Development of Pop-Up Book Based Mathematics Learning Media on Three-Dimensional Shapes Material for Elementary School Students

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Article History:
Received: Jul 15, 2024
Revised: Aug 22, 2024
Accepted: Sept 30, 2024
Online First: Nov 28, 2024

Keywords:
Learning Media,
Pop-Up Book,
Three-Dimensional Shapes.

Kata Kunci:
Bangun Ruang,
Media Pembelajaran,
Pop-Up Book.

How to cite:
Andreansyah, R., & Sari, E. Y. (2024). Development of Pop-Up Book Based Mathematics Learning Media on Three-Dimensional Shapes Material for Elementary School Students. *Edunesia : Jurnal Ilmiah Pendidikan, 5*(3), 1671-1689.

Abstract: Most students consider mathematics a complex subject. Many students complete assignments and tests and receive low scores. This is often due to the monotonous nature of mathematics Learning, which makes students bored and uninterested. This study aims to develop a Learning media based on pop-up books that are both valid and feasible, with an attractive design that can be used in the Learning process and address student challenges. This research employs a Research and Development (R&D) approach using the ADDIE model (Analyze, Design, Development, Implementation, and Evaluation). Data collection techniques include media, material, and language validation questionnaires and student response questionnaires. The results indicate that the pop-up book Learning Media is highly valid and features a perfect design, as evidenced by the validation results: media at 88%, material at 86%, and language at 91.5%, all within the valid/feasible category. Product trials were conducted in two stages: a small group trial at SDN 4 Ngentrong (with five students) yielded an 89% rating, and a large group trial at SDN I Wajak Lor (with 23 students) yielded an 88.2% rating both within the outstanding category. Thus, the development of the pop-up book-based Learning media is highly valid and suitable for use as a Learning tool for three-dimensional shapes in fifth-grade elementary school, and it features an attractive and perfect design.

Abstrak: Sebagian besar siswa menganggap pelajaran matematika pelajaran yang sulit. Banyak siswa mengerjakan tugas dan ulangan mendapat nilai rendah. Penyebabnya, pembelajaran matematika yang monoton sehingga membuat siswa bosan dan tidak berminat belajar matematika. Penelitian ini bertujuan mengembangan media pembelajaran yaitu media pop-up book yang valid/layak dan mempunyai tampilan media menarik yang dapat dipakai pada proses pembelajaran serta dapat mengatasi permasalahan siswa. Jenis penelitian ini adalah Research dan Development (R&D) dengan menggunakan model ADDIE (Analyze, Design, Development, Implementation, and Evaluation). Teknik pengumpulan data menggunakan angket validasi media, materi dan bahasa serta angket respon siswa. Hasil penelitian ini menunjukkan bahwa media pembelajaran pop-up book yang dihasilkan sangat valid dan memiliki tampilan media yang sangat baik, dibuktikan dengan hasil validasi dari media sebesar 88%, materi sebesar 86%, bahasa sebesar 91,5% kategori valid/layak. Pada hasil uji coba produk melalui 2 tahap yaitu diperoleh uji coba kelompok kecil di SDN 4 Ngentrong (5 siswa) memperoleh 89% dan uji coba kelompok besar di SDN I Wajak Lor (23 siswa) memperoleh 88,2% kategori sangat baik. Dengan demikian bahwa pengembangan media pembelajaran berbasis pop-up book sangat valid/layak dipakai sebagai media pembelajaran pada materi bangun ruang di kelas V SD serta memiliki tampilan media yang menarik dan sangat baik.

https://doi.org/10.51276/edu.v5i3.1001

A. Introduction

Learning is a series of activities following an educational curriculum to achieve educational goals. In teaching and Learning activities, various efforts are made to create supportive conditions so that students' interests and talents can develop optimally and educational objectives can be met. According to (Pane & Dasopang, 2017), learning is the process of behavioral change resulting from interaction with the environment. Learning indicates the individual's conscious or purposeful effort. This activity reflects a person engaging in mental activities that transform. Learning is a change in task performance due to experience. It is unrelated to spiritual maturity, fatigue, motivation, changes in stimulus situations, or other vague factors not directly associated with the Learning Activity (Furaida & Ediyono, 2021).

