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Developing Digital Pocketbook Interactive Based on HTML-5 to Improve Mathematics Learning Outcomes

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Abstract

Interactive learning media have an essential role in realizing interesting and interactive mathematics learning, so they have the potential to optimize student learning outcomes. This research aims to develop and evaluate an Interactive Mathematics pocketbook in HTML5 format that can be used to improve student learning outcomes. This research and development uses a 4D model. This research found that elementary school students need and like mathematics pocketbooks that look attractive and have interactive features as a learning tool. The product validation test results obtained a final score from material and language experts of 86.47%, which means that the product reached the very feasible category regarding content quality, graphics, and language. Media experts gave a final score of 88.3%, which means that the product is very worthy in terms of content structure, appearance, ease of use, and ease of learning. The results of field trials also show that the media developed can improve student learning outcomes in the medium category with an n-gain score of 0.56. These findings indicate that the development of an Interactive Mathematics Handbook in HTML5 format with a 4D model can produce a valid and effective product used to support the learning process of elementary school students.

Keywords: Digital Pocketbook; Mathematics; Interactive Media; Learning Outcomes

INTRODUCTION

Mathematics is a subject that supports the development of science and technology (Savitri & Karim, 2020). Therefore, mathematics is a subject matter that has an important role in education (Tutiareni et al., 2023). In mathematics learning, students who experience learning difficulties are considered normal, a common reality. This is because mathematics is a scary subject for students (Aprilia, Alifatul, Fitriana, 2022). Apart from being scary, mathematics is also considered a very boring subject (Nurjaya et al., 2023) because the discussion on the subject only contains numbers, pictures, arithmetic operations, and formulas. Learning is a process of personal growth or changes in students' behavior in motivated situations (Suharti, 2020). Therefore, the use of interactive learning media in mathematics is very important to help students absorb information.

Mathematics is considered a scary and boring lesson content, so the learning process that has been explained will not achieve the intended results because of the lack of student motivation in learning activities. This is known from observations and interviews with class V B teachers at Ngaliyan 03 Public Elementary School, Semarang City. The problems found are. First, students' need for more understanding of learning material can also be caused by a lack of learning media that facilitates the student learning process. This lack of learning media especially impacts understanding mathematics learning material, which is considered difficult to understand because of its abstract nature. Second, teachers only deliver existing learning materials such as worksheet books or teacher and student books using conventional lecture and assignment methods. Third, these two problems can result in not achieving learning objectives and have a negative impact on student learning outcomes, one of which is the content of mathematics lessons.

Learning outcomes, according to Pratiwi (2020) and (Mahardika, 2021), can be used as a benchmark to find out how far students have understood the learning material and what needs improvement. Because learning outcomes are the main component of student learning, teachers are tasked with measuring students' mastery of knowledge based on the objectives formulated (Untsa et al., 2019). The problems faced at the Ngaliyan 03 Public Elementary School, Semarang City, can be overcome by developing learning media to meet current learning needs. According to Yuanta (2020) in (Septiani et al., 2023), the presence of learning media also makes it easier to deliver material to students, and the absorption of knowledge students gain is also easier. Learning media, which includes audio, video, and a combination of both, helps teachers master an Education module that includes activities that stimulate responses between teachers and students (Mukaromah et al., 2024; Sukmawarti, 2021). The critical role of media in learning activities is that learning media can improve learning outcomes and increase students' attention in everyday life by motivating students to interact directly with teachers, the environment, and society (Ramdani, 2021). Some argue that simple media is preferable to

sophisticated media because it is easy and practical. On the other hand, some people prefer sophisticated media because they have more functions and are more durable (Batubara et al., 2023).

