

Pamudi Media Assisted by Index Card Match: An Innovative Science Learning Effort to Strengthen Students' Cooperation Character

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Abstract

Science learning in schools is synonymous with students' learning process skills, which include critical thinking and reasoning, as well as cooperation and respect for the opinions of others. The selection of learning media is necessary to meet the learning needs of students by providing meaningful learning experiences. The purpose of this research and development is to develop PAMUDI media "Puzzle Dua Sisi" supported by index card match on the material form of objects and changes in the form of objects to strengthen cooperation in grade IV students that are valid, practical and interesting. The findings show that science learning at SDN Pohkecik and SDN Sumberkarang is done in a monotonous pattern, resulting in less interaction among students, and boredom appears in students. Therefore, media is needed to make the learning process more varied. The research method used is the ADDIE method. Data collection techniques were carried out through observation, interviews and distribution of questionnaires. The results obtained from the research and development of PAMUDI media in the form of a validity test of 91.65% with a very valid category, a practicality test of 100% with a very practical category, and user attractiveness of 96.9% with a very attractive category, as well as the ability of the media to strengthen the character of cooperation 95.45% with a category very capable of strengthening the character of student cooperation.

Keywords: Learning Media, PAMUDI, Cooperative

1. Introduction

Science learning in elementary schools aims to develop students' learning process skills in finding knowledge, concepts, and skills. Based on these learning objectives, science is a product, process, and attitude (Wedyawati & Lisa, 2019). So based on this, science learning is not only about learning facts, concepts, theories but also teaching how to think critically and draw conclusions, as well as cooperation and respect for other people's opinions. The elementary school science learning process is carried out by paying attention to the needs of students in terms of determining models, methods, and media (Wijanarko, 2017). With the opportunity to use tools or media that are around them, students can learn and provide experience to students.

Learning media in teaching and learning activities is not only a learning tool. This is in line with the opinion of Untari (2017), that the media is one of the efforts to improve the quality of learning to strengthen students' memory of learning material. According to Azizah (2018), the science paradigm which studies many concepts and facts has a lot of memorization. So based on this, it is necessary to make an innovation such as learning media to help students understand science material. Learning will be meaningful if supported by conducive, constructive and innovative learning conditions (Surayanah & Karma, 2018). This is due to the characteristics of elementary school students who tend to like to play and get bored quickly, as well as the thinking ability of students who are considered still not thinking abstractly. Media is the main indicator in learning to attract students' interest and focus (Kurniawati, 2014). Thus the existence of media or innovation in game-based learning is able to provide a stimulus for students to learn.

Based on these problems, it was found that the practice of learning science that occurred at SDN Pohkecik and SDN Sumberkarang Mojokerto Regency through observation and interviews stated that in learning science almost never used learning media. Whereas at SDN Sumberkarang, the fourth grade teacher revealed that in learning the media that is usually used is only limited to pictures. The teacher revealed that in the material of the form of objects and their changes also did not use media so far, only in the material of plant organs and functions the teacher guided students to observe the surrounding plants. Science learning is carried out using lecture, assignment, and question and answer methods that are repeated at each meeting. It is known that students experience boredom while learning due to the amount of material read and tasks done. Teachers at SDN Pohkecik and Sumberkarang also revealed that student interaction is lacking in the classroom, such as when in groups some students find it difficult to mingle, so that cooperation from students in group activities is not optimal. Based on the teacher's opinion, it can be seen that in group learning activities students still need guidance.

Referring to the problems at SDN Pohkecik and SDN Sumberkarang which have the same learning characteristics, namely the lack of media and technology facilities that support learning, an innovation was made in the learning process through science learning media in grade IV on the material of the form and change in the form of objects by strengthening the character of cooperation. The innovation developed in this study is a learning media based on the PAMUDI game "Puzzle Two Sides" assisted by index card match to strengthen the character of student cooperation. The media is packed with a combination of images on two sides of the puzzle, shapes, and puzzles that can make it easier for students to learn so that they do not feel bored, participate actively in learning and are directly involved in using the media, and do not lose focus. This puzzle game media can foster creativity and deeper student memories, because students are invited to solve problems but still fun (Kurniawati, 2014).

