DEVELOPMENT OF MODIFIED DOMINO CARD LEARNING MEDIA IN SCIENCE LEARNING MATERIAL ON ANIMAL LIFE CYCLES FOR GRADE V ELEMENTARY SCHOOL STUDENTS

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Abstract

This research was conducted through interviews with classroom teachers to identify the difficulties in developing instructional media that led them to more frequently use existing media in the teaching and learning process. This situation can lead to boredom during learning. The objectives of this study are to enhance learning media using modified domino cards and to assess its suitability in teaching Natural Sciences (IPA), particularly focusing on the animal life cycle material. This research employs the Research and Development (R&D) method with the PPE model, encompassing three stages: planning, production, and evaluation. The research was carried out at SDN Baru 02 Pagi. Data collection for this study involved questionnaires distributed to media experts, content experts, education experts, and students, allowing them to assess the suitability of the modified domino card media. The evaluation results from media experts indicated a score of 80% in the "adequate" category, whereas content experts and education experts assigned a score of 92% in the "highly feasible" category. Additionally, the questionnaire results from students in the small-scale trial yielded a score of 79% in the "adequate" category. In the large-scale trial, the score reached 85% in the "highly feasible" category. Based on the attained results, the modified domino card media has demonstrated its effectiveness in enhancing the understanding of animal life cycles.

Keywords: Natural science, learning media, animal life cycles

INTRODUCTION

The 21st century is marked by the emergence of an era of globalization and openness, bringing fundamental and significant changes in lifestyle compared to previous periods. The rapid progress of science and technology during this century demands an increase in the quality of every human effort and work, requiring the existence of human energy sources that meet high-quality standards. Apart from that, the curriculum also undergoes adjustments over time, produced by institutions that are competently managed and able to achieve superior performance, such as educational institutions or schools. In the school environment, students can learn with guidance from experienced teachers who are experts in their fields (Ariya & Whindi Arini, 2021).

Education plays a vital role in ensuring human survival in the context of national and state life (Nillofa Ende et al., 2022). Through education, humans acquire values, knowledge, and attitudes that assist in decision-making. Education is one of the most essential elements in human life, implying a process of lifelong personality development with the aim of achieving progress and positive influence. As an inseparable entity, education acts as a guide towards better achievement. To make this happen, educational service standards must be high, including the availability of adequate educational facilities and infrastructure, as well as the presence of professional educators (teachers) (Panggabean et al., 2020).

Teachers take on the central role in ensuring the success of education, given their direct engagement with students. The caliber of the learning process and goal achievement hinges on four teacher competencies, primarily pedagogical competencies. Regrettably, only a minority of teachers adhere to this approach. Several educators rely solely on government-provided teaching materials and printed books.

Throughout the teaching and learning process, numerous teachers persist in utilizing conventional strategies, approaches, models, and methods such as demonstrations and lectures. Consequently, students become disinterested in the learning process, leading to suboptimal learning outcomes. Frequently, students fail to meet the established standards for learning outcomes. The development of teaching tools holds immense significance in supplying teaching materials tailored to students' needs. This culminates in an effective, active, innovative, and enjoyable learning experience, facilitating the successful and maximal achievement of set learning objectives (Bahan et al., n.d.).

Learning is an action carried out to plan the learning process with the aim of achieving learning objectives in the curriculum. This involves facilitating interactions between students and educators using innovative learning media (Zuhro et al., 2023).

The contextual approach embodies a teaching method that assists educators in contextualizing content through real-life situations experienced by humans. This prompts students to connect the knowledge they acquire with its practical application in daily life,

whether as individuals or within society. This approach activates students during the learning process through diverse activities and hands-on experiences, moving beyond mere knowledge transmission from teachers to students. Within this context, the learning strategy holds greater significance than the learning outcomes (Wayong, 2022).

The term "learning media" has its origins in the Latin word "medius," which literally means "middle," referring to the intermediary or messenger from the sender to the recipient of the message. In essence, media is a component in the learning system. As such, media should be an inseparable part and must be in harmony with the entire learning process (Nurfadhillah et al., 2021).