Therefore, educators are encouraged to develop abilities to master technology so that they can design innovative and technology-based learning (Nurdyansyah & Fahyuni, 2016). As agents of change, teachers can change students' thinking paradigms about teaching and learning activities by providing interesting lessons for students and giving them motivation to enjoy the lessons (Aini et al., 2020). One of these is educational innovation in learning, namely technology-based learning, which creates both progress and challenges in education. With technology, it can be used anytime and anywhere. Technology offers advantages because it allows instant feedback and corrects student misunderstandings in understanding the material (Wati, 2020). Learning media plays a role in the learning process activities to stimulate students' thinking patterns, activities, attention, and interests so that the interaction process during learning occurs effectively (Yayi FP & Yuliana A,2019). In the current era, teachers must be able to adapt and be willing to learn to be able to master technology in order to improve the quality of learning and be able to keep up with millennial students (Supandi et al., 2020). Robiyanto (2019) in (Miftahul Jannah, 2021) Digital Pocketbook is an innovative and interesting learning media for students. A Digital Pocketbook, or Indonesian digital pocketbook, is a digital book that can be used anytime and anywhere because of its superiority in media like that, according to Azhar (2005) (Junaedi, 2021). Generally, a pocketbook is defined as a small book that contains information and can be stored in a pocket so it is easy to carry anywhere (Zuliana et al., 2021). Nurhayati (2019) and (Miftahul Jannah, 2021) said Digital Pocketbooks can increase learning motivation so that the learning results achieved are declared successful or good. This Digital Pocketbook also has a positive impact on students who are interested in reading; it is easy to carry anywhere and is equipped with an attractive display with pictures and colors, which increases students' motivation to learn. Material in the pocketbook (Karolina Br Surbakti et al., 2022). With the Digital Pocketbook learning media, researchers hope to improve students' mathematics learning outcomes because students' success in learning mathematics can be assessed from the learning outcomes they achieve after completing the mathematics learning process. (Rivai, 2019).

This Digital Pocketbook learning media will be packaged in web form using HTML5 format. According to (Lelilita, 2020), Webs that use the HTML5 format have migrated their functions to hypermedia. The HTML5 approach is used to combine web displays with text and visual images, graphics, audio, and video. The advantages of HTML5-based learning media lie in displaying information, processing, and presenting multimedia. If designed well and appropriately, HTML5-based interactive learning media can create a comfortable learning atmosphere and motivate students to learn.

Several previous studies have shown that the development of an HTML5-based Digital Pocketbook is very suitable for use in learning (Andi Seppewali et al., 2022). The findings of this research also show that HTML5-based learning media is in the "very good" category and is suitable for use to increase teacher creativity (Rijal, 2020). Based on the research results described, learning media was created to make it easier for students to learn mathematics, make it easier for students to study comfortably anywhere, and stimulate students' desire to learn. Therefore, researchers researched the development of learning media titled "Development of HTML5-Based Digital Pocketbook Interactive Learning Media to Improve Learning Outcomes for Class V Students of Ngaliyan 03 Public Elementary School, Semarang City". The difference between this research and previous research is that this research designs and develops interactive learning media in the form of an HTML5-based website which produces learning media called DigiPo: Digital Pocketbook and can be opened via a web browser such as Google Chrome, Mozilla Firefox, or Internet Explorer for class V on load mathematics material for FPB and KPK. This development research aims to develop HTML5-based Digital Pocketbook learning media, test its feasibility, and test its effectiveness.

METHODS

This development research uses a 4D development model. The 4D development model was developed by (Thiagarajan & Semmel, 1974). Research and development steps are abbreviated as 4D, which stands for Define, Design, Develop, and Disseminate. This model was chosen because the implementation stages are divided in detail and systematically (Mukaromah et al., 2024). In the first step, the researchers determined learning outcomes based on curriculum study, material study, and students' needs. The second step is designing a Digital Pocketbook HTML5 using all the information gathered in the first stage. In the third step, the validity of the product was tested by two learning media expert validators, and the product's effectiveness was tested on 28 students through an experimental study (Batubara et al., 2022).

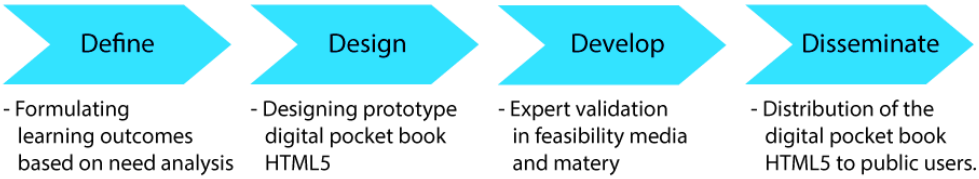

Figure 1
Stages of research

The validation in question determines the feasibility of product trials by requiring the assessment of experts, such as media and material experts. Qualifications for media experts are lecturers with skills in educational technology