PAMUDI media is one of the media in the form of visual media that has elements of loading and unloading games from several pieces of images. The use of puzzle media has the aim of practicing patience, cooperation, problem solving, and developing students' motor and cognitive abilities (Pebrianati, 2023). PAMUDI media accompanied by index card match is a media that is able to invite students to solve problems by finding pairs of answer and question cards that are used to find the arrangement of the puzzle image pieces. The use of this media can help teachers in providing material, because in addition to solving image puzzles, PAMUDI media assisted by index card match contains questions related to the material being taught.

The character of cooperation is built through interactions that occur through PAMUDI media. The character of cooperation is a sub-element of the gotong royong dimension of the Pancasila student profile in the independent curriculum. Cooperation is an activity shown through group work between students where there are activities to unite opinions into a common decision (Kusuma, 2018). The character of cooperation is important for elementary school students. This is in line with what Rukiyati et al. (2014) stated that the character of cooperation is important for elementary school students because the character of cooperation can train students' ability to understand, feel, and carry out joint activities to achieve a common goal. In addition, according to Yulianti et al. (2016), the character of cooperation can foster self-confidence in interacting and train students in adapting to new environments.

Based on the research of Alimah et al. (2014), it shows that there is a significant difference between learning motivation and student learning outcomes when using puzzle media in physics learning models. In addition, Purwanti & Khotimah's research (2020) states that puzzle media is suitable for use in learning activities in elementary schools, after going through tests from media experts and users. Meanwhile, Ernis & Hazmi's research (2021) proves that there is

an increase in student learning outcomes in food chain science material in grade 5 SD from using puzzle media in cycle I and cycle II. Through several previous studies, it can be seen that the use of puzzle media is considered valid and effective in increasing learning motivation, learning outcomes, and cooperation skills between students.

Based on the background previously described, a research and development was carried out with the title "PAMUDI Media Development 'Two-Sided Puzzle' assisted by Index Card Match Material Forms and Changes in Objects for Strengthening the Cooperation Character of Grade IV Elementary Students" which is valid, practical, and attractive, and is able to strengthen cooperation skills in students to overcome monotonous learning activities by presenting innovations in the form of game-based learning media.

2. Method

The research method used in this research and development is the ADDIE model (Analyze, Design, Development, Implementation, Evaluate). According to Sugiyono (2013) research and development is a type of research method or procedure in developing and producing certain products, by testing the feasibility of these products. The selection of the ADDIE research and development model for the development of PAMUDI media assisted by index card match material on the form and change in the form of objects is based on simplicity, completeness, and a systematic sequence with a revision and evaluation process at each stage that can reduce product weaknesses both in the process and in implementation. Research and development was carried out at SDN Pohkecik and SDN Sumberkarang during March-June 2024.

The PAMUDI media research and development procedures include, 1) analysis, researchers conduct an analysis of learning problems and needs, 2) design, carried out to design media products offered as solutions and validation test instruments, practicality, and attractiveness questionnaires, 3) development, this stage is carried out by researchers to conduct media validity tests on media experts and material experts, 4) implementation is a field product trial with small group trials and large group trials, and 5) evaluation carried out at each stage to minimize errors in media products.

