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# Development of Pop-Up Book Learning Media on IPAS Class IV Elementary School Energy Material

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**Abstract:** This study aims to develop and test the feasibility, practicality, and effectiveness of pop-up book material on changing the form of energy. This research is a research and development that refers to the ADDIE model (Analyze, Design, Development, Implementation, and Evaluation). Data collection techniques used test techniques (pretest-posttest) and non-tests in the form of observation, questionnaires, interview results, and document data. The results of validation by material and media expert validators showed that the pop-up book met the valid criteria with an average score of 91.4%. Based on the results of the pretest-posttest, the results show that pop-up books are effective in improving student learning outcomes with the results of an increase in the average pretest score of 50.68 to 84.77 on the posttest, the N-Gain test results obtained were 0.73 with a high category. Based on the results of the response questionnaire, a positive response was obtained from teachers and students. From these results it can be concluded that the pop-up book on the material of changing the form of energy is effective for improving student learning outcomes and is feasible and practical to use in learning IPAS grade IV SDN Ngijo 01 Semarang City.

**Keywords:** IPAS; Learning outcomes; Pop-up book

## Introduction

The National Education System is explained in Law No. 20 of 2003, Article 1, Paragraph 1 reads that: "Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, nation and State" (Habe et al., 2017). There are several ways to raise the standard of education, and one of them is to make an effort to comprehend how students learn so that the knowledge they are given may be integrated and retained for a long time in their minds (Nengsi, 2021).

Educational innovation is an intelligent thought that is able to predict products that aim to overcome problems related to education (Khonitan et al., 2018; Onde et al., 2020; Sudhyatmika et al., 2022). If they are to enhance learning, educators must make learning more creative and imaginative while motivating students to learn as much as possible in both classroom and autonomous settings (Hardiansyah et al., 2022; Rusli et al., 2019). The Merdeka Curriculum incorporates the merging of Natural Science (IPA) and Social Science (IPS) topics into Natural and Social Sciences (IPAS) as a means of enhancing Indonesia's basic education system (Andreani et al., 2023). The concept behind integrating science and social studies is to ensure that students in elementary schools generally view the world as integrated and whole. Students should be able to cope with both the natural and social environments in one unit as a result of the science and social studies disciplines being combined.

But in reality, there are still problems with IPAS learning at the elementary school level, namely there are certain materials that are difficult for students to understand, making learning less effective (Landina et

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al., 2022). One of the problems that occur in IPAS learning is the use of conventional learning media or in printed form which is less attractive to students. In addition, the limited use of learning media in IPAS learning causes students to be less able to think critically and affects motivation and learning outcomes (Landina et al., 2022). A tool that teachers can use to help students receive messages and information with greater efficiency and achieve learning objectives is learning media (Wardhany et al., 2022).

Researchers also found the above problems in class IV at SDN Ngijo 01 Semarang City. Researcher identified issues with the IPAS written material, especially a lack of student excitement for participation in class learning, based on observations and interviews. In addition, limited media in IPAS learning is also a problem. The teacher explained that the facilities and infrastructure provided by the school are sufficient to be used in learning, such as there are LCDs in the classroom, so teachers can utilize digital media to be used as learning media. Digital media displayed on the LCD include PPT, video, audio. As for conventional learning media or what can be called teaching aids, especially for IPAS learning, teachers admit that they are still lacking in their use. Apart from the limited tools and also the lack of enthusiasm of teachers in making conventional learning media, even teachers are still confused to determine the appropriate learning media.

From the results of student learning in science subjects, it is found that the Formative Assessment scores are still low. A total of nine students (40.9%) have not completed and as many as thirteen students (59.1%) have completed with KKTP (Criteria for Achieving Learning Objectives) is 70. This demonstrates that teachers' use of media does not improve student learning outcomes in an efficient or effective manner.

The solution in overcoming the above problems is to develop conventional learning media that are innovative, creative, and interesting. For the development of an environment for learning that would enhance science understanding, innovation must be applied (Muttaqin et al., 2021). The selection of learning media must be done appropriately and tailored to the needs so that the objectives can be achieved (Wijaya et al., 2021). With interesting learning media, students' curiosity will increase so that the value of students' attitudes, skills, and knowledge will also increase (R. H. Putri et al., 2022). Learning media is not only able to increase learning motivation, but the increase in student learning outcomes is also significantly seen with the use of learning media, meaning that the existence of learning media is not merely a complement to teaching and learning activities, but serves to facilitate the delivery of knowledge. Pop-up book learning media is one type of media that can be utilized to enhance IPAS learning (Fajriah et al., 2022; Simbolon et al., 2021).

