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DEVELOPMENT OF POP-UP BOOK LEARNING MEDIA IN SCIENCE SUBJECT AT ELEMENTARY SCHOOL

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ABSTRACT

One of the many obstacles faced by elementary teachers in learning is that lack of suitable teaching media and material thus failed to attract students' attention during the teaching-learning process, especially in science learning in which abstract concepts usually require concrete objects to enhance students' understanding. The purpose of this research is to determine the students' learning outcomes by using pop-up books as a media in teaching science for the elementary students. By using the saturation sampling technique, a total of 16 fourth-grade students in Aceh Singkil involve in this study. This Research and Development (R&D) study adopts the ADDIE instructional systems design framework model to develop the product. The results shows that the designed pop-up book is very valid thus can be used as the material for science teaching. Furthermore, the media can increase students' knowledge and can help student understand the concept easily.

Keywords: *Pop-up book, learning media, science.*

INTRODUCTION

To achieve the objective of education, it is crucial to have a well-designed curriculum that takes into account the specific circumstances, needs, and environment of the learners. The curriculum should be able to anticipate the situations that the learners will encounter. A curriculum is essentially a program that is based on a set of experiences and activities that facilitate learning. The quality of the learning process depends on three key elements: the curriculum itself, the teachers, and the participants. The educational process is a comprehensive endeavor that guides individuals in developing their abilities and personal lives, both as individuals and as members of society. It also helps individuals become responsible individuals who can navigate their relationships with the environment.

Law No. 20 of 2003 on The National Education System emphasizes that learning is a collaborative process between students, educators, and study resources in a conducive learning environment. The goal is to provide a learning experience that engages both the mind and the body. The success of learning can be observed through active student participation during study activities. Science (IPA) is a subject that facilitates behavioral changes through interaction with the environment. Therefore, active student participation is essential to gain valuable experiences. The teaching and learning process encompasses more than just imparting knowledge; it involves a holistic understanding. It is a unified activity where students and teachers interact and support each other.

According to Wahyana, as cited in Trianto (2012), IPA is a discipline that gathers knowledge in a systematic and comprehensive manner, primarily focused on understanding the natural world. Additionally, there are factual factors that contribute to this discipline, such as knowledge in various fields like technology, art, culture, and their connections to oneself, family, school, community, natural environment, nation, and state. By encouraging students to adopt a scientific mindset, they are able to develop critical and logical thinking skills that can be applied in their daily lives.

According to Powler in Samatowa (2010), IPA (science) is a systematic and structured field that gathers knowledge through observation and experimentation. It is not just about acquiring facts, concepts, or principles, but also involves a process of discovery that requires student involvement. Therefore, it is important to develop and use appropriate learning media that align with the developmental characteristics of elementary school students, who are at the stage of concrete operational thinking and can connect concepts.

Therefore, choosing the right learning media is crucial for teachers to achieve their learning objectives. According to Herliana & Anugraheni (2020), learning media refers to materials or tools used to convey messages or information about the subject matter in classroom activities. These media not only serve as guides, but also help to demonstrate, provide, and motivate participants in their education, making learning enjoyable and easy. It is important to note that while the nature of learning is abstract, the use of concrete learning media that can be seen, touched, or experienced in three dimensions is highly effective, especially for fifth-grade students in elementary school. One such learning media that can create a pleasant classroom environment is Pop-up books.

The pop-up book can be used as an example to explain abstract concepts that require concrete objects. Dzuanda (2011) stated that a pop-up book is a book that has moving parts or three-dimensional elements and provides a more interesting visualization of the story. Compared to regular children's storybooks, pop-up books can provide more enjoyment in reading stories. When enjoying a pop-up book, children not only read a story, but they can interact with the story presented in the book and actively participate, whether through touch, observation, or even through the sounds presented in the pop-up book. The element of surprise in pop-up books can cultivate children's curiosity about what will happen on the next page, making them more interested in reading. In addition, using pop-up books in thematic learning will broaden students' knowledge and eliminate boredom during the learning process (Khairunnisa, 2019). The use of pop-up books in early childhood education can help children bridge the gap between real-life situations and the symbols that represent them, as well as develop critical and creative thinking skills (Bluemel & Taylor, 2012).