Based on various sources discussing Learning, Learning is defined as a process of activities carried out by an individual with conscious awareness that results in permanent changes, thereby achieving educational goals optimally. The form of education that can enhance creativity, skills, and responsibility is mathematics education Anggoro (Tambunan & Tambunan, 2022).

Mathematics has a crucial contribution when related to daily activities. Students study mathematics from elementary school through higher education. Teachers must try to help students understand mathematics more easily (Yenni, 2023). Some students have responded that mathematics is the subject they find most challenging to grasp. Many students complete assignments and tests with low grades. Factors contributing to poor Learning outcomes include monotonous teaching methods in elementary schools, such as lectures and assignments, which make students bored and disinterested in Learning mathematics. Therefore, teachers must help students understand the subject more easily (Arifin et al., 2020).

In the pre-observation activities in the fifth grade at SD Negeri 1 Wajak Lor Tulungagung, it was found that 8 out of 23 students had difficulty understanding mathematics from the textbook. Additionally, the instruction did not fully utilize Learning media, such as mathematical manipulatives. This observation was made based on classroom Learning activities. The textbooks used by the students, such as the Cerdas Tangkas book, are predominantly black and white. In contrast, according to (Waluyatiningsih, 2019), using colorful textbooks and instructional media can help students better understand what they are Learning. Colorful and bright Learning media can capture students' attention during the Learning process (Sari, 2022).

Based on the preliminary study findings by Pradiani et al (2023) titled "Development of Pop-up Book Learning Media for Three Dimensional Shapes in Mathematics Instruction for Fifth Grade at SD 45 Mataram," it was found that teachers only taught concepts through questioning, lecturing, and using textbook materials. They only provided examples by drawing on the whiteboard. As a result, the lessons became unengaging, and students needed help understanding them. The use of Learning media in the mathematics teaching

https://doi.org/10.51276/edu.v5i3.1001

and Learning process significantly contributes to improving students' understanding of the subject.

This study, which is also supported by interviews with fifth-grade students at SD Negeri 1 Wajak Lor, indicates that students prefer Learning media that are illustrated and attractive. This preference highlights the need to develop innovative mathematics Learning media for fifth-grade material, specifically for Three-dimensional shapes. For three-dimensional shapes in Phase C, the Learning objectives (CP) include students being able to construct and decompose various three-dimensional shapes and their combinations and recognizing spatial visualization. This material is complex for students to understand and needs to be fully covered in the existing teaching materials or textbooks. The development of this Learning media is expected to support teachers in teaching mathematics with engaging and innovative methods. The presence of such Learning media can serve as an alternative or innovative solution to address students' Learning difficulties (Yudha, 2019).

Learning media refers to materials, tools, or techniques used in teaching and Learning activities to facilitate interactive communication between students and teachers. Learning media is also an intermediary for delivering information to stimulate students' thoughts, interests, emotions, and attention. Such media enables interactive, efficient, and effective communication between teachers and students (Sentarik & Kusmariyatni, 2020). Types of Learning media include visual media, audio media, and audio-visual media.

Based on pre-observation activities, it was noted that students prefer playing and tend to favor concrete or tangible media. According to Hilman and Dewi (in Maisarah et al., 2023), the development of Learning media should meet specific criteria, such as considering student characteristics, practicality, flexibility, and addressing the needs of both students and teachers. Therefore, the research developed visual Learning media as a pop-up book. This medium can be easily portable and usable anywhere and anytime (flexible), and it can enhance students' understanding. This is supported by Bakri & Muliyati (2017) research, which showed that the development of pop-up book media was based on an analysis of the needs of teachers and students. Expressly, 100% of teachers indicated a strong need for Learning media, and 92% of students expressed a need for mathematics Learning media.

A Pop-up book is a three-dimensional (3D) illustration (Fitri & Karlimah, 2018). This media has a unique appeal that can enhance students' interest, helping them better understand the material. A pop-up book works by designing the book so that images appear when the book is opened. Using a pop-up book makes the Learning environment enjoyable, as students feel like they are observing natural objects when 3D images appear on each page. It is hoped that this media will assist students in exploring their knowledge more effectively.