*Pop-Up Book* with movable, three-dimensional components is known as book media. It offers a more engaging way to see and present the content, which helps students grasp it better. (Resta et al., 2023; Setiyanigrum, 2020). *Pop-up book* can serve as both an engaging and educational tool for children who are readers (S. M. Dewi et al., 2021). *Pop-up book* media has the benefit of offering kids a unique experience because they can participate in activities including sliding, opening, and folding the pop-up book's pieces (Asnanda et al., 2022). This will leave a lasting impact on the reader, making it easier for them to remember when utilizing this medium (Q. K. Putri et al., 2019).

Pop-up book media is one of the many learning media that have been the subject of much research by earlier scholars. The study's findings demonstrated how learning media can improve student engagement and learning outcomes. Some of these studies are studies conducted by Nawawi et al. with the title "Development of Science Learning Media Based on Pop-Up Books on the Material of the Properties and Changes in the Form of Objects for Elementary School Students" with the results of the study showing that the pop-up book media developed is feasible and recommended for teachers to be able to utilize pop-up book media in the learning and teaching process (Nawawi et al., 2022). Research conducted by Praditha et al. with the title "Development of Pop-Up Book Media Based on Local Wisdom on the Material of Sasak Tribe Diversity" with the results of the study showing that the pop-up book media developed was declared to be very valid and very practical so that it can be used in the classroom (Praditha et al., 2024). In addition, research conducted by Putri et al. with the title "Development of Pop-Up Book Media Based on the Sasak Folk Tale "Putri Mandalika" to Instill Character Education Values" with research results showing that the pop-up book media developed is practical to use as a tool to instill character education values at the knowledge stage (D. M. E. Putri et al., 2024). Thus, based on the research that has been conducted by several researchers above, it can be concluded that the results of the development and application of pop-up book media can be used as a medium to improve student learning outcomes.

Based on the problems and descriptions above, the purpose of this study is to develop and test the feasibility, practicality, and effectiveness of pop-up book material on changing the form of energy.

## Method

Based on the problems and descriptions above, the reason for this investigation is to develop and test the feasibility, practicality, and effectiveness of pop-up book material on changing the form of energy (Pioke et al., 2023). One of the best and most effective design models is the ADDIE model, which examines the essential phases of the learning system at each phase of learning development (Cahyadi, 2019; F. F. Dewi et al., 2021). The research scheme can be seen in Figure 1.

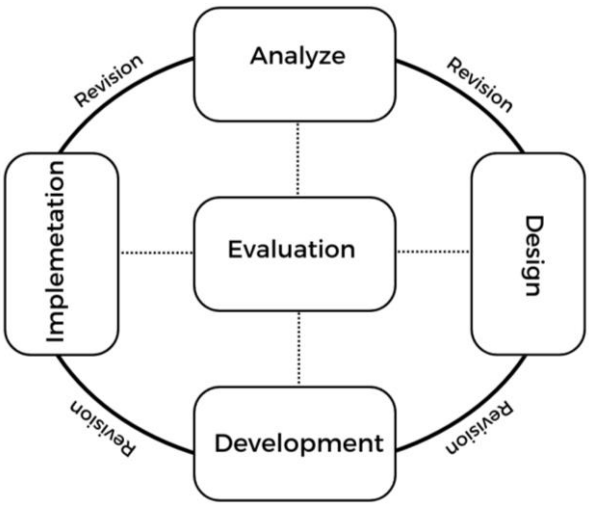


**Figure 1**. ADDIE development model chart

The analysis stage is carried out to find out the curriculum, needs, and characteristics of students at school by conducting interviews, observations, and distributing teacher and student needs questionnaires, as well as documenting information presented as learning outcomes of fourth grade students of SDN Ngijo 01 Semarang City. The next stage is product design which begins with creating and compiling a product framework. Product design is adjusted to the Learning Outcomes (CP) and Learning Objectives (TP) that have been prepared. The learning process must refer to the learning objectives, so that the learning objectives must be achieved by students during the learning process (Yulyani et al., 2020).