The purpose of this research is to determine the students' learning outcomes by using pop-up books as a media in teaching science for the elementary students.

METHODS

This study focuses on Research and Development (R&D). The process of research and development involves conducting research and then proceeding with the development of a new product. The aim is to create a new product through effective testing and development processes (Permana & Sari, 2018). In this particular study, the developed product is a learning medium called Pop Up Books. The development model used in this study is the ADDIE model, which is a systematic approach that consists of five steps: (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation (Tegeh, et al., 2014).

This research was conducted at SDN Situbuh-tubuh, Aceh Singkil. A total of 16 fourth-grade students involve in this study. The sampling technique used by the researcher was the saturation sampling technique. The researcher used tests and questionnaires to collect the data. The test consisted of a pre-test and a post-test. The pre-test was administered at the beginning of the first meeting before the learning process starts to determine the students' initial abilities. Meanwhile, the post-test was given after the learning material were delivered in the second meeting to assess the success of the learning process through the use of Pop Up Book media. The test in this study consisted of 20 multiple-choice questions related to the indicators that have been determined based on the lesson plan. Meanwhile, the questionnaire with 20 questions was distributed after all activities were completed.

The data from the quantitative test activity was analyzed using the Pre-Experiment Design One Group Pre-Test Post-Test Design method (Sugiono 2011).

Table 1. One Group Pre-Test Post-Test Design

Group	Pre-test	X	Post-test
Class IV	O_1	Treatment	O_2

Source: Arikunto, 2013, p.123

For:
O1 = *Pre-Test*
O2 = *Post-Test*
X = Treatment

N-Gain was used to measure the difference between the pre-test and post-test scores. The improvement in competence that occured before and after learning was calculated using the G factor formula (N-Gain) with the following formula:

Table 2. Assessment Categories (Arikunto, 2008).

Number	Information
80-100	Excellent
66-79	Good
56-65	Enough
40-55	Poor
30-39	Fail

$$P = \frac{S\,post - S\,pre}{S\,maks - S\,pre}$$

For:
S post = Post-test score
S pre = Pre-test score
S max = Maximum score

Table 3. The interpretation of N-Gain

Percentage	Interpretation
$0.7 < (g) \leq 1$	High
$0.3 \leq (g) \leq 0.7$	Moderate

0 < (g) < 0.3	Low

Data from the qualitative testing was analyzed based on the basic percentage formula, that was:

$$P = \frac{f}{n} x\ 100\%$$

For :
P = Presentation Number
F = Frequency
N = Number Respondent

The percentage that was obtained on each statement item or question then interpreted based on the criteria depicted in Table 3.4 as following:

Table 4. The Percentage Criteria

Percentage (%)	**Criteria**
81-100	Very active
61-80	Active
41-60	Moderate
0-40	Less active

RESULTS AND DISCUSSION

Researchers conducted initial work by analyzing the need for learning media in the form of a Pop Up Book. The analysis was carried out through observations at the SDN Situbuh-tubuh. The results of the analysis revealed that a lack of learning media is one of the reasons for students' inability to understand the Animals and Plants in My Home Environment material. To gather more information, the researcher interviewed the homeroom teacher. The analysis showed that 42% (see Tabel 5) of the teachers agreed that the lack of learning media is a contributing factor to students' difficulty in understanding the science learning material related to animals and plants in the environment. The results were as depicted in Table 5.

Table 5. Interview Results Need

No	**Indicator**	**Instrument score**					**Information**
		1	**2**	**3**	**4**	**5**	
1.	Is it difficult to teach science to students?				V		Difficult to teach to student

2.	Do students seem to have difficulty understanding science lessons?			V			Difficult enough
3.	Are students active in carrying out science learning?		V				Students are less active
4.	Do teachers use teaching media for every lesson?	V					Did not use learning media
5.	Are all media available, especially science teaching media?	V					No learning media available
6.	Has the use of media been done before?	V					Never
7.	Is the use of media appropriate?	V					It was not suitable
8.	According to the mother, does the student like science lessons?				V		They do like science lessons
TOTAL SCORE		**17**					
MAX		**40**					
PERCENTAGE		**42%**					

The Design Stage

The Design Stage is the stage of product design, where researchers first determine the learning objectives, material, and media design. At this stage, the researcher aims to develop a media that serves as an access to improve student learning outcomes.

