD) in the learning process, one of which is learning mathematics or other learning at the elementary level must connect the real context in everyday life.

To create learning that can develop abilities in mathematics learning is inseparable from the material to be learned and how to create and process the material so that students can be actively involved and use their minds to form concepts in the learning process. This emphasizes that learning does not only depend on how the teacher teaches but how the teacher creates. Therefore, teachers need the ability to develop learning media, namely Multimodal Book.

The implementation of learning activities in Indonesian is a process of interaction between students and educators, namely where teachers and learning resources in a place of learning to develop their ability to speak Indonesian in all the goals to be achieved. (Nurdiyanti & Suryanto, 2010). From the description above, to develop learning media that can make it easier for educators or students, especially students at the elementary school level (SD) to learn math learning, the researcher took the title "Development of Multimodal Book Mathematics and Indonesian Language for Elementary School Learning in West Bandung Regency". This is reinforced by the results of research (Munawwarah, Jusniar, Sumiati, & Nurhayati, 2022; Pappas, Varetas, Gill, & Ortiz, 2015) that the multimodal book developed can help students understand the material.

The objectives of this development research are (1) Developing Multimodal Book for learning Mathematics and Indonesian Subjects, Counting Operations of Whole Numbers, Mixed Counting Operations of Whole Numbers, Determining Mixed Counting Operations of Whole Numbers, Finding Main Ideas and Writing Poetry in Elementary Schools. (2) Knowing the feasibility level of Multimodal Book for learning Mathematics and Indonesian Language Subjects, Counting Operations of Whole Numbers, Mixed Counting Operations of Whole Numbers, Determining Mixed Counting Operations of Whole Numbers, Finding Main Ideas and Writing Poetry in Elementary Schools.

2. METHODS

This research uses the Research and Development (R&D) method, also known as the research and development method. "Research and Development (R&D) is a powerful project or method for improving practice." (Sukmadinata, 2009). The selection of research and development methods because the research develops products in the form of learning media, namely Multimodal Book). The product produced in this research is in the form of learning media in the form of Multimodal Book which contains mathematics learning materials and Indonesian language learning with the subject matter, counting operations of whole numbers, mixed counting operations of whole numbers, determining mixed counting operations of small numbers, finding main ideas and writing poetry in elementary schools in elementary schools.

The research subjects used as a limited trial were 2 elementary schools in Bandung Regency. The object of this research is the development of multimodal book learning media for mathematics and Indonesian on the subject of whole number counting operations, mixed counting operations of whole numbers, determining mixed counting operations of small numbers, finding main ideas and writing poetry in elementary schools. The place of product development research was conducted on campus in Cimahi. Meanwhile, the limited trial was conducted in two different schools to get a comprehensive conclusion. Research time was conducted in the even semester of the 2021/2022 school year.

The research subjects used as final product trials were in three schools. The object of this research is the development of multimodal book learning media for mathematics and Indonesian on the subject matter, counting operations of whole numbers, mixed counting operations of whole numbers, determining mixed counting operations of numerical numbers, fractions, finding main ideas and writing poetry in elementary schools.

The development procedure is guided by the steps of the Borg and Gall research model. (Sugiyono, 2015). In this stage, there are several steps that will be used, which are as follows: (1) preliminary study (2) Multimodal Book product development, and (3) product testing. Preliminary studies, including: literature studies, field surveys, and preparation of Multimodal Book product

drafts. The literature study was a literature search through journals, textbooks, and research relevant to the problem being developed. Field survey activities, conducted through documentation studies, direct observation, and interviews. In the second stage, product development consists of the stages of preparing materials and other completeness. In the product development stage, validation by material experts and media experts was carried out, consisting of two stages, namely expert validation (the product was validated by material experts and media experts) and revision based on the findings or comments from the validation results. The third stage is to conduct field trials and the product consists of 2 stages, namely product trials (students operate the product and fill out questionnaires) and final product refinement.

The instruments used in this study were tests and questionnaires. Tests are used to obtain student learning outcomes after students use learning products. Meanwhile, the questionnaire was used to obtain data related to the quality of material feasibility and the quality of media feasibility. (Mardika, 2010:14). The data analysis technique used is descriptive analysis technique by determining the average of the validation sheet that has been checked by media experts, material experts and students. The assessment is carried out to get feedback on product quality. The results in the form of scores from the assessment are then converted into values, after which using the value limit table is grouped to determine the category or assessment criteria (Nopriyanti dan Sudira, 2015, p. 227). To further strengthen the feasibility of the product, student learning outcomes tests (pretest and posttest) were conducted to determine the improvement of student learning outcomes and the results of the student response questionnaire were correlated with the student learning outcomes test (posttest).