After the product has been designed, product development is accomplished by bringing together the materials collected to correspond with media creation. After the product is suitable, design validation is carried out to expert validators who are competent in their fields. In this case, media experts and material experts, by filling out a validation sheet that has been prepared by researchers in the form of a Likert scale. Products that have been assessed by expert validators, then revised based on the suggestions given by expert validators so that the product is ready to be tested.

The next stage is the implementation of the product by testing it on students on a small scale, namely in class V consisting of 6 students using purposive sampling technique based on different levels of cognitive ability. At the product trial stage, learning was carried out using *Pop-Up Book* learning media. After carrying out the learning, teachers and students were asked to fill out a response questionnaire to the use of *Pop-Up Book* learning media. Then the results of the teacher and student response questionnaires are analyzed, and if there are suggestions, they can be made into revision materials for products that have been tested. After that, a trial use is carried out where the product that has been developed is tested on a larger scale. Researchers conducted trials of its use in Class IV of the 2023/2024 academic year totaling 22 students to determine the effectiveness of the products developed based on the learning outcomes obtained by students. The last stage is evaluation. This evaluation is carried out after the use of *Pop-Up Book* during learning by giving evaluation questions to students. The purpose of this evaluation is to compare the learning outcomes of the students before and after they used the *Pop-Up Book*.

Primary data are the kind that were used in this study. Directly collected data is what is referred to as primary data in research. This is where the qualitative and quantitative data lies. Qualitative data in this study was taken from observations, questionnaires, and teacher interviews conducted at SDN Ngijo 01 Semarang City. Quantitative data in this study were obtained from the learning outcomes of fourth grade students of SDN Ngijo 01 Semarang City on science subjects on the material of changing the form of energy.

Pre-experimental study with a single group pretest-posttest design model is the methodology employed, namely there is a pretest before being given an experiment and a posttest after the study. The aim is to know more about the results of the treatment, because it can compare the conditions before and after the treatment is given (Sugiyono, 2019). Methods for gathering data utilizing both test and non-test methods. The test technique is in the form of multiple choice questions as many as 20 questions and non-test techniques through observations, surveys, the outcomes of interviews, and information from documents. To determine the feasibility of the developed product, data analysis was carried out in the form of an assessment from material and media expert validators using a Likert scale. To determine the practicality of the product, student and teacher response questionnaires were used after using the developed product with a Guttman scale. Next, data analysis in the form of an n-gain test based on pretest and posttest results from large-scale trials was done to determine the effectiveness of the product.

## Result and Discussion

*Analysis*

At this stage, needs analysis, curriculum analysis, and analysis of student characteristics and learning environment were conducted. Based on the analysis, it is known that the fourth grade of SDN Ngijo 01 Semarang City uses the independent curriculum. Curriculum analysis was conducted to formulate Learning Objectives (TP) based on Learning Outcomes (CP). Pre-research findings in accordance with the requirements of the analysis stage, it was found that the use of monotonous lecture learning methods resulted in a lack of student activeness in participating in learning. The utilization of learning media is still minimal, especially in IPAS subjects so that students' enthusiasm for participating in learning is less than optimal. This affects the learning outcomes of students who have not fulfilled the Minimum Completeness Criteria (KKM), which is set at 70. Of the total 22 students, thirteen students (59%) have met the KKM score while nine students (41%) have not met the KKM score. To make learning more effective, enjoyable, and meaningful in this situation, learning materials are required that may stimulate students' interest in learning both individually and in collaboration with the teacher (Intaniasari et al., 2022).

Teachers need additional learning media to increase student enthusiasm in participating in classroom learning and improve student learning outcomes in IPAS subjects. Students need pop-up book learning media that is interesting in terms of pictures and color choices. Students also need learning media with interesting forms of evaluation such as puzzle games.

*Design*

After collecting data and information, the next step is to make pop-up book learning media. Pop-up book media is created with the Learning Outcomes (CP) and Learning Objectives (TP) for IPAS disciplines pertaining to the topic of energy transformation in mind. In the preparation of the design, a flowchart is needed for the learning media. then proceed with designing the design in the Canva application. The design is made with the help of the Canva application by choosing attractive images and colors according to the characteristics of students so that it is easy to understand. The initial design can be seen in Figure 2.