The Pop-up book is well-suited for implementation in mathematics education because it can stimulate students' interest in Learning. According to previous research by Ulfa & Nasryah (2020), titled "Development of Pop-up Book Learning Media to Enhance Learning Motivation of Fourth-Grade Students at SD Ujong Tanjung," the use of pop-up book media tailored to children's skills is considered attractive and practical. A lack of student enthusiasm during lessons is often due to less engaging teaching methods. Despite

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the availability of mathematical manipulatives at school, some students still need help understanding the material. Students have indicated that Learning solely with mathematical manipulatives is still perceived as less engaging. Therefore, there is a need to create an attractive and non-boring Learning atmosphere for students. The presence of a pop-up book can help prevent students from becoming bored, making the Learning process more dynamic and engaging.

Pop-up books have interactive aspects and feature three-dimensional visuals, which enhance students' attention to the information presented during lessons. From the perspectives and findings discussed above, pop-up book media can improve mathematical reasoning, representation skills, and problem-solving abilities (Fitri & Karlimah, 2018).

Based on this issue, this study aims to support teachers in enhancing students' understanding of three-dimensional shapes concepts through pop-up book-based mathematics Learning media.

B. Method

Innovation in research refers to a method recognized as R&D (Research and Development). According to Richey and Klein, as cited in (Sugiyono, 2019), research innovation is a structured study of the processes involved in designing a product, developing or creating the design, and evaluating the product's performance.

The subjects of this development research are fifth-grade students at SD Negeri I Wajak Lor. The product testing is conducted in two stages: a small group trial, which takes place in the fifth grade at SD Negeri 4 Ngentrong with five students, and a large group trial, which involves the fifth grade at SD Negeri I Wajak Lor with 23 students.

Data collection techniques and instruments include questionnaires. The research instruments used are validation sheets from media, material, and language experts, as well as validation sheets from student response questionnaires. Data analysis techniques involve evaluating the results from expert validations (media, material, and language) and the responses from student questionnaires.

This development research utilizes the ADDIE model, which includes five stages: Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model is considered relevant and efficient for application. According to Angko and Mustaji, as cited in (Kurnia et al., 2019), the ADDIE model is chosen for several reasons: (1) it adapts well to various situations; (2) it offers high flexibility in addressing issues while remaining practical in implementation; (3) it provides a structured framework with evaluation at each stage.

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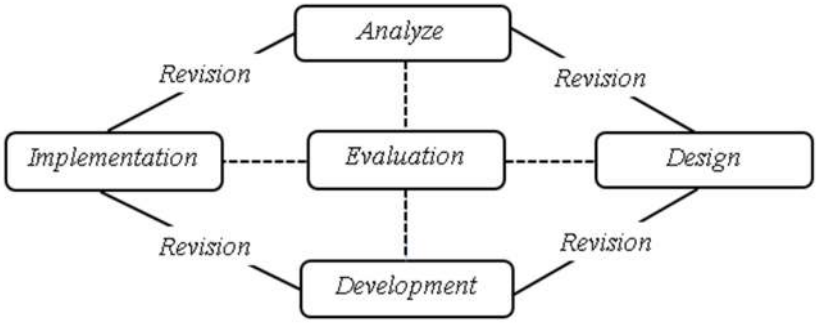

Figure 1. ADDIE Model Steps

Based on the development model used, the ADDIE model is employed as the research procedure. The stages of development research include:

1. Analyze

This stage involves analyzing and gathering information related to fifth-grade issues at SD Negeri 1 Wajak Lor Tulungagung. The researcher identifies problems found after conducting a pre-observation, enabling the development of pop-up book-based mathematics Learning media to solve these problems. Then, it is necessary to prepare for any evaluations; if no evaluation is needed, the process moves to the next stage.

2. Design

The design stage involves creating the layout for the pop-up book Learning media that will be developed. The researcher creates an initial product design, including a cover made using Canva, ensuring it is attractive to capture students' attention. The design includes color, font, and image size variations that are eye-catching and easy for students to understand. According to Zharandhont (Rizkiyanti, 2020), the brain reacts differently to various colors, and different colors can affect the viewer's psychology. According to Gale, children, especially young ones, are attracted to warm and bright colors. This influence led the researcher to select colors that match children's preferences. After creating the initial design, it needs to be evaluated to ensure it aligns with students' characteristics. The process can proceed to the next stage if it meets the criteria.