and material experts, namely lecturers who know Elementary School Mathematics content (Raihan et al., 2023). Then learning uses the Digital Pocketbook learning media for Mathematics lesson content for class V B students at Ngaliyan 03 Public Elementary School, Semarang City, intending to test the feasibility and effectiveness of the product in improving the learning outcomes of class V B students on FPB and KPK material. The data collection method in this research uses test and non-test techniques. The test technique is carried out through ¬pre-test and post-test (Adam & Mulyani, 2023). Meanwhile, non-test techniques are carried out through observation. Observations were conducted at the Ngaliyan 03 Public Elementary School, Semarang City, with the research subjects being class V B students.

The assessment instruments are for material experts and media experts, while the response questionnaire instruments are given to teachers and students, as shown in Tables 2 and 3.

Table 1. *Material Expert Assessment Instrument Grid*

No.	Aspects	Indicator
1.	Competency Aspects	Suitability of Mathematics lesson content with the Competency Achievements achieved
2.	Conformity Aspects	Suitability of Mathematics lesson content with learning media
		Suitability of Mathematics lesson content with learning evaluation
3.	Language Aspects	Language Clarity

Table 2. *Media Expert Assessment Instrument Grid*

No.	Aspects	Indicator
1.	Conformity Aspect	Suitability of learning media to learning topics.
2.	Display Aspects	Attractive design appearance
		The quality or display quality of learning media
3.	Usage Aspects	Learning media is easy for teachers and students to use.
4.	Aspects of Excellence	Learning media can be understood by users.

This study collected quantitative data using the validation questionnaire and the usability questionnaire, as well as the pre-tests and post-tests. In addition, expert validators' responses to the validation questionnaire and experimental group students' responses to the usability were analyzed using descriptive statistics. Furthermore, the feasibility and usability of the product were determined using the criteria shown in Tables 3 and 4

Table 3. *Test Statistic N-gain Criteria*

No.	N gain Score	Qualification
1.	<0.3	Low
2.	31-70	Middle
3.	71-100	High

Table 4. *Effectivity Criteria*

No.	Percentage	Qualification
1.	<40	Ineffective
2.	40-55	Less Effective
3.	56-75	Moderately Effective
4	>76	Very Effective

RESULT AND DISCUSSION

1. Define

The development research that has been carried out has resulted in a product in the form of HTML5-based Digital Pocketbook learning media for class V students at Ngaliyan 03 Public Elementary School, Semarang City. The research results examine the characteristics of learning media, the appropriateness of learning media, and improving student learning outcomes. The problems faced at the Ngaliyan 03 Public Elementary School, Semarang City, can be overcome by developing learning media to meet current learning needs from observations and interviews with class V B teachers at Ngaliyan 03 Public Elementary School Semarang City. The problems found are. First, students' need for more understanding of learning material can also be caused by a lack of learning media that facilitates the student learning process. This lack of learning media especially impacts understanding mathematics learning material, which is considered difficult to understand because of its abstract nature. Second, teachers only deliver existing learning materials such as worksheet books or teacher and student books using conventional lecture and assignment methods. Third, these two problems can result in not achieving learning objectives and have a negative impact on student learning outcomes, one of which is the content of mathematics lessons. Then, data was obtained that showed that the lack of mathematics learning resources for students ultimately resulted in low student learning outcomes. This also has an impact on students' lack of understanding of mathematics material, especially problem-solving material related to FPB and KPK. The results of the researcher's analysis produced a solution, namely by developing a product to solve the problem.

Data collection was carried out through direct interviews with class V teachers at Ngaliyan 03 Public Elementary School, Semarang City, and also obtained from a needs questionnaire distributed to teachers and students. So, we get data on student learning outcomes, Mathematics lesson content, and the results of questionnaires that are distributed to teachers and students. The researcher determined the learning media in this research, namely, the HTML5-based Digital Pocketbook learning media, which contains Mathematics lesson content material for class V FPB and KPK, because according to the researchers from the results of the data obtained, the learning media used in the school does not include the diversity of types of learning media such as videos, games, and pictures. In accordance with the characteristics of the media conveyed by Arsyad (2011) (Setyaningsih, 2019), media is an educational emphasis on audio and visual, of which characteristics media must have criteria that can be seen and heard, as well as touched with the senses. According to Can-can Liu (2023) and (Dong, 2023), Learning media that uses audio explanations is easier for students to understand because it can train their thinking skills. Based on observational research carried out by researchers at the Ngaliyan 03 Public Elementary School, Semarang City, V B students can use interactive learning media because almost all of them already have personal smartphones. As stated (Wafa & Fahmi, 2020), smartphones can easily be used as learning media by students.

