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DEVELOPMENT OF DOMINO CARD MEDIA TO IMPROVE HIGH-LEVEL THINKING ABILITY IN UNDERSTANDING THE CONCEPT OF FRACTIONS

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ABSTRACT
This study aims to develop domino card learning media to improve higher-order thinking skills in fractional material. This study uses an R&D approach to produce learning media products. The subjects in this study consisted of 4th grade students at SDN Ciandur 2 for the 2020-2021 academic year, grade 4 teachers at SDN Ciandur 2 and experts or practitioners, while the object in this study was the domino card media which is the development of domino media. This research design uses a 4D development model developed by Thiagrajan, which consists of four stages: define, design, develop, and disseminate. The results showed that the mastery of learning obtained results from the domino card media users positively influenced student learning outcomes. This is indicated by the students' learning mastery, who reached a percentage of 87%. Thus the development of domino card media can be said to be effective for use in class IV fraction material at SDN Ciandur 2.

Keywords: Domino Card; Research and Development; 4D

INTRODUCTION

The development of science and technology in Indonesia is so fast that global competition is getting tighter. Improving the quality of education is currently one of the main things being pursued by the government. Various factors influence the success of an education implementation. These factors include; students, curriculum, education staff, costs, facilities, infrastructure, and environmental factors. Elementary school is the main level of education and acts as a foundation for instilling the basics of knowledge for the next level of education.

Education is a conscious and or planned effort to create and create a learning atmosphere and learning process so that students become active in developing their potential in order to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed for themselves, society, and society: nation and state.

One of the sciences that is often used in various fields of science, even in everyday life, is mathematics. Mathematics is one of several components in a series of subjects that have a significant role in mathematics education. Mathematics is one of the fields that strongly supports the development of science and technology.

Until now, many students still consider learning mathematics a complex subject, not fun and even a terrifying subject by some students. This is due to the difficulty of students in mastering and understanding the material and the absence of effort from students in seeking and finding problem-solving. In addition, educators also find it difficult to adjust the concepts and learning media into them. The initial ability in mathematics is the ability to understand mathematics. Understanding skills need to be honed in order to develop other abilities such

as problem solving skills, higher order thinking, communication skills and others. For students to have higher-order thinking skills in solving mathematical problems, it is necessary to understand them seriously to produce the necessary conceptual understanding.

Higher order thinking skills are thinking ability that includes some thinking such as critical, logical, reflective, metacognitive, and creative Thinking (Agustyaningrum, 2015; Badjeber & Purwaningrum, 2018; Gradini, 2019) . Higher-order thinking skills include several kinds of thinking, such as logical Thinking, Critical Thinking and reasoning abilities which are essential in everyday life in the surrounding environment, regardless of academic achievement. (Mahanal, 2019; Zubaidah, 2010) . So that it can be said that higher order thinking is a thinking ability that includes several thoughts, including logical thinking and critical thinking, in everyday life. Mathematics learning which is the subject of discussion, is fractional material (Murtiyasa & Wulandari, 2020; Unaenah & Sumantri, 2019) . Fractions are considered one of the most difficult materials in learning mathematics, resulting in a lack of student understanding of fractions; fractions are often encountered in everyday life.

Fraction comes from the Latin word Francisco, another form of Frangere that means to split (to break). Fractions can also be interpreted as part of a whole. In the illustration of the picture, the part that is meant is the part that is considered, usually marked with shading. This part is called the numerator. The intact part is the part that is considered a unit, and is called the denominator. Compared with real numbers, fractions look more complex and abstract so that many students need more detailed and concrete explanations to understand fractions (Nuraini & Muhtadi, 2019; Tian & Siegler, 2017) . So a fraction can be interpreted as a fraction consisting of a numerator and a denominator. Historically, fractions were used for numbers less than whole numbers and to break down and divide food, trade and agriculture.

The difficulty of students in solving fractions problems is caused by the lack of media use, as stated by Aida Hasanah SS, that in delivering a material, especially the basic mathematics subject, the fractions used are markers on the blackboard. So far, teachers have only dominated teaching and learning activities by means of students only listening, paying attention to the examples given by the teacher after working on the questions.

One of the keys to solving this problem can be solved by improving the learning process carried out by the teacher. In other words, teachers must continue to innovate, be creative in learning by developing appropriate media for mathematics subjects, especially fractions. Learning media is a means of delivering teaching material which is expected to make it easier for students to understand the concepts of teaching material being taught so that learning will be more meaningful which results in a deeper understanding of students' basic concepts. Media is a vehicle for disseminating learning information or messaging, *(AECT (Association of Education and Communication Technology)* defines media as a form of channel used to convey orders or information. This shows that media is one of the most frequently used means to facilitate learning. Various forms of media that can be used in learning, one of which is in the form of games. Games will help children in learning exercises in honing problem solving skills using logic (Kartika et al., 2019) . Games or fun that can support the achievement of an instructional goal of good mathematics teaching cognitive, affective and psychomotor aspects (Fiorella et al., 2019) . Mathematics learning media is needed to make it easier for students to understand abstract concepts. With manipulated objects, students can see, feel, observe and interact with more abstract concepts more easily.

One alternative solution to embed the concept of fractions in mathematics is one of them by using visual media in the form of domino cards. Domino is a card-based game that is played for fun. The game of identical dominoes is carried out using money as the ultimate goal of the game. This has resulted in dominoes being often seen as a bad game to be played by children (students). To change this negative view, efforts are made to adapt the domino card game in learning mathematics.