Data collection techniques used in research and development of PAMUDI media through interviews, observations, and questionnaires. The types of data obtained from this research and development are quantitative data and qualitative data. Qualitative data obtained from interviews involving both grade IV teachers of SDN Pohkecik and SDN Sumberkarang, observations, and questionnaires of needs by grade IV students of SDN Pohkecik and SDN Sumberkarang. Meanwhile, quantitative data was obtained based on the results of validity tests, practicality tests, and user attractiveness tests. The research subjects involved were media and material experts, as well as teachers. Student subjects in the small group trial involved 9 fourth grade students from SDN Sumberkarang and 22 fourth grade students from SDN Pohkecik. The formula used to calculate the percentage of scores from quantitative data is:

$$Vah = \frac{Tse}{Tsh} \times 100\%$$

Description:

Vah = Expert validation result

Tse = Total score obtained

Tsh = Total maximum score

3. Results and Discussion

3.1 Results

The results of this research and development are in the form of PAMUDI media products assisted by index card match material on the form of objects and changes in the form of objects to strengthen the cooperation character of grade IV students developed through 5 stages. The first stage was an analysis of needs, performance, and analysis of student characteristics. Analysis of the needs of the two schools shows that there is still a limited presence of media that supports learning activities which causes boredom and monotonous learning. The performance analysis showed that the school applied the independent curriculum, with learning methods such as lectures, questions and answers, assignments, and occasional experiments on the material of plant body parts. So it was found that in the material of the form of objects and changes in the form of objects, only lectures and questions and answers were carried out, which had minimal social interaction with students. Based on the analysis of student characteristics, students tend to like activities that involve psychomotor abilities which are identical to the kinesthetic learning model.

The design stage is carried out to create a PAMUDI media design which includes several components including covers, pictures of puzzle pieces, question and answer cards (index card match), material summaries, and instructions for use. Making the design design is done with the help of applications such as canva and adobe, resulting in a design as in Figure 1 below.



Gambar 1. Design of Puzzle Pieces

While the physical puzzle product is made using cardboard material which is then cut according to a predetermined size using a cutter. The size for the puzzle box is 40cm x 62cm, the size of the cube puzzle is 7cm x 7cm, the size of the question card is 10cm x 8cm, while the size of the instructions for use and summary is made on A4 size paper.

The media development stage is carried out to test the validity of the media. At this stage, the media that has been made is then submitted to validators, including media expert validators, material experts, and teachers. The tests are presented in table 1 below.

Tabel 1 Validity and Practicality Test Results

No.	Aspect	Percentage	Average Percentage	Category
1.	Validiti			
	a. Media Expert	100%	91,65%	Very Valid
	b. Material Expert	83,3%		
2.	Practicality			
	a. Guru SDN Sumberkarang	100%	100%	Very Partical
	b. Guur SDN Pohkecik	100%		

Table 1 shows that the PAMUDI media product assisted by index card match material on the form of objects and changes in the form of objects to strengthen the cooperation character

of grade IV students of SDN Pohkecik obtained a validity score percentage of 91.65% with a very valid category. PAMUDI media products also obtained a percentage score of 100% for the practicality aspect with a very practical category. So it can be concluded that PAMUDI media can be used in learning practices at school for science learning.

The fourth stage is product implementation to assess the attractiveness and strengthening of media cooperation characters in students. The activity was carried out with two phases of small group trials and large group trials. The small group trial involved 9 students at SDN Sumberkarang with categories of students who had low, medium, and high abilities. Meanwhile, the large group trial was conducted on 22 students at SDN Pohkecik. The results of the implementation stage attractiveness test are as follows in table 2.

Table 2 Response to Media Attractiveness and Character Reinforcement

No.	Aspect	Percentage	Average Percentage	Category
1.	Attractiveness			
	a. Small group trial	98,8%	96,9%	Very attractive
	b. Large group trial	95%		
2.	Strengthening the character of cooperation			
	a. Small group trial	100%	95,45%	Very strengthening the character of cooperation
	b. Large group trial	90,9%		

Table 2 shows that PAMUDI media products obtained a percentage score of 96.9% with a very interesting category for the aspect of student attractiveness. Furthermore, in the aspect of strengthening the character of cooperation, a percentage score of 95.45% was obtained in the category of being very able to strengthen the character of cooperation. Thus, PAMUDI media assisted by index card match material on the form of objects and changes in the form of objects to strengthen the character of cooperation of grade IV students of SDN Pohkecik is suitable for use in learning activities.