Learning media assumes a pivotal role in the learning process, functioning as a conduit for material delivery that enhances students' comprehension of natural science concepts. Integrating learning media in teaching can cultivate interest, motivation, and stimulate learning activities. For instance, revisiting learned content reinforces learning and elicits more robust responses from students. Consequently, educators can employ learning media as effective tools to convey subject matter to students, facilitating enhanced understanding (Wahyuningtyas & Sulasmono, 2020).

The function and utilization of media play a crucial part in learning. Media's role in learning is to attain efficiency and effectiveness in achieving learning objectives. The deployment of learning media throughout the learning process involves generating newfound interests and desires, boosting motivation, inciting learning activities, and influencing student psychology. Learning-oriented media significantly heightens the dynamism of the learning process. Simultaneously, media imparts information, learning content, and the merits of the media itself, particularly fostering interactions from teacher to student, which catalyze optimal learning (Trisiana, 2020).

The role of learning media in the learning and teaching process holds an integral place within the education sector. Learning media functions as a tool employed to transmit messages from the teacher to the message recipient, with the intention of stimulating students' thoughts, emotions, attention, and interest, thereby fostering greater enthusiasm in the learning process. Through the utilization of learning media, students become more motivated to learn, facilitating engagement in writing, speaking, and imaginative activities.

The incorporation of learning media can enhance the effectiveness and efficiency of the teaching and learning process, while also fortifying the bond between teachers and students. Moreover, media serves as a means to counteract potential boredom that may arise during classroom learning. As such, it falls upon the teacher to provide motivation to students through the utilization of media, in order to cultivate a more captivating and interactive learning environment (Smp, 2019).

One way for students to become interested in participating in the learning process is through the use of learning media in the form of modified domino cards. This media can be applied in learning activities at the elementary school (SD) level, as stated by Mumpuni & Supriyanto in 2020. This finding is also reinforced by the results of research conducted by Setiawan, Yandari, & Pamungkas in 2020, which stated that the use of modified domino cards can improve students' understanding (Nelwati & Rahman, 2022). Domino cards are thick sheets of small size that have a center line, dividing each card into two parts, namely the right side and the left side. In general, this card contains large dots whose number varies between 0 and 6 dots on each side (Muthoharoh & Cholifah, 2020).

Domino, a popular game spanning diverse age groups from children to adults, can be employed as a learning medium to aid students in enhancing skills necessary for advanced-level thinking, comprehension of material, and heightened concentration during the learning process.

The term "IPA" is an abbreviation derived from "Natural Science." "Nature" signifies the natural world, while "science" pertains to knowledge. Thus, Natural Sciences (IPA) can be precisely defined as a scientific field devoted to the exploration of natural phenomena. Its objective is to comprehend and elucidate various occurrences in nature, encompassing processes, effects, and causes (Fitrianti, 2019).

Referred to as science education and abbreviated as IPA, Natural Sciences represent a core subject within the Indonesian educational curriculum, spanning down to the elementary school level. Science intimately intertwines with the process of learning itself, involving a systematic exploration that equips students with knowledge about the natural world in their daily lives. IPA (Natural Science) is frequently perceived as a challenging subject by students, ranging from elementary to high school levels. Often, students find science lessons daunting, and their learning outcomes often fall short of expectations (Azizah et al., n.d.).

The subject of Natural Sciences (IPA) holds a crucial position within the school curriculum. This subject primarily revolves around a methodical approach to comprehending nature, moving beyond mere memorization of facts and concepts. The scientific discovery process significantly relates to everyday life. Beyond imparting knowledge, science aims to cultivate students' logical, rational, critical, and creative thinking abilities, effectively teaching them to think in a scientific manner. Learning science extends beyond mere information mastery; it provides avenues for students to nurture scientific attitudes, hone problem-solving skills, and apply this knowledge to real-life scenarios.

As a fundamental cornerstone in the realm of science, the field perpetually advances, serving as the bedrock for science and technology development. Science is primarily centered on comprehending diverse natural phenomena, encompassing four key components: processes, attitudes, applications, and outcomes. Scientists systematically examine these phenomena by

applying scientific principles, culminating in a holistic grasp of the realm of natural science (Sriariati, 2019).