The final product is a pop-up book for learning. The elements developed from this pop-up book media include a dice as a game and learning material, and inside the media there are envelopes, each with a number and a related question about the material to be explained. The inclusion of a dice game in this pop-up book learning media increases the enthusiasm for learning and eliminates boredom for students in an effort to improve the learning outcomes of the students.

The researcher designed a Pop Up Book learning media by measuring the appropriate size of the media, incorporating 3D elements. Then, the researcher designed the material aspect by emphasizing on motion and movement using the Pop Up Book media in a concise and clear way. The language used in the Pop Up Book media was clear, straightforward, and easily understood. The Pop Up Book media is designed according to the needs of the students, consisting of core competencies, basic competencies, objectives, spatial structure material, conclusions, and questions.

The Development Stage
Language validation results

The product of this research is the Pop Up Book learning media for the fourth-grade students. The following are the validation results of the product. Language validation aims to determine the experts' opinions on the language use in the media. The complete results of the language validation are presented in the following Table 7.

Table 7. Linguist Validation

No	Statement	Score	Score Max	P (%)	Information
1.	The accuracy of the sentence to convey the message and the information.	3	5	60%	Valid/No Revision
2.	The effectiveness of the sentences used	3	5	60%	Valid/No Revision
3.	The terms used is in accordance with the function	4	5	80 %	Valid/No Revision
4.	Easy to understand	4	5	80 %	Valid/No Revision
5.	Able to motivate students	4	5	80 %	Valid/Not Revision
6.	Encourage students to think critically	4	5	80 %	Valid/Not Revision
7.	Punctuation appropriateness	4	5	80 %	Valid/ No Revision
8.	Appropiate with the students' emotional level	4	5	80 %	Valid/NoRe vision
9.	Accuracy of punctuation used	4	5	80 %	Valid/No Revision
10.	Accuracy of the spelling used	4	5	80 %	Valid/ No Revision
11.	Provides the ability to ask questions	4	5	80 %	Valid/ No Revision
12.	Sentence standardity	4	5	80 %	Valid/ No Revision
13.	Accuracy of language use	3	5	6 0%	Valid/ No Revision

14.	Consistency in use of terms	4	5	80 %	Valid/ No Revision
15.	Understanding the message or information	4	5	80 %	Valid/No Revision
16.	Words repetition	4	5	80 %	Valid/ NoRevision
17.	Grammatical correctness	4	5	80 %	Valid/ No Revision
18.	Appropriateness used of language	5	5	100 %	Very valid
Total		**70**	**90**	**77 %**	**Valid/ No Revision**

The data in Table 7 were calculated using the following formula:

$$\text{Validity (v)}= \frac{f}{N} \text{x } 100\%$$
$$\text{Validity (v)}= \frac{70}{90} \text{x } 100\%$$
$$\text{Validity (v)}= 70\%$$

Based on the validation results of the language, it was concluded that the Pop Up Book developed can be used in learning. This is proven by the score on the questionnaire items validated by the validator for the Pop Up Book media, which obtained an average score of 70% with a suitable criteria result.

Material validation results

The validation results of the material on the Pop Up Book media about Animals and Plants in the Environment Around My House were obtained through experts validation. The validation of the learning material was done in a valid manner. The complete validation results are presented in Table 8.

Table 8. Material Validation

No	Statement	Score	Score max	P(%)	Information
1.	In accordance with the basic competencies	5	5	100	Very Valid/ No Revision
2.	In accordance with the indicators	5	5	100	Very Valid/No Revision
3.	In accordance with the learning objectives	5	5	100	Very Valid/No Revision