2. Design

The learning media developed by researchers requires a storyboard as an initial design and outline content as an outline of the product that will be created later. According to (Mislena et al., 2021), Using storyboards can improve the organization, time management, and planning of researchers because it makes it possible to organize and describe the researcher's ideas before writing them down using words. The design can be created or implemented through drawings as a guide to making it. Then, after collecting data through a needs questionnaire, researchers can create a prototype to give an idea of what the product will be like in the future. The component content of the product to be created consists of text, video, animation, and accompanying music. All existing component contents must be adapted to the material needs and learning objectives presented in the learning media.

Media characteristics were designed using Canva. The initial display of the HTML5-based Digital Pocketbook learning media contains the media application title, start button to enter the home menu, instructions for use, learning outcomes, learning objectives, and developer profile. The following are the results of developing HTML5-based Digital Pocketbook learning media. The results of the development of learning media are presented in Figure 1.

Figure 2. *Results of HTML5-based Digital Pocketbook Learning Media Development*

After the media has been designed, design validation is then carried out. At this stage, the process of evaluating whether the product is suitable for use is completed. The evaluation was carried out through a validation stage with media expert validators and material experts. Each expert was given an instrument to assess the feasibility of HTML5-based Digital Pocketbook learning media. After that, the two experts proposed improvements to the press that had been evaluated so researchers could immediately repair them. After analyzing the design revisions. At this stage, the researcher made improvements following the suggestions of the two experts, media and material experts. Then, when the product has been revised, the media is reassessed by media experts and material experts so that the media is suitable for testing.

3. Develop

After the media design is ready for use, expert validation is carried out to determine the suitability of HTML5-based Digital. The aspects measured in media suitability include media suitability, appearance, practicality of use, and media superiority. The results of the media feasibility test can be seen in Table 5**.**

Table 5. *Media Feasibility Test*

Validator	Criteria	Score	Description
Material Expert	Competency Aspects	23/24	very feasible
	Conformity Aspects	26/32	
	Language Aspect	19/20	

	Total	68/76 86.4%	
Media Expert	Conformity Aspect	10/12	very feasible
	Display Aspects	22/24	
	Usage Aspects	10/12	
	Aspects of Excellence	11/12	
	Total	53/60 88.3%	

The data in Table 4 Shows that the validation results were obtained from media experts and material experts. The aspects measured in media suitability include media suitability, appearance, practicality of use, and media superiority. The validation results obtained 53 out of 60 points with a maximum percentage of 88.3%. Meanwhile, the aspects measured regarding the suitability of the material include competence, suitability of the material, and use of language. The validation results obtained a score of 68 out of 76 points with a percentage of 86.4%.

Based on media and material experts' assessments, suggestions have been received that can improve the HTML5-based Digital Pocketbook learning media for FPB and KPK materials. Even though the press is highly suitable, the validators still provide input to improve the media. Improvements are needed to the menu components in the media so that they are more easily accessible according to the use of content in the media, such as materials, practice questions, LKPD, and games. The media needs to be repaired according to suggestions and revalidated so that a final prototype of the media is obtained (Fajriah et al., 2021). The following are the results of the revision of Pocketbook Digital Learning Media Based on HMTL5 Figure 3.

Figure 3. *Revision Results of HTML5-Based Digital Pocket Book Learning Media*

Based on the expert evaluations and the results, the HTML5-based Digital Pocketbook learning media is suitable for use as a support for learning activities, with revisions adding complete FPB and KPK material, which was previously considered incomplete by material experts, then the suitability aspect of adding discussion questions to the discussion material and changing the questions on the practice questions menu become more complex questions, and finally the language aspect with revisions changing the position of the title and name of the discussion material menu to the LKPD menu. The HTML5-based Digital Pocketbook learning media is suitable for use because it has gone through a feasibility test and obtained scores from experts, so it can add learning media references to the Mathematics lesson content at the Ngaliyan 03 Public Elementary School, Semarang City.