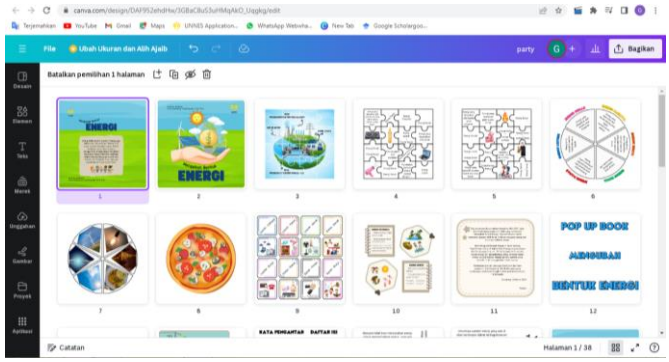

**Figure 2**. Design via canva

*Development*

After the design is arranged, then the pop-up book is made into real media or printed products. The contents of the pop-up book developed include:

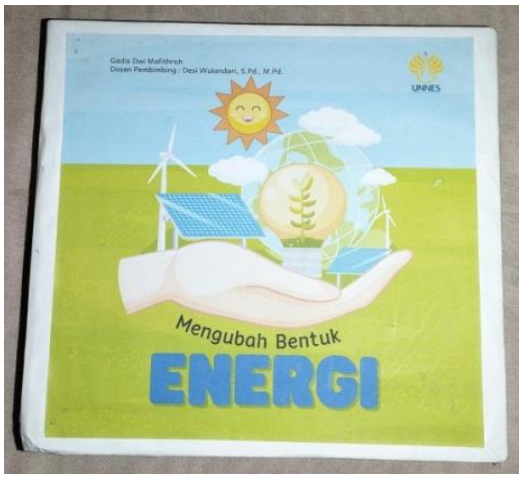


**Figure 3.** Front cover of pop-up book

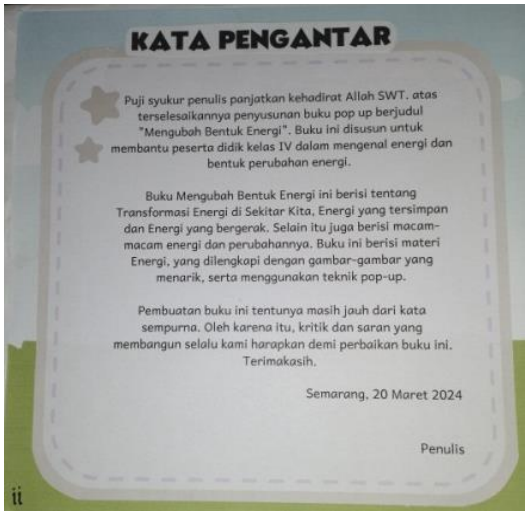


**Figure 4.** Foreword

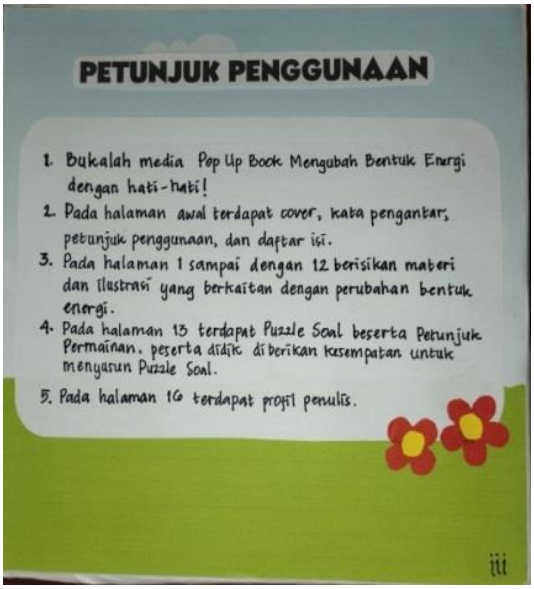


**Figure 5.** Directions for use


**Figure 6.** Table of contents

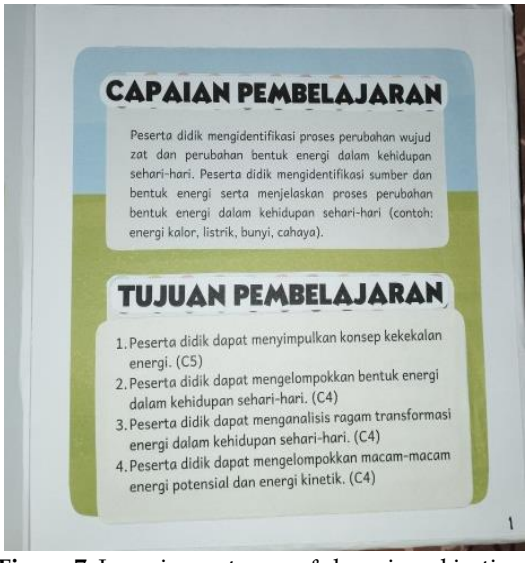


**Figure 7.** Learning outcomes & learning objectives


**Figure 8.** Material 1

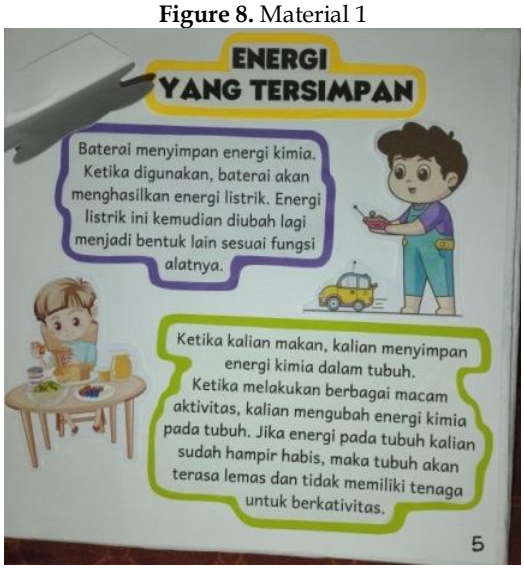


**Figure 9.** Material 2


**Figure 10.** Material 3


**Figure 11.** Material 4


**Figure 12.** Material 5

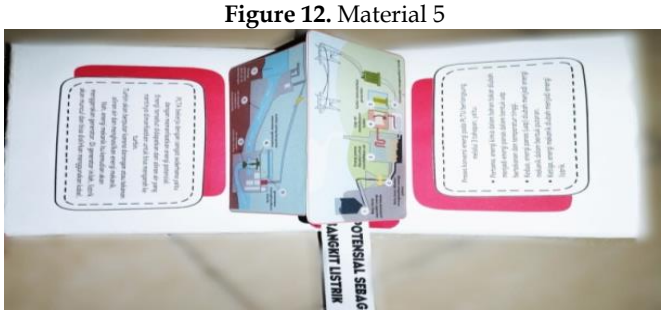

**Figure 13.** Material 6


**Figure 14.** Evaluation


**Figure 15.** Glossary, bibliography, author and supervisor profiles


**Figure 16.** Pop-up book back cover

The steps in designing a product include: preparation of materials, format, and layout for customized material design; creation of product design; application of pop-up book media.

*Pop-Up Book Product Feasibility*

*Design Validation*

At this stage, researchers will conduct product validation to competent media expert validators, namely lecturers of the Elementary School Teacher Education study program, material experts, namely lecturers of science subjects in the Elementary School Teacher Education study program. After being assessed by the validator, there will be suggestions related to the product developed by the researcher so that the researcher can revise the product developed.

**Table 1.** Pop-Up Book Expert Validator Assessment Results

| Eligibility Aspects | Index Validasi (%) | Information |
|---|---|---|
| Material | 92.8 | Very Valid |
| Media | 90 | Very Valid |

Table 1 shows that the validation results given by the validators are valid and included in the criteria are very feasible. Pop-Up Book is declared valid overall media appearance, content and material and ready to be tested. This is consistent with past research that found that pop-up book production was deemed practical after receiving validation scores of 91% from material experts, 75% from media experts, and 91% from design experts (Rahmayanti et al., 2023). The established pop-up book items are workable and suitable for use as instructional tools in primary school IPAS curricula, according to these findings. In additional research, it was reported that pop-up book media development received a validation score of 88.18% from media professionals and

a score of 91.17% from material experts. This indicates that the media is deemed realizable (Komari et al., 2022).