3. Development

The development stage involves creating the pop-up book Learning media based on the predetermined design. This research stage focuses on producing pop-up book-based mathematics Learning media. The development process includes:

a. Preparing the Canva application.
b. Setting up the design elements, such as color variations, sizes, fonts, etc.
c. Designing parts according to the initial design.
d. Assembling the pop-up book Learning media.
e. Adding content and example images to the designated areas.

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f. Presenting the designed pop-up book Learning Media.
g. Finalizing the pop-up book for printing and implementation in teaching.

Experts will review or evaluate the product. Before the learning media is tested with students, this validation process assesses the media's appearance and obtains recommendations and feedback from experts on how to improve the quality of the learning media product.

4. Implementation

The next step in the ADDIE model development process is implementation. After several validators have approved the product, it will first be previewed by a small group of fifth-grade students at SD Negeri 4 Ngentrong. Once necessary revisions are made, the product will be tested with fifth-grade students at SD Negeri 1 Wajak Lor Tulungagung. If the product is deemed suitable, it can be implemented in the educational process, particularly as a teaching tool at the elementary school level. According to established guidelines, the researcher can use the pop-up book as a Learning aid.

5. Evaluation

The researcher evaluates the product by distributing questionnaires to students who have used the designed product. The responses from these students are used to assess the suitability of the developed product.

C. Result and Discussion

Result

This study applies the ADDIE development model. According to Tegeh and Kirna (Kurnia et al., 2019), the ADDIE model provides a systematic approach to Learning designed to address Learning challenges related to instructional material by organizing activities systematically. This approach aims to meet students' needs and characteristics. Branch also notes that ADDIE stands for Analysis, Design, Development, Implementation, and Evaluation (Sugiyono, 2019). Below are the steps for implementing the ADDIE model.

Analysis Stage

At this stage, the focus is on analyzing the observations made in the field. Based on data obtained from pre-observation, it was found that supportive media in the teaching and Learning process are not yet fully utilized. Currently, instructional materials such as textbooks, Cerdas Tangkas, and local content are used. This study requires interviews to strengthen the data collected from pre-observation activities. Interviews were conducted with the class teacher about materials students perceived to have difficulty understanding, which could be used in a more engaging teaching method. The interview results revealed that the teacher recommended focusing on three-dimensional shapes and their components, as this material is only briefly covered in the instructional materials and is merely

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demonstrated on the blackboard. Despite the availability of teaching aids, students still struggle to understand the content. Therefore, based on the needs analysis and the interview results with the fifth-grade teacher at SD Negeri I Wajak Lor, it was determined that media support for Learning has yet to be fully maximized or utilized. Consequently, this research will develop a pop-up book, Learning Media, focusing on three-dimensional shapes.

Design stage

The design stage involves developing the Learning media based on the interview results related to three-dimensional shapes. Since students enjoy interactive activities and prefer concrete or tangible objects, a pop-up book was selected as the medium. The initial design was revised based on feedback from the lecturer, which included suggestions to add Learning objectives, additional content, projects, and quizzes. After evaluating the design stage, the process moves on to the next stage: development. The revised design of the pop-up book media includes the following:

Front and Back Covers of the Pop-up Book

Figure 2. Pop-Up Book Cover

The Front Cover Includes the title and subject matter, illustrations related to the content, grade level, and the author's and supervising lecturer's names. The back cover displays the institutional identity.

Usage Instructions and Table of Contents

Figure 3. Usage Instructions and Table of Contents

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Page 1 provides instructions on how to use the pop-up book and includes the table of contents for the media.

Usage Instructions and Learning Objectives

Figure 4. Usage Instructions and Learning Objectives

Page 2 Includes the Learning objectives and goals that students are expected to achieve through the instruction provided by the pop-up book.

Content of the Pop-up Book

Figure 5. Definition of Three-Dimensional Shapes and Their Components

Page 3 Contains the definitions of three-dimensional shapes, including their components such as edges, faces, and vertices, and the concept of the nets of spatial shapes. Pages 4-6 cover material related to the definitions of various spatial shapes and their properties. It includes examples of three-dimensional (3D) shapes and demonstrates the nets of these shapes, showing how they fold into 3D objects.

