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# Flashcard Development to Improve Learning Outcomes in Private 4th Class Science Learning

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**Abstract:** This research aims to develop flashcard products equipped with barcodes, test the feasibility of flashcard media in science learning to improve student learning outcomes; and knowing the effectiveness of using flashcard media in increasing average scores. This type of research is Research and Development (R&D) using the Borg & Gall development model which includes eight stages, namely potential and problems, gathering information, product design, design validation, design improvement, product testing, product revision, and usage trials. The subjects of this research were fourth grade students at SDN 01 Bojongkoneng. The research results showed: Flashcard learning media, product validity as seen from the validation results by material expert validators got a percentage of 90%, and media experts got a percentage of 92%; The effectiveness of the product can be seen from the results of student responses which include small group trials getting an average pretest score of 54 and posttest 82, and large group trials getting an average pretest score of 51 and posttest 85. In the small class the score is n- the gain was 0.60 in the medium category, while the large class obtained an n-gain value of 0.68 in the medium category. Thus, the research results show that learning media in the form of flashcards and equipped with barcodes is feasible and effective in learning science and technology as an improvement in student learning outcomes.

**Keywords:** Cultural Wealth; Flashcards; Science Learning

## Introduction

The fact that we need to know is that Indonesia is a country that has a lot of natural wealth. The existence of this natural wealth causes Indonesia to have culture or cultural wealth which can be divided into 2, namely material culture and non-material culture (Sahertian & Jawas, 2021; Sopa, 2018). Judging from the different natural conditions in each region, Indonesia has become a country that has a variety of cultural riches. In accordance with the motto "Bhinneka Tunggal Ika" which means different but still one, this emphasizes that cultural richness shows the similarity of human nature from various tribes, nations and races. One of the subjects that discusses cultural wealth is Science and Science, which combines science and social studies material into one learning theme which aims to educate students to become moral individuals and citizens who care about fellow living creatures (Hopeman et al., 2022; Mensah, 2019; Nowell et al., 2017). Picture cards or flashcards with innovative barcodes on the back containing video explanations are learning media that will be created by researchers. Flashcards are a learning medium that can attract students' attention because there are pictures, short definitions and QR codes on the cards measuring 12.5 cm x 7.5 cm. Apart from that, choosing bright colors can also make children interested in playing it.

Learning media in the form of picture cards or flashcards is a type of printed visual-based media

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development (Fitriani et al., 2021; Kesumawati et al., 2022). Flashcards are designed and designed to provide convenience for students during the learning process. The way to play flashcards is that students will be divided into 8 groups, then each group will present the pictures they got in front of their friends (Setiawan & Wiedarti, 2020). It could be said that flashcards or picture cards can make children interested in trying them in the hope that there will be an increase in student learning outcomes (Dunlosky et al., 2013). Based on the results of observations at SDN 01 Bojongkoneng, Kec. Kandangserang, Kab. Pekalongan, Central Java in Class IV science learning, has not been fully implemented in the learning process. The interview process with the teacher revealed that students were enthusiastic about using several learning methods and added educational games in groups which aimed to increase student learning activity (Bulut et al., 2022; Cheung & Ng, 2021; Zainuddin, 2023). However, teachers rarely use learning methods and educational games in implementing learning. This is what motivated researchers to create flashcards as supporting learning media that can increase average scores.

Based on these problems, the researcher wants to develop a learning media, namely a card that can be used effectively in the learning process. Researchers will make Flashcards as an effort to increase students' average scores, especially on cultural wealth material (Masino & Niño-Zarazúa, 2016; Senzaki et al., 2017). This product is in the form of a card equipped with a barcode containing a video that uses a game to make it seem interesting to elementary school. The benefit of using learning media is to motivate students and strengthen the learning process in a real way (Harsiwi & Arini, 2020; Mayang Sari et al., 2023). Apart from that, learning media is considered to be able to make children enthusiastic about learning. Researchers wanted to create concrete but safe media for use by elementary school age children, so the researchers chose image media (Okdiansyah et al., 2021; Papavlasopoulou et al., 2019). However, before that, researchers had carried out a series of actions starting with making a plan, implementing it, and evaluating it. It is hoped that this action can help students increase their understanding of the cultural riches spread throughout the Indonesian archipelago. Then, the results of the analysis of the need for image media or flashcards in class IV Indonesian cultural wealth material at SDN 01 Bojongkoneng also show that schools need learning media that suits the needs of students. This indicates that so far students have not been accustomed to using learning media.