*Design Revision*


**Figure 17.** Learning objectives before revision

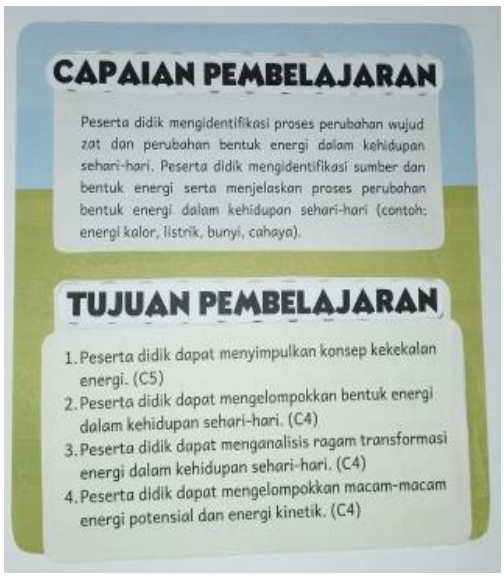


**Figure 18.** Learning objectives after revision


**Figure 19.** Before barcode addition


**Figure 20.** After barcode addition


**Figure 21.** Before profile addition supervisor

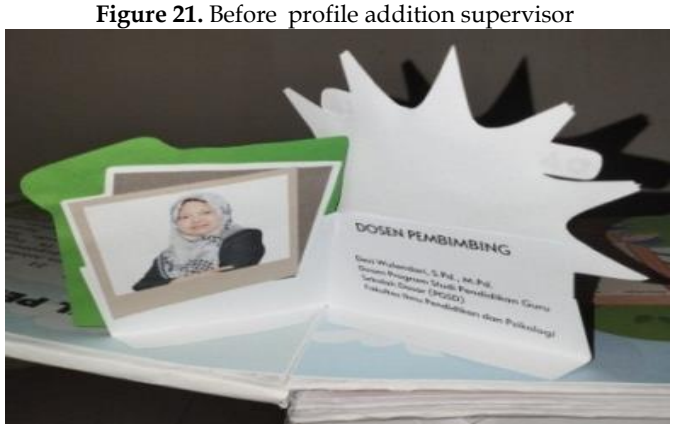


**Figure 22.** After profile addition supervisor

Researchers revised the design according to suggestions from media experts and material experts. The validation expert from the media advised finishing the supervisor's profile. Recommendations made by material expert validators to include LKPD barcodes and adding supervisor profiles to pop-up books, and adjusting the formulation of learning objectives.

*Practicality of Pop-Up Book Products (Product Trial)*
*Implementation*

This implementation was carried out with small-scale and large-scale trials. In this trial, there were 6 fifth grade students with heterogeneous selection based on student ability levels, two pupils who received poor scores, two who received medium scores, and two who received good scores. After students do the learning, students and teachers are given an answer sheet

containing 10 questions with a Guttman Scale that must be filled in based on experience in using existing products developed by researchers. The questionnaire has the following assessment criteria: Assessment with very positive criteria if the value is 76%-100%, Assessment with positive criteria if the value is 51%-75%, Assessment with negative criteria if the value is 26%-50%, Assessment with very negative criteria if the value is 0%-25%. The calculation to measure the percentage of teacher and student response questionnaire answers is as follows:

$$NP = \frac{R}{SM} \times 100\% \quad (1)$$

To test the practicality of the Pop-Up Book, a questionnaire was distributed to the responses of teachers and students who had 2 aspects, namely the presentation of the content of the material and the technical quality and presentation of the media, which were then divided into 4 indicators, namely the presentation of the content of the material, the effect of the material in the learning media on students, instructions for use, and media display.

**Table 2.** Results of Teacher and Student Response to Pop-Up Book on a Small Scale

| Respondent Assessment | Evaluation (%) | Information |
|---|---|---|
| Teacher | 100 | Very Positive |
| Students | 96.67 | Very Positive |

Table 2 shows that the results of teacher and student responses and students' responses to the Pop-Up Book had very positive results because they scored above 75%. So that the Pop-Up Book is declared very positive and practical based on 10 Guttman scale questions because almost all questions get a score of 1, so there is no product revision in the small-scale trial. This is in line with the research that has been done which explains that the teacher and student response questionnaire with a percentage of 84.8% which is above 75% so that it displays extremely favorable outcomes, indicating that Pop-Up Book is useful for educational purposes (Athifah et al., 2022).