Figure 6. Cuboid

Figure 7. Cube

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Figure 8. Triangular Prism

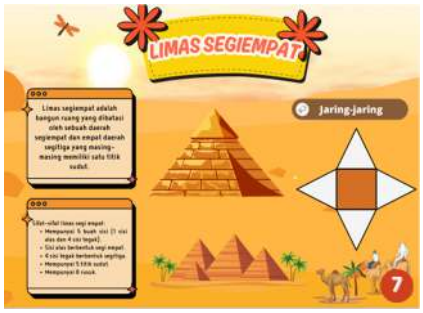

Figure 9. Square-Based Pyramid

Figure 10. Cone

Figure 11. Cylinder

Quizzes and Projects

Figure 12. Quizzes and Projects

On the last page, there is a quiz where students must guess which envelope contains the correct net of a cube. Additionally, there is an individual project where students draw the nets of spatial shapes.

Development Stage

In the development stage, the revised product design is printed and validated by experts, including material, media, and language experts. The validators are Mrs. Dr. Ria Fajrin Rizqy Ana, M.Pd., a media and material expert. Mr. Aditya Pringga Satria, M.Pd., is a material and language expert. Mr. Nugrananda Janattaka, M.Pd., serves as a media and language expert. All three are lecturers at Universitas Bhinneka PGRI. The validation aims

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to determine the product's suitability for use in classroom teaching. Below is the presentation of the feasibility and criteria for the educational media.

Table 1. Percentage of Eligibility and Interpretation Criteria

Percentage	Eligibility Level	Information
85% - 100%	Very valid	Worthy/No need for revision
70% - 84%	Valid	Quite worthy/ Need revision
50% - 69%	Less valid	Less Worthy/Total revision
1% - 49%	Invalid	Not suitable for use

Validation Results from Experts

Table 2. Media expert validation results

No	Aspects that are Evaluated	Assessment Score Media Expert I	Media Expert II
Practicality of the media			
1.	The pop-up book Learning Media is flexible in its use (open-close).	4	4
2.	The pop-up book can be used repeatedly.	4	3
3.	The pop-up book is easy to carry anywhere.	4	4
4.	The size of the pop-up book is suitable for use both in the classroom and outside the classroom.	3	4
Appearance of the Media			
5.	The design of the pop-up book is engaging and aligns with the spatial shapes content (motivates student Learning).	3	3
6.	The font type used is appropriate for elementary school students.	3	3
7.	The images in the pop-up book are consistent with the three-dimensional shapes.	4	4
8.	The images presented reflect the surrounding environment.	3	4
9.	The spatial shapes in the pop-up book create an appealing impression for students (standing when opened).	3	4
Feasibility of the Media			
10.	The font size is straightforward for students to read.	3	3
11.	The sentences used are understandable by students and do not contain ambiguous meanings.	3	4
12.	The use of color in the pop-up book is tailored to the characteristics of elementary school students.	3	4
13.	The layout of images in the pop-up book is appropriate for the three-dimensional shapes.	3	3
14.	The materials used in the pop-up book are safe for students.	4	4
15.	The pop-up book is durable over time	3	4
	Total Score	**50**	**55**
	Maximum score	**60**	**60**
	Percentage	**84%**	**92%**

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According to Table 2, the validation results from the two media experts yield an average score of 88% when divided by 2. Therefore, the media is categorized as highly valid/appropriate (85 - 100%) and can be used in teaching.

Table 3. Material Expert Validation Results

No	Aspects that are Evaluated	Assessment Score	
		Material Expert I	Material Expert II
Alignment with the Curriculum			
1.	The material is based on the elementary school curriculum, namely the Merdeka Curriculum.	4	4
2.	Alignment of the material sequence with the Learning Outcomes.	4	3
3.	Alignment with the Learning Objectives.	4	3
4.	The clarity of the material in the pop-up book media is consistent with the three-dimensional shape of the content.	4	4
Sequence of the material			
5.	Completeness of the material in the pop-up book	4	3
6.	The material presented is engaging for students	3	3
7.	The material is related to everyday life	3	3
8.	The material in the teaching media is packaged according to the characteristics of Elementary School students	4	3
9.	The material presented enhances student's knowledge or understanding	3	4
Suitability of the media			
10.	The presentation of the material can stimulate student's curiosity.	3	3
11.	The presentation of the material can foster student's creative thinking.	3	3
12.	The presentation of the material can nurture students' imaginations.	3	3
13.	The material presented is straightforward for Elementary School students to understand.	4	3
	Total Score	**46**	**43**
	Maximum score	**52**	**52**
	Percentage	**89%**	**83%**

According to Table 3, the validation results from 2 subject experts show that the average score obtained from the two validators, when divided by 2, results in a percentage of 86%. Therefore, the material in the media can be categorized as very valid/appropriate (85 - 100%) and can be used in the teaching and Learning process.