The goal of learning Natural Sciences (IPA) at the SD/MI level is to equip students with the skills necessary to comprehend and apply pertinent scientific concepts in everyday life. Furthermore, this form of education strives to cultivate positive attitudes, curiosity, and an awareness of the intricate relationship between science, technology, the environment, and society. Learning materials are tailored to foster the development of process skills required to analyze the natural environment, as well as to teach decision-making and problem-solving techniques. An equally important aspect is enhancing student consciousness regarding the significance of participating in environmental conservation (Nur Jannah, 2020).

Derived from an interview held on Monday, January 2, 2023, with Mrs. Dwi Suherlina, S.Pd, it is evident that Mrs. Dwi underscores the significance of incorporating learning media within the educational process. In her perspective, learning media plays a pivotal role in aiding students to grasp and master taught content while igniting their passion for learning, thereby rendering the learning journey enjoyable. Mrs. Dwi Suherlina also shared her utilization of visual aids, including visual images, in her teaching methodology. However, she faced challenges due to time constraints in creating and preparing lessons, often leading teachers to primarily rely on textbooks as the main resource.

The pedagogical process can effectively employ modified dominoes as educational materials for science subjects, concentrating particularly on the life cycle of animals. These modified dominoes, essentially constituting a game utilizing blocks featuring values from 1 to 6, are adapted in a manner where one side portrays an image and the other side is blank, enabling students to draw corresponding pictures on the cards. The rationale behind employing this learning medium is to facilitate student comprehension, stimulate higher-order thinking, and foster an enthusiasm for learning.

Based on the explanation provided, several challenges arise during the learning process, namely (1) a limited time to create an optimal learning environment, and (2) a significant dependence of teachers on existing learning materials.

A subsequent analysis stemming from observations made on Wednesday, January 9, 2023, in elementary schools highlights the following issues: (1) students continue to encounter difficulties in grasping the animal life cycle topic, primarily due to inadequate learning media, and (2) the availability and implementation of suitable learning media remains insufficient.

Given the aforementioned context, it is evident that effective learning necessitates the use of fitting learning media. Teachers are expected to possess adeptness in employing a variety of learning media to ensure a seamless teaching and learning process. Thus, considering the outlined scenario, the development of captivating learning media assumes paramount importance in enhancing the learning journey.

Motivated by the aforementioned background, the authors are driven to enhance the learning environment through the utilization of modified domino cards for science subjects. This research is titled "Development of Modified Domino Card Learning Media in Science Learning: Animal Life Cycle Materials for Grade V Elementary School Students."

METHODS

Research and Development (R&D) methodology is an essential research approach often employed by researchers at both undergraduate and postgraduate levels. The primary purpose of utilizing research methods in this context is to gather empirical information that meets the criteria of validity, reliability, and objectivity. To obtain the necessary empirical data, researchers must create or develop valid and reliable research tools. The process of developing research instruments with validity and reliability can be conducted using research and development (R&D) methods (Nurmalasari & Erdiantoro, 2020).

In their research, the researchers employed the Research and Development (R&D) research methodology, which emphasizes a systematic analysis of the design, development, and evaluation of learning programs, processes, and learning products, while paying attention to the criteria of validity, practicality, and efficiency.

This research falls under the category of descriptive research that adopts a Research and Development (R&D) approach. In the initial stages, descriptive research was utilized to gather data about existing conditions. These conditions encompass the following:

1. The state of the existing product, serving as the basis for benchmarking the product under development.

2. Conditions of users, such as schools, teachers, principals, students, and other parties involved in the education sector.

3. Factors that facilitate or impede the development and utilization of the product to be produced. Aspects under consideration include educators, education personnel, infrastructure, costs, administration, and the educational environment where the product will be used (Danuri & Maisaroh, 2019).

Furthermore, researchers employ specific research approaches and methods to achieve their research objectives. In the development of this model, a qualitative approach and quantitative data were utilized. Quantitative data involve tests measured using variables studied on an object, typically in the form of questionnaires distributed to experts, as well as trials conducted with students. On the other hand, qualitative research was conducted through observations and interviews, with the evaluation results providing suggestions for validation by material experts and media experts.

In this research, a research and development model that refers to the Richey and Klein approach is used. This model implies three main stages that researchers must go through,

namely planning, production, and evaluation, known by the abbreviation PPE (Oktavianti & Permana, 2023).