4.	The material aspects are correct	5	5	100	Very Valid/ No Revision
5.	The material is easy to understand	4	5	80	Valid/No Revision
6.	The material is in accordance with the learning media	4	5	80	Valid/No Revision
7.	The language and content are appropriate	4	5	80	Valid/ No Revision
8.	Relevance of animal and plant material with the students' environment	4	5	80	Valid/No Revision
9.	Parts of plants and their functions	5	5	100	Very valid/ No Revision
10.	Encourage curiosity	5	5	100	Very Valid/ No Revision
11.	Creates the ability to ask questions	5	5	100	Very Valid/ No Revision
12.	Encourage students to make connections with everyday life	5	5	100	Very Valid/ No Revision
13.	Using a pop up book as an example	5	5	100	Very Valid/ No Revision
14.	Accuracy of the image with the material	5	5	100	Very Valid/ No Revision
15.	Accuracy of the icons used	5	5	100	Very Valid/ NoRevision
16.	Encourage critical thinking	5	5	100	Very Valid/ No Revision
17.	Completeness of the contents	5	5	100	Very Valid/ NoRevision

Amount	**81**	**85**	**95 %**	**Very Valid/ No Revision**

The data in Table 8 were calculated using the following formula:

$$\text{Validity (v)}= \frac{f}{N} \text{x } 100\%$$
$$\text{Validity (v)}= \frac{81}{85} \text{x } 100\%$$
$$\text{Validity (v)}= 95\%$$

Based on the validation results of the material, it was concluded that the Pop Up Book developed can be used in learning. This is proven by the score on the questionnaire items validated by the validator for the Pop Up Book media, which obtained an average score of 95% with a very high criteria.

Results media validation

The media validation on the Pop Up Book about Animals and Plants in the Environment Around My House were obtained through experts validation. The validation of the learning material was done in a valid manner. The complete validation results are presented in Table 9.

Table 9. Validation Media Expert

No	Statement	Score	Score max	P (%)	Information
1.	Easy to use	5	5	100	Very Valid/ No Revision
2.	Integration between components in the media	5	5	100	Very Valid/ No Revision
3.	The illustrations reflect the reality	4	5	80	Very Valid/ No Revision
4.	Selection of media forms	5	5	100	Very Valid/ No Revision
5.	Quality of the materials used	5	5	100	Very Valid/ No Revision
6.	Durability of the materials used	5	5	100	Very Valid/ No Revision
7.	Color choices in media	4	5	80	Valid/ No Revision
8.	The relevance of the media to the material	5	5	100	Very Valid/ No Revision

9.	Safety	4	5	100	Valid / No Revision
10.	The front and back cover designs are unified and consistent	5	5	100	Very Valid/ No Revision
11.	The colors used are attractive	5	5	100	Very Valid/ No Revision
12.	The illustrations used are interesting	5	5	100	Very Valid/ No Revision
13.	The images used are suitable for the material.	5	5	100	Very Valid/ No Revision
14.	Writing size	5	5	100	Very Valid/ No Revision
15.	Media size	5	5	100	Very Valid/ No Revision
16.	The language used is clear	5	5	100	Very Valid/ No Revision
17.	Clear writing	5	5	100	Very Valid/ No Revision
18.	Creative and dynamic	5	5	100	Very Valid/ No Revision
19.	Use of letters that are not excessive	5	5	100	Very Valid/ No Revision
20.	The captions for the illustrations and images	5	5	100	Very Valid/ No Revision
Amount		**97**	**100**	**97 %**	**Very Valid**/No Revision

The data in Table 9 were calculated using the following formula:

$$\text{Validity (v)}= \frac{f}{N} \text{x } 100\%$$
$$\text{Validity (v)}= \frac{81}{85} \text{x } 100\%$$
$$\text{Validity (v)}= 95\%$$

Based on the validation results of the media, it was concluded that the Pop Up Book developed can be used in learning. This is proven by the score on the questionnaire items validated by the validator for the Pop Up Book media, which obtained an average score of 97% with a very high criteria.

Validation appropriateness

Based on validation results on the language use, material, and media, it can be concluded that Pop Up Book media is suitable to be used in learning (see Figure 1).

The image shows the percentage score results for the suitability of the Pop Up Book learning media obtained from each validator. It can be depicted through the graph (Figure 1) with the conclusion that the Language validator obtained a score of 77% in the suitable category, the Material validator scored 95% in the very suitable category, and the Media validator scored 97%. It can be concluded that the Pop Up Book learning media can be implemented for fourth-grade students at Situbuh-tubuh Elementary School with a very suitable category.