3. FINDINGS AND DISCUSSION

Field survey activities were carried out through documentation studies, direct observation and interviews. This research is a research and development, so the product of this development research is Multimodal Book in the form of android-based learning media that meets the criteria of valid and effective. Multimodal Book development research using steps, namely: (1) preliminary study (2) product development of Learning Media model, and (3) product testing. Preliminary studies, including: literature studies, field surveys, and preparation of draft learning media model products. Literature study is a literature search through journals, textbooks, and research relevant to the problem being developed. Field survey activities, conducted through documentation studies, direct observation, and interviews.

In the preliminary study step, the researcher made observations to the school by interviewing one of the teachers at the school used as a research site, from the results of this preliminary study the researcher obtained information about the achievements of students who were still experiencing deficiencies in learning. Where students still find it difficult to do calculation problems, namely in math subjects, and also find it difficult to understand the material in Indonesian subjects which causes students to not really understand math and Indonesian subjects. The above statement is in line with Arnidha (2015) which states that in reality when in the field there are still student errors when solving problems, especially in integer counting operations in the form of addition and subtraction operations, even though this material must have been mastered by elementary school students at an early age or during low grades such as in grade one and grade two. So this researcher is interested in making a teaching material that is made to help students in learning activities and help teachers in the teaching process which makes learning interactive, active, and fun.

There are student errors when solving problems in math subjects where students are still mistaken in the calculation operations of the problems that have been determined, and these errors can be seen in the picture below:

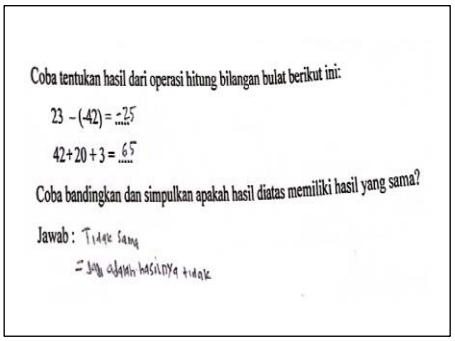

Figure 1. Student errors in counting operations

From Figure 1. it can be seen that students' mistakes in the first problem, where there is a problem from the operation of integers 23-(-42)=⋯ which should be the correct answer is 65. The errors experienced by students when answering questions on subtraction arithmetic operations lie when students perform subtraction where the subtraction of numbers causes these errors because students lack understanding of the concepts of integers or mathematical concepts in arithmetic operations material (Arnidha, 2015). From the problem, it can be seen that the student's mistake in solving the problem above, whereas when the multiplication operation (-) × (-) will get the result (+), then the problem becomes an addition operation, so when compared to the answer in the second problem will have the same result of 65.

The results of the preliminary study were carried out to obtain information related to the variables studied. The preliminary study stage carried out is an analysis of development needs, in this case the requirements for product development in accordance with user needs and a development research model that is suitable for developing products. In determining and determining the requirements of learning devices, it begins with a literature study of the supporting variables of the study such as (a) analysis of mathematics and Indonesian language materials for Grade 4 elementary school students, (b) student characteristics, (c) literature study supporting multimodal books and (d) formulating learning objectives.

In the multimodal book component there is an opening menu, initial menu, instructions menu, material menu and exit menu.

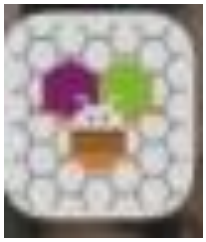

Figure 2. Product Menu Display

Figure 3. Initial Menu Display

Figure 4: Math Learning Start Menu

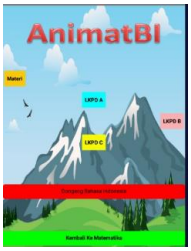

Figure 5. Indonesian Language Learning Start Menu

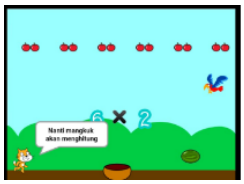

Figure 6. Multiplication material

Figure 7. Round Number Counting Operation

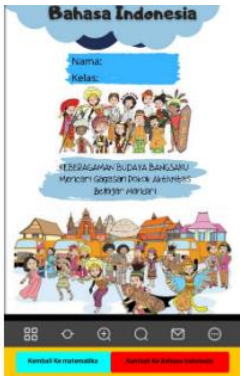

Figure 8. Indonesian Language Material

Figure 9. Sample Problem

Product development involves an expert validation assessment, so that before the field trial the learning media has been revised based on the assessment, suggestions and input of the experts. On the results of multimodal book validation have been validated by experts in the field of media and materials. Validators of media experts and material experts as lecturers of mathematics education study programs. Besides that the validator consists of media experts who have expertise in the IT field. There are criteria and limits for the value of material feasibility according to Riduwan (Aini, Syachruroji., & Hendracipta, 2021) The results of the assessment that have been obtained from validators and practitioners are presented in tabular form, as follows:

Table 1. Criteria and Material Feasibility Score Limits

No	Percentage	Category
1	81% – 100%	Very good
2	61% – 80%	Good
3	41% – 60%	Fair
4	21% – 40%	Less
5	0% – 20%	Very Poor

The following are the results of the material feasibility test that has been assessed by the validator.