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Table 4. Language Expert Validation Results

No	Aspects that are evaluated	Assessment Score	
		Language Expert I	Language Expert II
Direct			
1.	Consistency of sentence structure in the pop-up book media	4	4
2.	The sentences presented are effective	4	3
3.	Correctness of terminology	4	3
Sequence of the material			
4.	Ability to motivate students in the Learning process	4	3
Dialogic and interactive			
5.	Presentation of the material using language that is easy for students to understand, polite, and engaging	3	4
6.	The presentation of the material can foster students' creative thinking	4	3
Use of Symbols, Terminology, and Icons			
7.	Using sentences by standard language rules (EYD)	3	4
Adherence to language norms			
8.	Consistency of the language used in explaining the material	3	3
9.	Words used are not offensive or disrespectful	4	4
Appropriateness for students' development			
10.	Presentation of the material using language that is easy for students to understand, polite, and engaging	4	3
	Total Score	**38**	**35**
	Maximum Score	**40**	**40**
	Percentage	**95%**	**88%**

Based on Table 4, the validation results from 2 language experts show that the average score obtained from the two validators, when divided by 2, results in a percentage of 91.5%. Therefore, the language in the pop-up book is very valid/appropriate (85 - 100%) and can be used in the teaching and Learning process.

Implementation Stage

The next stage after development is the implementation phase, which involves testing the media with students to assess their responses and the effectiveness of the pop-up book. The following is the interpretation of the student questionnaire responses.

Table 5. Interpretation of the Student's Questionnaire Responses

No	Score Interval	Category
1	81 - 100	Very Good
2	61 - 80	Good
3	41 - 60	Adequate
4	0 - 40	Poor

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Product Testing Results

a. Small Group Testing

The small group testing was conducted with five fifth-grade students from SD Negeri 4 Ngentrong, selected from 5 students. These students were selected randomly while considering various characteristics, including active participation in class, interest in the teacher's explanations, preference for group Learning, and a range of Learning outcomes from adequate to high. The results of the student questionnaire responses from the small group testing are shown below.

Table 6. Results of Small Group Testing Recap

No	Student Name	Total Score	Result (%)	Remarks
1.	DMP	44	84%	Very good
2.	ADE	46	88%	Very good
3.	FASP	45	87%	Very good
4.	APH	50	96%	Very good
5.	ZRAZ	47	90%	Very good
	Average	**46,4**	**89%**	**Very good**

Based on Table 6, the student questionnaire responses from the small group testing show a total score of 46.5, with an 89% percentage. According to the criteria (Sugiyono, 2019), the pop-up book learning media is very good (81–100%) and has an attractive appearance. Therefore, it is ready to be tested with a larger group.

b. Large Group Testing

After completing the small group testing, the next step is to conduct testing with a larger group. In the significant group testing phase, the pop-up book media was implemented in a fifth-grade class at SD Negeri I Wajak Lor, consisting of 23 students. The students' feedback results are documented below.

Table 7. Results of Large Group Testing Recap

No	Student Name	Total Score	Result (%)	Remarks.
1.	AM	45	87%	Very good
2.	AFA	49	94%	Very good
3.	AF	49	94%	Very good
4.	ARP	44	84%	Very good
5.	AD	46	88%	Very good
6.	ANY	48	92%	Very good
7.	AAP	45	87%	Very good
8.	BO	46	88%	Very good
9.	DAY	39	75%	Good
10.	DI	46	88%	Very good
11.	FAMN	46	88%	Very good

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No	Student Name	Total Score	Result (%)	Remarks.
12.	IFP	45	87%	Very good
13.	MAS	48	92%	Very good
14.	MAPA	47	90%	Very good
15.	MAAP	49	94%	Very good
16.	MDS	47	90%	Very good
17.	MFR	46	88%	Very good
18.	MN	45	87%	Very good
19.	RAF	48	92%	Very good
20.	SA	46	88%	Very good
21.	SAYF	45	87%	Very good
22.	YSP	39	75%	Good
23.	YCN	49	94%	Very good
	Average	**45,96**	**88,2%**	**Very good**

According to Table 7, the results of the significant group student questionnaire show an average score of 45.96, with a percentage of 88.2%. It can be concluded that the student's responses to the pop-up book Learning Media for three-dimensional Shapes are categorized as very good (81–100%) and that the media has a perfect and attractive appearance.