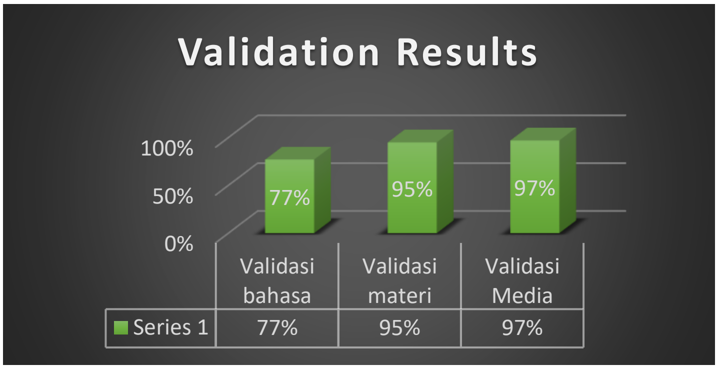

Figure 1. Media and Material Expert Assessment Diagram

Implementation Stage

The implementation stage involves the application of the developed Pop Up Book media. After being deemed highly valuable by the validator, the researcher proceeded to the field to test the media that had been prepared for validation. The purpose was to determine the effectiveness of the media in enhancing student learning. The application took place at Sijiwa-body State Elementary School. At the conclusion of the implementation stage, the researcher distributed a questionnaire to the students to assess the impact of the Pop Up Book media on their learning. The data collected from the students' responses regarding the learning media indicated the following:

Table 10. The students Responses

No	Subject	F	Max Score	P (%)
1	M.F	93	100	93%
2	H	93	100	93%

3	A	93	100	93%
4	R.A	91	100	91%
5	CRB	94	100	94%
6	WB	93	100	93%
7	CH	96	100	96%
8	RBM	97	100	97%
9	AT	97	100	97%
10	V	98	100	98%
11	RNT	95	100	95%
12	m	95	100	95%
13	R	95	100	95%
14	I	95	100	95%
15	R.B	92	100	92%
16	FAS	100	100	100%
Total		**1517**	**1,600**	**95%**

The data in Table 10 were calculated using the following formula:

$$P = \frac{f}{n} x\ 100\%$$
$$P = \frac{1517}{16} x\ 100\%$$
$$P = 95\ \%$$

The results shows that 95% of the students agree that the Pop Up Book media is an interesting learning media in science.

Evaluation Stage

Pre-test and post-test results

Learning outcomes are assessed by measuring the knowledge or mastery of students through the use of Pop Up Book learning media. The data collection process involved administering both a pre-test and a post-test. The pre-test was conducted to assess the students' initial abilities before they were exposed to the Pop Up Book learning media, which was used to prepare the participants for the learning process. On the other hand, the post-test was administered to evaluate the students' understanding of the material taught during the learning process, specifically in relation to the motion and movement presented through the use of the Pop Up Book learning media. The results of the study, including the pre-test and post-test data, are presented in Table 4.7.

Table 11. Pre-test scores

No	NAME	Pre-test Value	Criteria
1.	CRB	60	Enough
2.	MM	40	Less
3.	HZ	35	Fail
4.	A	30	Fail
5.	WB	60	Enough
6.	RM	35	Fail
7.	PS	45	Fail
8.	CH	55	Fail
9.	PS	50	Fail
10.	RP	40	Fail
11.	AT	30	Fail
12.	NA	50	Fail
13.	R	40	Fail
14.	IB	30	Fail
15.	RT	50	Fail
16.	M.L	40	Fail
Average		**43**	

Table 12. Post-test scores

No	NAME	Post-test Value	Criteria
1.	CRB	75	Good
2.	MM	60	Enough
3.	HZ	65	Enough
4.	A	65	Enough
5.	WB	80	Very well
6.	RM	80	Very well
7.	PS	70	Good
8.	CH	90	Very well
9.	PS	85	Very well
10.	RP	75	Good
11.	AT	80	Very well
12.	NA	90	Very well
13.	R	80	Very well
14.	IB	80	Very well
15.	RT	80	Very well
16.	M.L	70	Good
Average		**77**	