Table 2. Percentage of Expert and Practitioner Results

No.	Aspects to be assessed	Validator						Average
		V1	V2	V3	V4	V5	V6	
1	Material	92%	80%	84%	84%	80%	84%	86%
2	Accuracy, Relevance and Accuracy	80%	89%	83%	89%	77%	86%	84%
3	Display and Design	90%	80%	80%	80%	80%	80%	82%
	Evaluation	80%	87%	80%	87%	93	80%	85%
	Avarage all item							84%

Based on the results of the table that has been obtained from validators and practitioners, the average percentage is 84%, it can be concluded that the development of multimodal books made is

very good and suitable for use. In addition to the assessment of the material, there are criteria and limits for the value of media feasibility according to Prasetyo (Pradilasari, Gani, & Khaldun, 2019). The results of the assessment that have been obtained from validators and practitioners are presented in tabular form, as follows:

Table 3. Media Feasibility Criteria and Score Limits

No	Percentage	Category
1	85% – 100%	Very Decent
2	69% – 84%	Feasible
3	53% – 68%	Decent Enough
4	37% – 52%	Less Feasible
5	20% – 36%	Not Feasible

The results of the validator's assessment of the developed media are as follows:

Table 4. Media Validation Results

No	Validator	Total	Precetage
1	P1	54	90%
2	P2	46	77%
	Avarage		83%

The results of validation by media experts by 1 validator get a score with a percentage of 90%, while the second validator gets a score with a percentage of 77% according to the media validation criteria table. The average result of the media validation above is 83%, included in the "Appropriate" criteria. Product revision is the improvement of multimodal book products developed. Revisions are based on input in the form of comments and suggestions given by material experts, media experts and students. Not all input is used as the basis for product revision. Only relevant suggestions were used as the basis for product revision. There are the results of suggestions from several validators shown in the table, as follows:

Table 5. Comments, Suggestions and revisions

No	Comments and Suggestion	Revision/Follow-up
1	The display font is enlarged (too small)	Revised
2	Indonesian language and math materials should be combined (Thematic)	Revised

Limited trials were carried out on two schools, namely SDN Neglasari and SDN SIlihasih, by distributing questionnaires to 30 elementary school students. The following are the validity criteria for student responses

Table 6. Student Response Validity Criteria according to Tegeh (Rosyita & Tsurayya, 2021)

Percentage	Criteria	Description
90% – 100%	Very good	Not Revised
75% – 89%	Good	Partially Revised
65% – 74%	Fair	Moderately Revised
55% – 64%	Deficient	Many Revisions
0% – 54%	Very Poor	Total Revision

Based on data analysis of student responses to learning in the final test in two schools during the limited trial, it was found that there was an increase in the average score of 19 and there was a significant difference between learning before and after using multimodal books. With an n-gain

score of 1 or 55% with "medium" or "Effective Enough" criteria. The next stage is the broad trial. Data collection techniques for broad trials were carried out in 3 elementary schools, namely SDN Cilame, SDN Jalantir and MI Azzahra. The following are the results of the broad trial that have been obtained can be seen in the following table: Category of Acquisition of N-Gain Score according to Aprilia, Sutrio, and Sahidu (2021) (Rosyita & Tsurayya, 2021)

Table 7. N-Gain Score Calculation Category

N-GainScore	Category
$g \geq 0{,}7$	High
$0{,}7 < g < 0{,}3$	Medium
$g < 0{,}3$	Low

Table 8. Math Learning Outcomes

Results Score	School						Average
	S-1		S-2		S-3		
	Pretes	Postes	Pretes	Postes	Pretes	Postes	
Lowest Grade	50	65	40	65	50	70	
Highest Score	69	93	69	88	68	88	
Average N-Gain	43%		40%		51%		45%
Students who meet the KKM	0	81%	0	72%	0	95%	
Students who do not meet KKM	100%	18%	100%	28%	100%	5%	

Based on the data in the table, it can be seen that the pretest and posttest scores in Indonesian language subjects have increased. Students who have met the KKM have also increased, especially in S-3 where students who have reached the KKM have reached 95%, the remaining only 5% who have not reached the KKM. This shows that the development of multimodal media in mathematics and Indonesian is effective in improving students' mathematics learning outcomes. Likewise, the results on Indonesian learning outcomes are as follows:

Table 9. Indonesian Language Learning Outcomes

Results Score	School						Average
	S-1		S-2		S-3		
	Pretes	Postes	Pretes	Postes	Pretes	Postes	
Lowest Grade	46	63	29	67	40	65	
Highest Score	88	96	75	96	69	88	
Average N-Gain	46%		60%		40%		49%
Students who meet the KKM	33%	73%	5%	95%	0%	72%	
Students who do not meet KKM	66%	27%	95%	1%	100%	28%	

Based on the data in the table, the score of students' learning outcomes in Indonesian language subjects has increased between the pretest and posttest. This comparison is a result of the development of the developed media. To see the comparison more clearly, it can be seen in the bar chart as follows:

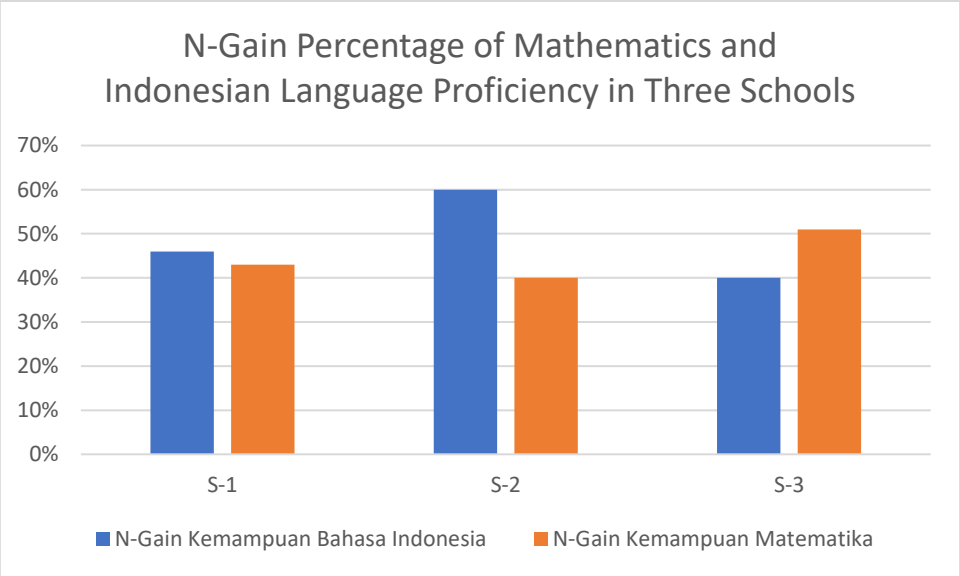

Figure 10. Comparison of N-Gain in Mathematics and Indonesian Language in Three Schools

Based on the results obtained in the table above, it is known that the average n-gain obtained from the three schools for mathematics learning outcomes is 45% and for Indonesian learning outcomes is 49% so it is categorized as moderate. Students who met the KKM in math and Indonesian respectively at the time of the posttest averaged 83% and 80%. From the results of the acquisition of posttest data that meets the KKM and the average n-gain that has been achieved, it can be concluded that the development of multimodal books is quite effective and feasible to use. Several studies have reported that multimodal-based media are effective in improving students' abilities. (Abidin, Mulyati, & Yunansah, 2017; Yeh & Tseng, 2020; Zakiya, Sinaga, & Hamidah, 2017). To sum up, the results of this study, it shows that the use of multimodal books in learning mathematics can help students improve their understanding of the material being studied.

4. CONCLUSION

This study successfully developed a multimodal book product for learning Mathematics and Indonesian Language in Elementary Schools in West Bandung Regency. This multimodal book has the potential to facilitate understanding of concepts with the help of animations, images, sounds, stories and materials that are in accordance with learning mathematics and Indonesian Language in Elementary Schools with the characteristics of the product, namely, (1) students play an active role, (2) precise and consistent language, (3) selection of music, background, buttons, type, color, attractive fonts, (4) animations and images support the understanding of elementary school students. Multimodal books made into the category worth using seen from the results of validation, evaluation results and student learning test results. Based on the validation results, the average score of the material falls into the excellent category and the average score of the media falls into the appropriate criteria. So that the multimodal book that has been made is included in the good criteria and is suitable for use as a learning media for elementary school students in math and Indonesian subjects. Feasibility is supported by an increase in student learning outcomes before and after using multimodal books with an average n-gain average obtained from the three schools for math learning outcomes of 45% and for Indonesian learning outcomes of 49% in the medium category. This research was only conducted at the primary level so further research needs to be developed at different levels so that the results of this study can provide a more complete picture of the effectiveness of using the multimodal book developed.

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