Evaluation Stage

The final stage is evaluation. This stage is divided into several phases. The first phase is analysis, where the evaluation involves identifying initial issues in the fifth-grade class. The results of this identification serve as a basis for developing the pop-up book product. The second phase is design, where the evaluation includes enhancing Learning outcomes and improving the design of the pop-up book to make it more engaging. The third phase is development, where the evaluation involves reviewing the printed media based on the design plan and receiving feedback and suggestions.

Consequently, the researcher revises the initial design and creates a revised plan. The revised product is then assessed by expert validators, deemed suitable, and ready for testing in small and large groups. The next phase is implementation, which is carried out in two stages: small-group and large-group testing. The small group test was conducted with five fifth-grade students at SD Negeri 4 Ngentrong, who responded well, with a percentage of 89%. This was followed by the significant group test with 23 fifth-grade students at SD Negeri I Wajak Lor, achieving a response percentage of 88%. Based on these results, the implementation phase is considered complete, with no further evaluation needed, as the media is deemed very good and has a beautiful appearance.

Discussion

The use of media is closely related to the teaching and Learning process. Educational instruments function as tools educators utilize to enhance the Learning process for students. These instruments support students' understanding, making it more transparent and achieving the Learning objectives more effectively and optimally (Kustandi & Darmawan,

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2020). According to Arsyad and Rahman (Yenni, 2023), Learning media can help students understand lessons more quickly, making them more active and independent. Based on the explanation, Learning media is beneficial for improving teaching activities and facilitating communication and interaction between educators and students during the teaching and Learning process.

Based on the preliminary observation conducted at SD Negeri I Wajak Lor, issues were explicitly identified in the fifth-grade class. The purpose of the observation was to examine and understand the various supporting media used by the teacher in the Learning process, the teaching materials, the teaching approach applied by the teacher, and the students' perspectives during the Learning process. The findings indicate that the teaching materials used are based on the Merdeka Curriculum, with Learning resources such as textbook packages, Cerdas Tangkas, and local content. The teacher employs methods such as questioning, discussion, and lecturing during the teaching process. Although the implementation of these methods by the teacher has been relatively effective, innovation is still needed to support Learning, such as having additional supporting media in schools to make Learning more meaningful for students, even though the school already has mathematical teaching aids. During classroom instruction, students focus more on the books, and the delivery methods are limited to demonstrations on the whiteboard, thus not fully utilizing available educational media.

Learning media plays a significant role in education and the teaching-learning process, greatly contributing to students' progress in schools by effectively ensuring their understanding and absorption of material from the teacher (Junaidi, 2019). Adopting Learning media in the teaching-learning interaction makes the Learning experience more engaging and reduces monotony, allowing students to grasp the material more quickly and providing opportunities for a better holistic Learning experience. Consequently, students can comprehensively understand the material presented (Nurrita, 2018). Based on the preliminary observation, the issue identified in the fifth-grade class at SD Negeri I Wajak Lor is the suboptimal use of Learning media.

Subsequently, interviews were conducted with students regarding their understanding of three-dimensional shapes and their reactions to having the material presented as a pop-up book. The students were very enthusiastic about having the material presented in the new format of a pop-up book. The pop-up book was chosen because it aligns with the student's characteristics, as they enjoy interactive and tangible objects. A pop-up book is particularly suitable because it includes moving or emerging elements when the pages are opened, featuring three-dimensional (3D) opening mechanisms such as folds, scrolls, slides, tabs, or wheels (Batubara, 2020). The pop-up book contains engaging illustrations that make Learning more enjoyable for students (Fitri & Karlimah, 2018).

Additionally, the pop-up book utilizes origami techniques, as each page is folded like origami. Some parts of the pop-up book pages are glued and arranged neatly, resembling origami folds, but pop-up books use adhesives and paper, whereas origami does not. Due to its interactive nature, the pop-up book is an attractive educational tool for

https://doi.org/10.51276/edu.v5i3.1001

students in the teaching and Learning process. Furthermore, the advantage of a pop-up book is that it involves movement when the pages are opened (Habibi & Setyaningtyas, 2021).