Table 13. The Score of *Pre-test* and *Post-test*

No	Student's name	*Pre-test*	*Post-test*	Difference	Ideal Score (100- pre)	N-Gain	Criteria
1.	CRB	60	75	15	40	0.4	Moderate
2.	MM	40	60	20	60	0.3	Moderate
3.	HZ	35	65	30	65	0.5	Moderate
4.	A	30	65	35	70	0.5	Moderate
5.	WB	60	80	20	40	0.5	Moderate
6.	RM	35	80	45	65	0.7	High
7.	PS	45	70	25	55	0.5	Moderate
8.	CH	55	90	35	45	0.8	High
9.	PS	50	85	35	50	0.7	High
10.	RP	40	75	35	60	0.6	Moderate
11.	AT	30	80	50	70	0.7	High
12.	NA	50	90	40	50	0.8	High
13.	R	40	80	40	60	0.7	High
14.	IB	30	80	50	70	0.7	High
15.	RT	50	80	50	50	1.0	High
16.	M.L	40	70	30	60	0.5	Moderate
Average		**43**	**7 7**			**0.6**	Moderate

The pretest results showed an average score of 43, indicating that many students had not reached the minimum passing grade of 65. This was likely due to their lack of understanding of the questions and their inability to connect them with their existing knowledge and experience. However, after using the Pop Up Book learning media for the posttest, the average score increased to 77. This improvement demonstrates the effectiveness of the Pop Up Book media in enhancing students' learning outcomes. Some students even achieved scores above the passing grade and the N-gain value of 0.6 indicates a significant improvement. In conclusion, the use of Pop Up Book media can effectively improve students' academic performance.

DISCUSSION

This part elaborates the result of the analyzed data in detail. The developmental research focused on the creation of a learning medium. The development process followed the ADDIE model, consisting of five stages: analysis, design, development, implementation, and evaluation. The results of the study included the validation of the Pop Up Book Learning Media and the learning outcomes of the students.

Validation of learning media by the language experts, material and media aims to determine the opinions of experts regarding the validity of the product as a learning media and as a basis for improving and enhancing the quality of learning media. The validation of the media was conducted by 3 validators, the linguist, the material validator, and the media validator. The validation results for the Pop Up Book product are as follows: 77% (acceptable) in the language aspect, 95% (very good) in the material aspect, and 97% (Very good) in the media aspect. Therefore, it can be concluded that the Pop Up Book learning media is very good.

The learning outcomes of the students were measured using a pretest and a posttest. The pretest, consisting of 20 questions with a maximum score of 100, revealed an average score of 43, indicating that many students had not yet reached the Minimum Passing Grade. This was due to their difficulty in understanding the questions and connecting them with their knowledge and experience. However, after using the Pop Up Book learning media, the posttest results showed an increase in the average score to 77, proving the effectiveness of the treatment.

During the trial stage, we create product to aid in the learning process about Animals and Plants in My Home Environment. We used learning media Pop Up Books to teach the students to understand science material. After giving treatment with the Pop Up Books, the posttest results showed an increase. This indicates that there was an enhancement in the students' marks, with some students even obtaining marks above the KKM (minimum mastery criteria). The N-gain was calculated to be 0.6, which is considered good. Learning outcomes occur when someone studies and experiences a change in their behavior, such as going from not knowing to knowing, or from not understanding to understanding.

CONCLUSION

The process of developing Pop Up Book learning media using the ADDIE model involves five stages, which are analyzing, designing, developing, and implementing, evaluating. The development of Pop Up Book learning media involves making the book's display more attractive, ensuring that paragraphs are in line with the pictures, and keeping the material in the book not too overwhelming so that children are more interested in learning by looking at the new and more attractive book display. Students do not feel bored and also find it easy to understand because the material is in line with the pictures. This can increase students' knowledge because they are interested and can easily understand the material, connecting the motion and movement of science learning.

The development of Pop Up Book learning media with the material of Animals and Plants in My Environment for science learning is "Very Valid". With a percentage result by language validator of 77% in the category of appropriate, material expert validator 95% in the category of very appropriate, and media expert validator 97% in the category of very appropriate. It can be concluded that the Pop Up Book learning media can improve student learning outcomes, as evidenced by Pre-Test and Post-test results obtaining an N-gain between 0.6 with moderate criteria.

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