The learning media used still does not make students understand and makes it easier to understand the material being taught (Herawati et al., 2022; Liando et al., 2022). Teachers need learning media that can attract students' enthusiasm when learning, so in this case teachers must be able to innovate (Anwar et al., 2023). With the flashcard media on Indonesian cultural wealth material for class IV elementary school, it is hoped that this can be a solution for teachers and students in class IV SDN 01 Bojongkoneng. This research aims to give students an interest in knowing and loving various Indonesian cultures (Rahmawati et al., 2023). Researchers will develop learning media or teaching aids to support the learning process in the hope of achieving learning objectives. Media is a device that can be manipulated, seen, heard, read, and can influence the effectiveness of instructional programs (Ng et al., 2023).

## Method

This research uses a Research and Development (R&D) development model with the final result being a product that will be used as a learning medium (Daryanes et al., 2023). Researchers will create products with the latest novelties or innovations as solutions to overcome existing problems at the research site. Products from the R&D development model have several forms, including learning materials, learning tools, learning media, evaluation instruments, learning assessments, and learning models. It can be said that in development research, researchers try to find a solution to a problem by producing a quality product that has gone through various stages of testing (Ebneyamini & Sadeghi Moghadam, 2018). The steps that must be taken in the R&D development model from Borg & Gall include potential and problems, data collection, product design, design validation, design revision, product testing, product revision, and usage trials (Norsidi et al., 2024). The following is presented in the form of a flow diagram and discussion.

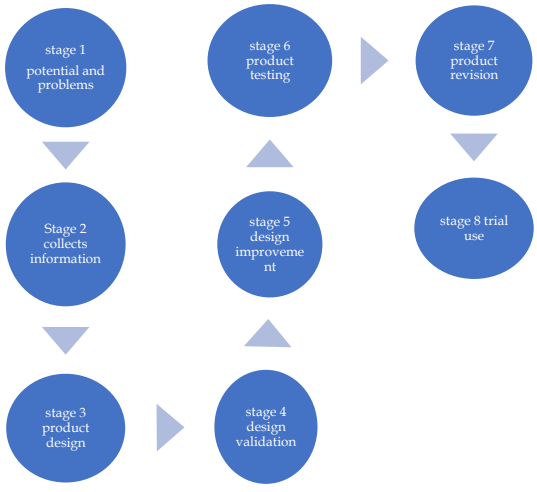


**Figure 1.** Flow diagram regarding research steps

*Potential and Problems*

A place will be researched if there are potentials or problems. Potential means everything that will have added value. Meanwhile, problems can become potential if there are deviations between what is expected and what happens. However, a problem can be overcome by researching so that a model or pattern can be found that can solve the problem.

*Gathering Information*

After finding the potential and problems, the next stage is collecting information and literature studies which will later be used as material for planning a product that will be made by researchers and of course can overcome the problems.

*Product Design*

The product or learning media at this stage is uncertain, meaning the product can still change its form based on suggestions and input from the supervisor. It is best to make product or media designs as detailed as possible so that supervisors can understand.

*Design Validation*

The designs we have created will be validated by media experts. At this stage you will be asked about the novelty or innovation of the products we make. Then, our product will be assessed whether it is suitable for testing without revisions, with revisions, or even not suitable for testing.

*Design Improvements*

After passing the design validation stage, the shortcomings of the product we make will be known so that at this stage we submit the product results that have been revised or improved. If there are no further revisions then you may proceed to the next stage.

*Product trial*

Product testing is the stage where we use the revised media in elementary schools. At this stage we carry out trials in class V at SDN 01 Bojongkoneng to prove whether our media is effective for use in the learning process or whether there are still difficulties.

*Product Revision*

After being tested, we will know the shortcomings or difficulties faced by researchers when using this media during the learning process. At this stage we will improve the media or product so that the media research process functions well and there are no problems.

*Usage Trial*

Learning products or media that have gone through various testing stages can then be applied as the final result of researchers in creating media to support the learning process.

**Table 1.** Media expert and material expert questionnaire scores

| Alternative Answers | Score |
|---|---|
| Very Good (SB) | 4 |
| Good (B) | 3 |
| Enough (C) | 2 |
| Less (K) | 1 |

**Table 2.** Media and material eligibility criteria

| Eligibility Criteria (%) | Eligibility Level |
|---|---|
| 81 – 100 | Very Worth It |
| 61 – 80 | Worthy |
| 41 – 60 | Not Worth It |
| 21 – 40 | Not feasible |
| 21 – 40 | Totally Not Worth It |

The scores in the pretest and posttest after going through the normality test and t-test will then be tested for N-Gain. The formula that can be used to find the N-Gain value is:

$$G = \frac{\text{Post test score} - \text{pretest score}}{\text{Ideal score} - \text{pretest score}} \quad (1)$$

After getting the N-Gain value, then we analyze the criteria including whether the value is high, medium or low.