Next, the classroom teacher was interviewed to assess the need for developing material for the pop-up book Learning media. The interviews revealed that the teacher suggested incorporating content on three-dimensional shapes and their components. This recommendation was based on the observation that the material was only briefly covered and demonstrated on the blackboard with limited teaching aids. The aim is to use this media to provide a more in-depth introduction and understanding of three-dimensional shapes and their components more concretely.

The developed pop-up book media also has advantages, according to Dzuanda (Istasfi, 2016), including providing a more tangible and concrete visualization of three-dimensional shapes, reinforcing the impressions intended to be conveyed, facilitating understanding of the material, and the three-dimensional visual appearance enhancing the significance of the pop-up book. Additionally, the pop-up book media is practical to carry anywhere and anytime and is easy to use. It is well-suited to children's capacities and is practical, attractive, and simple (Ulfa & Nasryah, 2020). The pop-up book is also developed with variations in color, font, and image size that are engaging and easy for students to understand. Zharandhont (in Rizkiyanti, 2020) explains that the brain responds differently to each color. Various colors can influence the psychology of those who see them. Children, especially young ones, are attracted to warm and bright colors. This is why the researcher chose colors that match the preferences of children.

In previous research by Fahrizar & Oktaviana (2019), titled "Analysis of the Needs and Feasibility of Pop-Up Book Learning Media Based on Contextual Teaching and Learning," it was found that textbook materials only present two-dimensional elements such as illusionary images. Therefore, there is a need for Learning tools that allow students to observe three-dimensional elements directly. Additionally, students' observations indicated that they tend to lose focus when engaged in mathematics Learning by merely imagining an object. Media development refers to the criteria for determining media based on Hilman and Dewi (in Maisarah et al., 2023), which include considering students' characteristics, practicality, flexibility, and addressing the problems faced by both students and teachers. Based on this theory, the researcher developed a pop-up book media. Bakri & Muliyati (2017) explained that the development of pop-up book media is based on the analysis of the needs of both teachers and students, where the results showed that 100% of teachers indicated a high need for Learning media, while 92% of students required mathematics Learning media. The pop-up book is an interactive and attractive Learning medium for students, combining 3D images with appealing colors. The pop-up book also provides a highly realistic experience that helps extend material retention and enhance the meaning of Learning (Kristianingrum & Radia, 2022).

Introducing this Learning media will likely encourage teachers and students better to understand three-dimensional shapes, particularly for fifth-grade students. The presence

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of this media can also inspire researchers and future educators to become more innovative and creative and to inspire fellow teachers to explore the potential of Learning media further. This will make Learning more engaging, enjoyable, and meaningful, and it will align the development of Learning media with the needs and characteristics of students.

D. Conclusion

This development research has produced a product in the form of a pop-up book on three-dimensional shapes. According to media experts, material experts, and language experts, the developed Learning media is highly feasible and valid for addressing issues faced by fifth-grade students in elementary school. The pop-up book Learning Media is perfect and visually appealing, as demonstrated by student responses from two rounds of testing with both small and large groups.

This Learning media can enhance students' understanding of three-dimensional shapes, especially for fifth-grade elementary students. Additionally, this media can motivate future educators to explore the potential of developing more engaging, enjoyable, and meaningful Learning media, aligning the development of educational tools with students' needs and characteristics.

Based on the conclusions regarding the development of the pop-up book Learning Media, recommendations for future researchers include further enhancing the Learning Media's content and material to make it more comprehensive and interactive. Additionally, researchers should develop Learning media that helps students understand the concepts being taught.

Acknowledgment

The researcher would like to extend special thanks to parents, campus friends, and friends from outside the campus, as well as to classmates from 8B, the 2020 batch of the Primary School Teacher Education Program at Universitas Bhinneka PGRI Tulungagung, who have continually provided encouragement and motivation, enabling this research to be completed on time. The researcher also expresses gratitude to the supervising lecturer, Mrs. Eka Yuliana Sari, M.Pd, and the examiner lecturer, Mrs. Rohmatus Syafi'ah, M.Pd, for their guidance, support, and direction throughout the research process.

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