Tabel 1. Stages PPE

Activity stages	Activity
Plannung stage	In this phase, the identification of students' needs is conducted through interactions with education experts and students who serve as users of the learning media. Findings from this research are also integrated into the curriculum and the implementation plan for learning (RPP). Additionally, at this stage, there is involvement in designing learning media in the form of customized Domino Cards to meet these needs.
Production stage	The development of modified Domino Card media occurred in two stages: the product printing stage and the content validation stage. The creation of modified Domino Card media was executed using an application. During the validation stage, criticisms, responses, and suggestions were gathered to enhance the quality of the modified Domino Card media. If these criticisms and suggestions are taken into consideration, it is expected that the final results of the learning media products will exhibit higher quality.
Evaluation stage	Assessments are conducted on learning media to evaluate their impact on the achievement of learning objectives.

The researchers employed the PPE (Planning, Production, Evaluation) development model, which offers a systematic approach to learning development. Following Richey and Klein's concept, the research methodology in this study encompasses the Planning, Production, and Evaluation stages.

During the planning stage, a product design or plan is crafted. This process commences with an initial literature search to gather relevant data for background research and development.

The selection of the sample in this study aligns with the interviews and observations conducted at SDN Baru 02 Pagi, which highlight the need for suitable learning media and underscore the importance of the teacher's ability to utilize these media to enhance the learning process.

The production stage entails creating products based on previously formulated plans. This stage involves activities associated with product manufacturing. The designs prepared earlier in this study were implemented to create modified domino card media for elementary schools. After successfully crafting the product, it undergoes testing by experts and users/students.

In the evaluation stage, the product or media is assessed by experts in their respective fields (expert judgment) to ensure its utility and effectiveness for the intended users. Expert judgment provides valuable insights and input for enhancing products to meet the necessary criteria, namely effectiveness, usability, and high quality (Marpaung et al., 2021).

RESULTS AND DISCUSSION

The objective of this research is to enhance and evaluate the suitability of learning media, such as modified dominoes, for science subjects. The study was conducted at SDN Baru 02 Pagi, situated at Jl. RA. Fadillah No. 3, RT. 11/RW. 4, Cijantung, Kec. Ps. Rebo, East Jakarta City, Special Capital Region of Jakarta 13770.

This research primarily focuses on the development of modified domino card media to enhance students' understanding of animal life cycles in higher grades. The utilization of this media aids students in comprehending the subject matter and piques their curiosity. The research activities follow a structured approach, known as PPE (Planning, Production, Evaluation). These stages involve validation processes conducted by various validators, including media experts and subject matter experts, who assess the product's feasibility for development within this study. The ultimate goal is to ensure that researchers can create suitable and effective learning materials.

Throughout this research project, researchers actively participate in on-site data collection, ensuring that the obtained results faithfully represent the real-world context. The research follows the PPE (Planning, Production, Evaluation) approach, comprising the following stages:

1. Planning and Design

    Design is the first step in the PPE development model, which involves observational activities to collect information and requirements needed before entering the stage of creating natural science learning materials. For this reason, researchers need to gather data about the characteristics of students at SDN Baru 02 Pagi, especially those in class V. The data should include information about their hobbies, preferences, interest in learning, and their preferences for learning materials, as well as any problems they encounter during the learning process. Researchers obtained this data through

interviews with homeroom teachers. Based on the students' characteristics, it is evident that they require learning materials, especially for natural sciences. This need arises due to the educators' difficulty in conveying material related to the life cycle of animals. Therefore, researchers have developed innovative learning materials, such as card-based games.

The purpose of this learning material is to make it easily accessible to all students while increasing their interest and understanding of the subject matter. This game-based medium is designed to enhance comprehension skills, develop higher-order thinking abilities, and capture students' interest in learning in an enjoyable way, enabling them to learn while having fun.