**Table 3.** Normalized gain assessment standards

| G value | Criteria |
|---|---|
| $g > 0.70$ | Tall |
| $0.30 < g \leq 0.70$ | Currently |
| $g \leq 0.30$ | Low |

## Result and Discussion

The results of the questionnaire analysis that have been distributed by researchers are questionnaires on teacher needs and student needs to produce products or media that will be used for the learning process (Dwivedi et al., 2023; Montenegro-Rueda et al., 2023). The media created by researchers has the latest innovations so it will be different from flashcards in general on the market (Castles et al., 2018). The learning media developed is flashcard media equipped with barcodes containing explanations. Suggestions and input provided by supervisors, media experts, and material experts produced flashcard media along with improved tools (Oktaviani & Isdaryanti, 2024). The researcher took 8 kinds of cultural diversity of objects and non-objects, each of which contained 5 examples of flashcards so that the total flashcards developed by the

researcher were 40. The following is an example of a flashcard created by the researcher.


**Figure 2.** Cover for the flashcard holder


**Figure 3**. Front and back of Indonesia's cultural riches

Products or learning media that have been developed by researchers have been reviewed by lecturers who are experts in their fields to find out whether the media is suitable for use or vice versa (Getie, 2020; Romualdi et al., 2023; Tlili et al., 2022)). Media validation includes several aspects, namely: media appearance; material; and usefulness. Meanwhile, material validation contains several aspects, namely: Accuracy with learning objectives; In accordance with the student's level of thinking; Support for learning content; Images can facilitate goal achievement; and Appropriate to support lesson content that is facts, concepts, principles or generalizations. The validation results provided by media and material experts are then revised again by the researchers according to the suggestions and input obtained until the product or media meets the criteria for being suitable for use in research settings.

**Table 4.** Validation results by media and material experts

| Aspect | Score(%) | Criteria |
|---|---|---|
| Media | 92 | Very Worth It |
| Material | 95 | Very Worth It |

The results obtained show the feasibility of flashcard media. We can see that the feasibility aspect of flashcards gets a very decent percentage with criteria between 81%-100%. It could be said that the media can be used to conduct research because it meets the feasibility score. After validating the media and material that received the criteria as very feasible and suitable for researchers to conduct research in small groups. This research involved 6 students from class V. The first step taken by the researcher was to open the learning process as usual. Next, the researcher asked a small group consisting of 6 students to do a pretest. If students have completed the pretest, they will continue with the presentation of the material using flashcard media. Next, the researcher distributed post test questions to the 6 small group students.

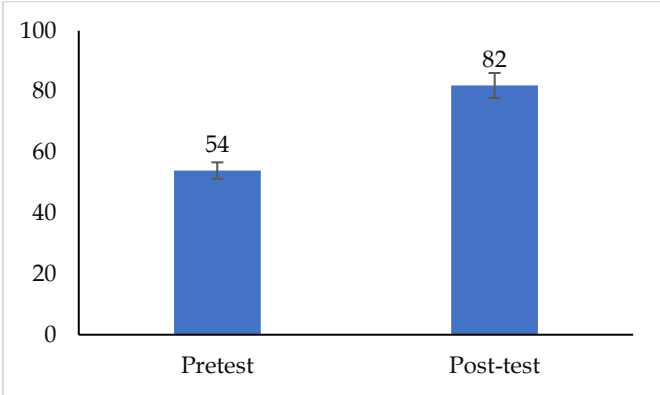


**Figure 4.** Average increase in pretest and posttest results in small groups

Based on the picture above, it shows that the learning outcomes of small group students have increased from an average of 54 to 81. Data from research results in small groups were obtained from pretest scores and post test scores. Then the data will be processed to find out whether the flashcards created by the researchers are effective or not when used. The analysis carried out was in the form of a normality test of pretest data and posttest data, t-test, and average increase test (N-Gain).

**Table 5.** Small group normality test results Shapiro Wilk

| Mark | Statistic | df | Sig |
|---|---|---|---|
| Pretest | 0.892 | 6 | 0.331 |
| Postest | 0.907 | 6 | 0.415 |

The normality test in this research aims to determine statistical techniques for processing data. The normality test is used to calculate normality in pretest and posttest questions (Khatun, 2021; Kitchenham et al., 2017; Nimon, 2012). The results of the analysis are sig values of 0.331 and 0.415 or greater than 0.05, so it can be said that the data from the pretest and posttest research above is normally distributed.