Next, they were carried out on a large scale, where the research subjects were all 28 students in class V B of Ngaliyan 03 Public Elementary School, Semarang City. The design used by researchers is a pre-experimental design with a one-group pre-test post-test design model. Namely, the pre-test is carried out before learning, and the post-test is carried out after learning. This is useful for knowing reliable treatment results because it can compare conditions before and after treatment (Sugiyono, 2020).

Table 6. *Large Group Cognitive Learning Results*

Action	Average	Highest Value	Lowest Value	Average Difference
Pre-test	48,6	60	32	27,8
Post-test	76,4	92	69	

Based on the results from Table 5, there has been an increase in the average student learning outcomes of 27.8. This shows that there is a difference between the conditions before and after students use the HTML5-based Digital Pocketbook learning media. The next stage is the evaluation stage, by looking at the N-Gain value. The N-Gain test results from the HTML5-based Digital Pocketbook learning media can be seen in Table **6.**

Table 7. *N-Gain Result*

Action	Average	Average Difference	N-Gain	Category
Pre-test	48,6	27,8	0,56	Effectivity moderate
Post-test	76,4			

Based on the results of the N-Gain test, this learning media is effective in increasing student understanding. N-Gain test results show that this learning media is quite effective in improving students' understanding, with a gain score of 0.56 on the medium criteria. Based on the results of expert evaluations and the results, the

HTML5-based Digital Pocketbook learning media is suitable for use as a support for learning activities. The HTML5-based Digital Pocketbook learning media can be said to be quite effective because it can be seen from the results of tests carried out by researchers to test the effectiveness of using the HTML5-based Digital Pocketbook learning media in Mathematics lesson content. By using this learning media, students can more easily understand FPB and KPK material.

Previous research findings also show that interactive learning media can improve students' understanding of learning (Hanikah et al., 2022) and foster student motivation (Safira et al., 2022) so that the learning outcomes obtained by students can reach the minimum completeness score (Marsya & Tamam, 2023). The results of the discussion prove that the HTML5-based Digital Pocketbook learning media is suitable for use in learning activities. This can be seen from the results of expert assessments and also tests showing results according to predetermined criteria. The results of this research influence the learning process, especially the content of Mathematics lessons, thereby creating a conducive and effective learning atmosphere. The HTML5-based Digital Pocketbook learning media is very suitable for teaching and learning activities in the classroom and for students' independent learning

4. Dissemination

The final step in the research process is dissemination. This product was developed using the Canva application, with the final result in the form of an HTML5 link and can be accessed using the internet. This media can be accessed via the link provided: https://delia-sonanta-nurvidia.itch.io/digital-pocketbook. Therefore, anyone, especially students and teachers in Indonesia, can access the website page and use it anywhere and anytime.

CONCLUSION

Based on the research on the development of HTML5-based Digital Pocketbook teaching materials for Mathematics lesson content in class V of Ngaliyan 03 Public Elementary School, Semarang City, it can be concluded that: 1. The teaching materials developed contain material that instills an understanding of concepts on FPB and KPK.2. The aspects of HTML5-based Digital Pocketbook teaching materials include Material title, instructions for use, CP and Learning Objectives, developer profile, references, FPB and KPK material, LKPD (teaching aids), educational games, and practice questions. Borg and Gall development model has been applied through 8 stages.3. The HTML5-based Digital Pocketbook was found to be very feasible based on media experts' evaluation (100% feasibility) as well as material experts' assessment (86.47% feasibility).4.The researchers have found that the HTML5-based Digital Pocketbook is effectively used to improve learning outcomes in Mathematics lesson content related to FPB and KPK; this

conclusion is drawn from analysis of pre-test and post-test scores which show a significant increase in effectiveness. These results were obtained through analysis of pre-test and post-test scores. The results of the paired t-test analysis show sig (2-failed) 0.000 < 0.05, and the N-Gain results show a value of 0.56. The results of this statistical data can prove that there has been a significant increase in the criteria being quite effective or moderate.

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