2. Production and Development

Based on the analysis, researchers can now proceed to develop a product called "modified domino card learning materials" to enhance the effectiveness of the learning process. Subsequently, the researchers designed the front and back views of these materials using the Canva application. The front view design includes pictures illustrating the process of animal metamorphosis, starting from the perfect stage, through the imperfect stages, to those stages that do not represent the animal's life cycle.
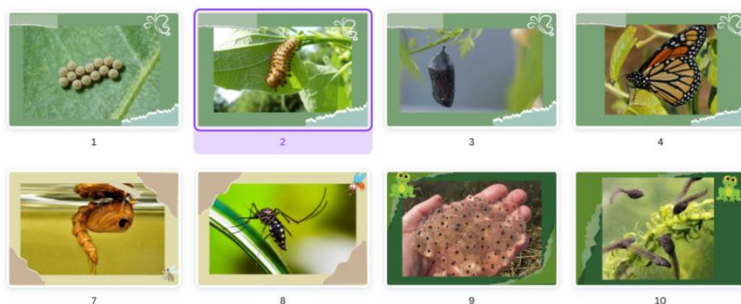

Figure 1. front view

After completing the design for the front view, the next step is to design the rear view, as shown in Figure 1.1. Once the design is complete, the subsequent step involves the printing process using art carton material, which is then coated with a layer of glossy lamination. The application of glossy lamination transforms the back view into a surface upon which students can write to identify the animal depicted in the front view. This enables interactivity and active participation of students in the learning process.
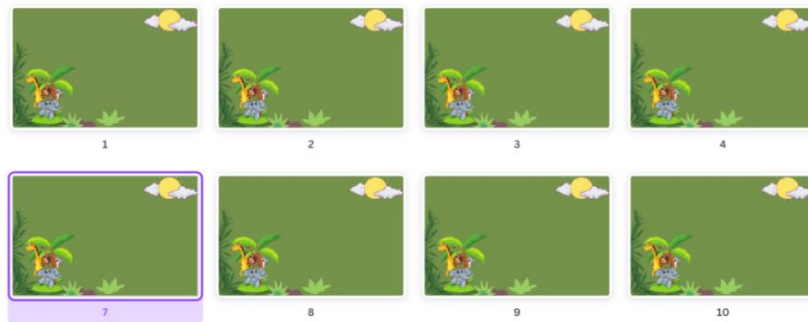
Figure 2. Rear view

3. Evaluation and Assessment

This stage involves administering questionnaires to students and conducting pre-test and post-test assessments. Through the results of this evaluation, researchers can gauge the effectiveness and suitability of modified domino cards as learning materials.

Data for this research were collected using observational methods, including interviews with class teachers to understand students' difficulties and learning processes. In addition to this, questionnaires were distributed to both experts and students to assess the validity of the expanded product. This research ensured validity through three validators, including a media expert (Dr. Arum Fatayan M.Pd, Lecturer at Muhammadiyah University Prof. Dr. HAMKA), a subject matter expert (Dra. Zulfadewina M.Pd, Lecturer at Muhammadiyah University Prof. Dr. HAMKA), and an education expert (Dwi Suherlina S.Pd from Class V at SDN Baru 02 am). The data generated in this research comprises validation results by experts and responses obtained through questionnaires.

Validation techniques were employed to assess the suitability of the media, and researchers gathered questionnaires with corresponding scores, as well as research tools completed by experts. The following table presents the assessment instruments utilized:

Tabel 2. Presents the assessment instruments utilized

Score	5	4	3	2	1
category	Very worth it	Worthy	Decent enough	Not worth it	Very unworthy

Based on the analysis of validation data from material experts, media experts, teacher validation, and student trials, the formula is as follows

$$P = \frac{f}{N} \times 100$$

Information :

P   : validation presentation

f   : Total Score Results of Data Collection

N   : Total Maximum Score

Based on this formula, the level of success in development can be determined by assessing the feasibility level and carrying out necessary product revisions. The following table displays the criteria for achieving eligibility.

The research aims to evaluate the effectiveness, feasibility, efficiency, and attractiveness of the products developed for use in the learning process. The try-out was conducted in two stages: a small group trial phase involving five fifth-grade students and a large group trial phase involving ten fifth-grade students. Students were expected to complete a questionnaire as part of the assessment of the suitability of the media used in learning activities.

The focus of this research is on the product development stage, particularly the validation stage, where previously created designs are evaluated by experts through trials conducted with small and large groups. The purpose of this stage is to determine whether the learning media design is suitable for use. If it is declared suitable, the design will be further improved to support the learning process and achieve the expected goals. This product has successfully passed the validation stage conducted by three validators, including material experts, media experts, and education experts, to assess the feasibility of the developed product.