**Table 3**. Results of Teacher and Student Response to Pop-Up Book on a Large Scale

| Respondent Assessment | Evaluation (%) | Information |
|---|---|---|
| Teacher | 100 | Very Positive |
| Students | 96.81 | Very Positive |

Table 3 shows that the results of teacher and student responses to the Pop-Up Book have very positive results because they scored above 75%. So that the Pop-Up Book is declared very positive and practical based on 10 Guttman Scale questions because almost all questions get a score of 1. This is in line with the research that has been done which explains that the teacher and student response questionnaire is above 75% so that it shows very positive results which means that the Pop-Up Book is practical for use in learning (Prasetiyo et al., 2021).

*Pop-Up Book Product Effectiveness Evaluation*

Large-scale evaluation is done with Pop-Up Books in IPAS subject matter, which alters the form of energy, in order to assess the product's efficacy in relation to learning objectives for students. Pre-experimental design using a single group pretest-posttest design model is the methodology employed; that is, a pretest is given prior to treatment and a posttest is given following the investigation.

**Table 4.** Normality Test Results on Trial Use

| Test Type | Average | Average Difference |
|---|---|---|
| Pretest | 50.68 | 34.09 |
| Posttest | 84.77 | |

Based on table 4, it is known that the average student learning outcomes showed an increase of around 34.09 in the large-scale product trial. The data shows that there are differences in the learning outcomes of students regarding the content of IPAS subject matter changing the form of energy in class IV SDN Ngijo 01 Semarang City, there are differences before and after using Pop-Up Book media using Pop-Up Book media. To find out the criteria for increasing the average pretest and posttest, N-Gain testing was carried out by comparing the difference between SMI and pretest.

**Table 5.** Average N-Gain Testing Results

| Average Difference | N-Gain | Criteria |
|---|---|---|
| 34.09 | 0.73 | High |

Based on table 5, it is known that the average difference was 34.09 in the large-scale product trial. This shows that the scores of fourth grade students of SDN Ngijo 01 have an average increase of 0.73 and are included in the high criteria. This average increase shows that the use of Pop-Up Book used in learning IPAS material on changing the form of energy in class IV SDN Ngijo 01 has succeeded in improving student learning outcomes. This is consistent with earlier study that demonstrates how the creation of Pop-Up Book media can draw the interest of SDN Tamban Raya Baru fifth grade students, hence improving student learning outcomes in the areas of material properties and object transformations (Nawawi et al., 2022). Furthermore, the creation of educational materials via the Canva software can enhance human learning outcomes for motion

system content (Analicia et al., 2021). Pop-Up Book learning media used in learning animal material around me class I can improve student learning outcomes because students are interested in Pop-Up Book and more easily understand the material (Sinta et al., 2021). Pop-up book materials can be used by teachers to aid students in understanding the subject matter, which will improve learning results (Ningtiyas et al., 2019). Students in the fifth grade who study science can also develop their critical thinking abilities by using Pop-Up Book learning resources (Kasih et al., 2023). Based on the research conducted, it was found that there was an increase in student learning outcomes after using Pop-Up Book in the "high" category. This demonstrates that using Pop-Up Books for learning is both practical and efficient (Firman et al., 2021).

## Conclusion

Based on the research's findings, it can be said that Pop-Up Book media can enhance students' learning outcomes when it comes to the topic of shifting energy forms in IPAS courses. The development of learning media in this research and development uses the ADDIE model of analysis, design, development, implementation, and evaluation. This is evidenced by the results of the media validation assessment which obtained an average of 91.4% with a very feasible category. Data analysis of students' pretest and posttest scores has increased with an average difference of 34.09 and N-gain of 0.73 which is included in the high criteria. This proves that Pop-Up Book media is feasible, practical, and effective for improving student learning outcomes in IPAS subjects on the material of changing the form of energy in class IV SDN Ngijo 01 Semarang City.

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**Author Contributions**
G.D.M wrote the article draft, revised, and edited the draft article. D.W as a supervision of the research contributed to the guidance in writing articles and provided critical feedback on the manuscript.

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**Conflicts of Interest**
The authors declare no conflict of interest.

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