**Table 6.** Small group t-test results

| Test Type | Average | Average difference |
|---|---|---|
| Pretest | 54 | 28 |
| Post test | 82 | |

The t-test or paired sample t-test is a testing method used to assess the effectiveness of treatment (pretest) which is indicated by the difference in the average before and the average after treatment (posttest) (Sukarni, 2021). Based on the data above, the results of the analysis are an average pretest score of 54 and an average posttest score of 82, so there is an average difference of 28.

**Table 7.** Small group N-Gain test results

| Average difference | N-Gain | Criteria |
|---|---|---|
| 27.50 | 0.60 | Currently |

The next stage carried out by researchers after carrying out the t-test was to find the average increase value through N-Gain calculations (Anggraeni et al., 2021; Ariwibowo et al., 2024). Based on this table, it can be seen that the average increase (Gain) from the pretest and posttest data in the small group was 0.60 with medium criteria. After conducting research on small groups, the researcher will then conduct research on large groups. The large group is a group that comes from 1 class, totaling 30 class V students at SDN 01 Bojongkoneng, Kec. Kandangserang, Kab. Pekalongan. Researchers will carry out analysis on the pretest and posttest normality test, t-test, and average increase test (n-Gain).

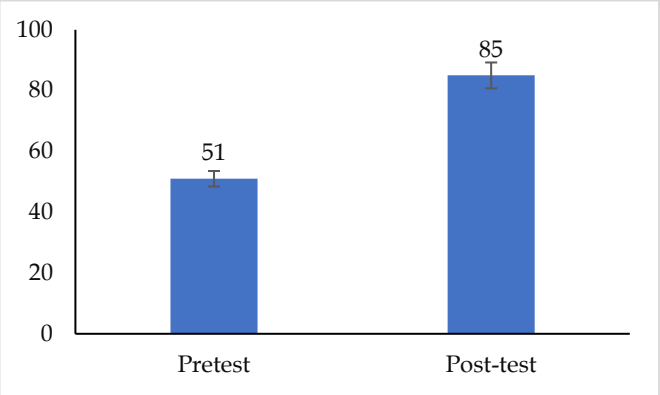


**Figure 5.** Average increase in pretest and posttest results in the large group

**Table 8.** Large group normality test results Shapiro Wilk

| Mark | Statistic | df | Sig |
|---|---|---|---|
| Pretest | 0.975 | 30 | 0.669 |
| Posttest | 0.905 | 30 | 0.011 |

The normality test is used to calculate normality in pretest and posttest questions (Saputro et al., 2020). The results obtained based on the table above are sig values of 0.66 and 0.11 or greater than 0.05 so it can be said that the data from the pretest and the posttest above is normally distributed.

**Table 9.** Large group t-test results

| Test Type | Average | Average difference |
|---|---|---|
| Pretest | 51 | 34 |
| Post test | 85 | |

The t-test or paired sample t-test is used to assess the effectiveness of treatment (pretest) which is characterized by the difference in the average before and the average after treatment (posttest). Based on the results of this analysis, The average pretest score is 51 and the average posttest score is 85, so there is an average difference of 34.

**Table 10.** Large group N-Gain test results

| Average difference | N-Gain | Criteria |
|---|---|---|
| 33.30 | 0.68 | Currently |

After carrying out the t-test, the next thing the researcher did was find the size of the average increase through the N-Gain calculation. Based on this table, it can be seen that the average increase (Gain) from the pretest and posttest data in the large group was 0.68 with medium criteria.

## Conclusion

Researchers developed a product in the form of learning media called Flashcard. The media consists of 40 cards with 8 kinds of cultural diversity, objects and non-objects. On the front of the flashcard contains an image and a short definition, while on the back there is a barcode containing an explanation of the image. The validity of the flashcard media in the material component got a percentage of 90% with very decent qualifications, and the media component got a percentage of 92% with very decent qualifications. So we can conclude that the flashcard media that has been created by researchers is valid to be used as a media to support the learning process, especially in class V science and science learning material on material and non-material cultural diversity. The effectiveness of the product is seen from the results of student responses related to character which includes small group and

large group trials. The average score obtained in the small group was 54 pretest and 82 post test, while the large group obtained an average pretest score of 51 and post test 85. The N-Gain score obtained in the small group was 0.60 in the medium category. , and in the large group obtained an N-Gain value of 0.68 in the medium category. It is hoped that this research can help students understand the material on material and non-material cultural diversity, and can be a solution for elementary schools which have almost the same problem in creating learning media.

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**Author Contributions**
Conceptualization; R. F., E. F. S.; methodology; R. F.; validation; E. F. S.; formal analysis.; R. F.; investigation.; E. F. S resources; R. F.data curation: writing—original; E. F. S, draft preparation; R. F.; writing—review and editing; E. F. S. Visualization; R. F. All authors have read and agreed to the published version of the manuscript.

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

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