The evaluation stage is carried out at all stages of the research. Evaluation of the analysis is carried out on the needs of the school found to then provide solutions for the development of media products. The design evaluation is carried out by the supervisor regarding the components that need to be added and adjusted to the media. Development evaluation is based on the results of comments and suggestions from experts and teachers. While the implementation evaluation is carried out based on comments on suggestions obtained from students when the trial process is carried out. Based on these suggestions, the media can be improved into a valid, practical, and attractive final product.

3.2 Discussion Product Validity

The validity of PAMUDI media products is used to determine the feasibility of the product before research is conducted. Validity is a measurement that is prepared to determine the feasibility, compatibility, and appropriateness of a product for field practice (Dewanti et al., 2019). Based on the recapitulation of the results of the validation of media products by the two media experts, the results of the validity level reached a percentage score of 100% with a very valid category. The media validity test focuses more on the material content and appearance of the media. So that the harmony between the use of fonts, images, colors, is very important to

support the presentation of material. The display aspect has several things to consider such as the accuracy of font selection and font size, the integration of color combinations, image proportions, clarity of writing, and neatness in the preparation of each component (Pribowo, 2018). Some of these things determine whether the media can be applied in learning with students or have in common with other student learning aids such as books. PAMUDI media made using materials that are safe for students with attractive designs are expected to help students to be more motivated to learn.

Validity is also used to determine the feasibility of the content of the material presented by the media. The validity of PAMUDI media based on material experts reached a value of 83.3% with a valid category. There are several aspects of assessment measured in conducting material expert validation including 1) suitability of material, 2) language, and 3) feasibility of media presentation. Material can be said to be appropriate if there is compatibility with CP, besides that the material needs to be adjusted to the characteristics of students, because this has an important role to support the quality of learning in the classroom (Hidayatullah et al., 2022). The resulting PAMUDI media product already has the suitability of the material with the content of the CP curriculum and learning resources. The suitability of the material in the media can be known based on the suitability of the material with the achievement of the material with the curriculum, the suitability of the material with the learning process in the classroom, and the ability of the material to make students think (Dewanti et al., 2019).

Language in the presentation of material in the media produced is also an important thing to note. Language acts as a learning communication tool to achieve a predetermined goal (Wicaksono, 2016). The presentation of material in a language that is easily understood by students can be seen in the use of simple, clear, and easy to understand sentences in the question cards, answers, and material summaries. The linguistic aspect supports the role of the media used as a tool for translating material to students, so that through the use of appropriate language, it is also an indicator of the success of media products in meeting their development objectives. In addition, the delivery of material on PAMUDI media is combined with the presence of supporting images that correlate with each other. The material will be more liked and easily understood by students if it is given in a varied manner (Aufa et al., 2021).

Product Practicality

The product practicality test assesses aspects of content content and practicality of media use in the field. Product practicality can be seen through the results of product trials in the field, considered practical if the product can be applied in learning (Rahayu et al., 2019). The practicality test was assessed from several aspects in a questionnaire filled out by the teacher, the assessment was assessed by 2 grade IV elementary school teachers who were used for field trials. The assessment results showed a percentage of practicality of 100% with a very practical category. There are several aspects of the assessment contained in the questionnaire including, 1) the suitability of the material, 2) the language used in the media, 3) the feasibility of media presentation, 4) appearance, 5) the use of media in the field, and 6) the usefulness of the product in learning.

The practicality of the material in the media is measured through the practicality of the media in presenting the material and the feasibility and management in learning (Sehe et al., 2016). The maximum score is obtained based on these indicators, which shows that the media is good at helping to present material in a form that is not monotonous. In addition, the practicality of the product is measured to determine the use of the product by teachers and students in learning, which is based on the ease of use of media products (Rahayu et al., 2019).

Media products can be called easy to use because they are equipped with instructions for use, a summary of the material and do not require other devices in the operation of the media. Consideration of product practicality is based on the ease of use of the media, easy to interpret in learning activities (introduction, content, closing) (Zakirman & Hidayati, 2017).