The validation process involves media experts with special expertise in technology or IT. Their skills enabled them to understand and validate the modified domino media effectively, yielding robust results. The media validation results indicated that the modified domino card media was highly effective, scoring 40 out of a maximum of 50 points. This translates to an 80% score, signifying its suitability for use.

During validation, the materials expert's role is to assess the suitability and appropriateness of the materials used in the developed media. The assessment by material experts indicates that the materials align with the current curriculum and are suitable for students' abilities. The validation results from the material experts yielded a score of 46 out of a maximum of 50, equivalent to an average percentage of 92%, which qualifies as highly feasible. The validation process involves expert educators assessing the utility of the modified dominoes used in the classroom. The researcher selected Dwi Suherlina S.Pd as the validator from SDN Baru 02 Pagi.

After observing how researchers utilized the modified domino cards, the validator acknowledged the level of creativity exhibited by this media, as it successfully engaged students'

interest and attention in science learning. Furthermore, the validator believes that this product has the potential to boost student enthusiasm for learning. The validation results, obtained through expert educators' evaluation of the modified domino cards, yielded a score of 23 out of 25, equivalent to 92%, and were categorized as "highly feasible." After the product was validated by three validators and categorized as "Very Feasible,"

Tabel 3. Validation score

Validator	Score Obtained	Maximum Score	Average Percentage
Media Expert	40	50	80%
Subject Matter Expert	46	50	92%
Education Expert	23	25	92%
Total			88 %
Qualification			Very Worth It

After successfully completing the validation process with all three validators and receiving the classification of "Very Eligible," the next stage involves small and large group trials. In the small group trial, five selected students from Class V participated. During this trial, a questionnaire served as the instrument to assess the feasibility of the modified domino card media before its implementation with a larger group.

Tabel 4. Feasibility of domino card media

Student Respondents	Skor (max 50)	Precentage	Worthiness
1	43	86%	Very worth it
2	40	80%	Worthy
3	41	82%	Very worth it
4	38	72%	Worthy
5	37	74%	Worthy
Avarage	202	79%	Worthy

After taking a group test in which students were given a questionnaire, they achieved an average score of 202 out of 250, placing them in the "adequate" category with a score of 79%. Furthermore, students in this group were not required to retake the exam to continue with the large group testing phase.

Tabel 5. Feasibility of domino card media session 2

Student Respondents	Skor (max 50)	Precentage	Worthiness
1	44	88%	Very worth it
2	36	72%	Worthy
3	40	80%	Worthy
4	38	76%	Worthy
5	47	94%	Very worth it
6	50	100%	Very worth it
7	39	78%	Worthy
8	47	94%	Very worth it
9	40	80%	Worthy
10	44	88%	Very worth it
Avarage	425	85%	Very worth it

An experiment was conducted in large groups by administering the Media Testing questionnaire to students for a specific purpose. The average test result in the experiment was 425 out of 500, which, when expressed as a percentage, reached 85%. Consequently, it falls into the "highly feasible" category.

During the product effectiveness testing stage, information related to student learning outcomes was combined with pre-tests and post-tests concerning the material being assessed. The pre-test was used to measure students' initial abilities before using learning media, while the post-test was conducted after students had been exposed to the material through the learning media. To evaluate the effectiveness of the modified domino card media in enhancing understanding of the animal life cycle material, pre-test and post-test results were analyzed. According to the available data, there was a significant increase from a pre-test score of 49.125% to a post-test score of 90.375%. This represents an improvement of 41.25% among the total of 40 students who participated in the trial. Therefore, it can be concluded that this modified domino card media is effective in enhancing students' comprehension of the animal life cycle material.

CONCLUSION

Based on the previously outlined research, the use of modified domino card media in teaching natural science subjects, especially on the topic of animal life cycles, has been tested by students and validated by media experts, content experts, and education experts. The final results of the research indicate that the modified domino card media can serve as a learning resource, enhancing students' educational experiences in the school environment. Overall, this study has successfully developed domino card media that is highly suitable and can be effectively

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