Product Attractiveness

Product attractiveness based on student assessment of media products. The percentage results reached 98.8% for small groups and 95% for large groups. So it can be interpreted that the media is very interesting to use during learning. The use of media is considered important, with learning media can provide meaningful experiences to students (Hasan et al., 2021). Meaningful learning is based on the cognitive learning theory of constructivism which emphasizes that presenting a comfortable learning atmosphere to help students think and solve problems, find ideas, and make decisions (Wahab & Rosnawati 2021). This is supported by experimental activities and PAMUDI media games, so that students not only listen and listen, but also take an active role in managing their knowledge. The cognitive learning theory of constructivism emphasizes student-centered learning. Learning that emphasizes that knowledge is not only transferred through teachers to students but also involves students in obtaining this knowledge (Yuberti, 2014). In other words, new information that students have if it is in accordance with the initial scheme will be adapted through the assimilation process of integrating new information into existing schemes, so that new experiences are formed through learning by experimenting and playing PAMUDI media answer card pairs.

PAMUDI media made in the form of physical media played directly by students, can stimulate student activity. This is supported by the opinion of Al Arif Hidayatullah et al. (2022) that the use of physical media has advantages that are not owned by online media, namely media can stimulate activity in students. Puzzle media designed for group learning will also indirectly increase students' social interaction activities such as cooperation with friends. This is also shown by the results of the questionnaire strengthening the character of cooperation in students, which obtained results of 100% and 90.9% with a very capable category in strengthening the character of cooperation in students. There are several indicators that reflect the character of cooperation in students, namely self-confidence, self-awareness, caring, and mutual respect (Yuniar, 2021).

PAMUDI media which requires students to work in groups and help each other, will indirectly foster mutual respect and care among friends. In line with the explanation from Kusuma (2018) that through group work students will learn to unite opinions and accept each other's opinions to reach a common decision. Students will ask friends who look difficult in finding appropriate answers to questions, with these circumstances students will learn to accept input from others. The character of cooperation is important for students, because with the character of cooperation students are able to understand, feel, and carry out joint activities to achieve a common goal (Rukiyati et al., 2014).

PAMUDI learning media products on the material form of objects and changes in the form of objects to strengthen the character of cooperation in grade IV students are known to have advantages and disadvantages. The advantages of PAMUDI media products compared to the usual puzzle are 1) there are two sides of the picture in one puzzle, 2) the media is equipped with question and answer cards, 3) the media is able to attract students' interest in learning, 4) the media is able to strengthen the character of cooperation between students, and 5) media products are able to present a more pleasant learning atmosphere for students. While the shortcomings are 1) it cannot be used from the beginning of the learning series, it can only be

used at the end of learning, 2) it still requires teacher guidance in the implementation of learning, 3) research that was only developed based on 2 elementary schools, allowing different needs in other schools due to the incompatibility of the background of the problem.

4. Conclusion

PAMUDI media products assisted by index card match material on the form of objects and changes in the form of objects to strengthen the cooperation character of grade IV students of SDN Pohkecik get the results of validation tests by media experts obtaining a percentage value of 100% with a very valid category. While in the material expert the percentage of media validity obtained a value of 83.3% with a valid category. The results of the teacher's practicality test obtained a percentage value of 100% in the very practical category. Student interest obtained a percentage of 96.9% and the media's ability to strengthen the character of cooperation amounted to 95.45%. Thus, PAMUDI media products assisted by index card match material form of objects and changes in the form of objects to strengthen the character of cooperation of grade IV students SDN Pohkecik can be declared valid, practical, interesting, and able to strengthen the character of cooperation in students worthy of use in learning at school. PAMUDI media products should be used after students have prior knowledge of the material and re-discuss the questions in the media. In addition, in the research and development of PAMUDI media developed to pay attention to the components and proportions of the media, instruction manuals that can be accompanied by video demonstrations in the form of barcodes, and combine with other materials on the unused side of the puzzle.

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