Several studies related to learning media, especially for learning mathematics on the material of fractions, have been widely carried out, including research by Febriyandani & Kowiyah, (2021); Prihanto & Yunianta, (2018) on the development of comic-based media, Ardhiyah & Radia, (2020); Sari et al., (2020) who used flash macromedia, (Mawanto et al., 2020) who conducted research with illustrated story media and Indrawati & Suardiman, (2013) who used game media. From these previous studies, the development of domino card media on fractional material is feasible as a form of research novelty.

METHOD

Research and Development (R&D) is currently one of the most widely developed types of research. Understanding Research Development or Research and Development (R&D) is often defined as a process to improve or develop something new, new products to improve existing products. The subjects in this study consisted of 4th grade students at SDN Ciandur 2 for the 2020-2021 academic year, grade 4 teachers at SDN Ciandur 2 and experts or practitioners, while the object in this study was the domino card media which is the development of domino media.

Researchers think and design the learning media based on the needs analysis that has been carried out on grade 4 students at SDN Ciandur 2. This domino card media is designed to help students understand the concept of fractions and improve higher-order Thinking on equivalent fraction material. The development research design describes the steps complete data that needs to be taken long before the development is carried out so that the data that should be needed can be obtained properly, can be analyzed objectively and the right conclusions can be drawn according to the problem being studied.

This research design uses a 4D development model developed by S. Thiagrajan, Doroyhy S. Semmel, and Melvyn in 1974. This 4D development model consists of four stages, namely define, design, develop, and disseminate. The 4D development model can be adapted into 4Ps, namely definition, design, development and deployment as shown in the figure below.

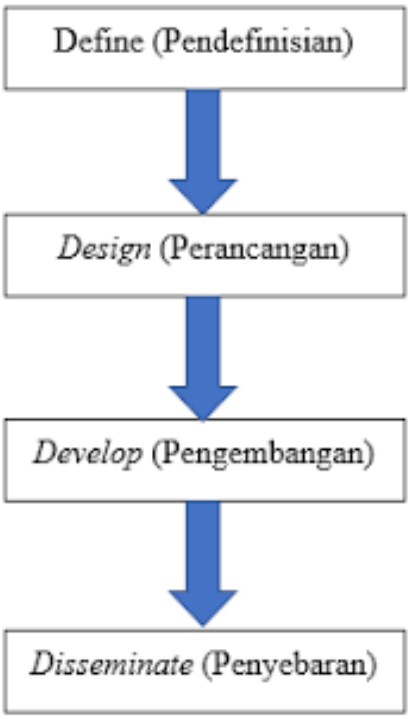

Figure. 1 4D Development Model

RESULTS AND DISCUSSION

A. Product Development

1. Define Stage

The definition stage is obtained based on interview and observation information that has been carried out at the Ciandur 2 Elementary School. This stage is useful for defining and determining the needs in the learning process and collecting information related to the product to be developed.

a. Early-Late Analysis

Based on the results of interviews and observations obtained information about learning media that is too watching and less interesting

1) The learning process carried out is *teacher* -centered, namely teacher-centered learning.
2) The method used by the teacher when learning mathematics is the lecture and assignment method.
3) The use of media is less so that students perceive mathematics as a scary subject.
4) The presentation of the material delivered in a coherent and systematic manner is in accordance with what is stated in the thematic book.
5) Lack of interest in learning mathematics

The initial-late analysis aims to emerge and define the problems to be faced. This goal was also achieved after conducting interviews with teachers and students, it can be seen that there are two basic problems, among others, as follows:

1) Learning mathematics at SDN Ciandur 2 has not been effective and watching
2) The ability to sort fractions is still low.

After seeing the second problem, it is necessary to have learning media that can create effective learning and can improve the ability to sort fractions for students.

b. Student Analysis

Students' understanding of the concept of fractions, especially the sorting done by the teacher is very low. The sorting ability possessed by students is also very low, it can be seen from the number of students who get scores below the KKM.

Based on the description above, the card media was developed into a domino card (which contains fractional numbers) to improve the ability to understand concepts in sequencing fractions.

c. Concept Analysis

In the research and development carried out, the research will include the concept of ordering fractions from the smallest to the largest and vice versa in the card.

Table 1. Basic Competencies and Indicators

NO	Basic competencies	Indicator
1	3.1 Explaining equivalent fractions with pictures and concrete models	Explaining fractions
2	**4.1** Identify equivalent fractions with concrete drawings and models	Sort the fractions from smallest to largest, and vice versa from largest to smallest.

d. Task Analysis

In this stage, the research has made detailed assignments from the content of teaching materials from basic competency standards and basic competencies that will be included in the domino card media. The material used in this study is material about fractions. The material for fractions here is to sort the fractions from smallest to largest and vice versa from largest to smallest and examples of problems that occur in everyday life related to fractional material.

e. Learning objectives

After conducting a preliminary analysis of the end of learning in grade 4 SDN Ciandur 2. The study concluded that the purpose of this research and development was to produce a domino card product that contained fractional numbers in random form so that students were expected to sort the fractional numbers from from the smallest to the largest, with this students can solve the problems in the problem

2. Design Phase (Design)

a. Media Voters

Based on the results of student analysis and concept analysis, the learning media needed by children at SDN Ciadnur 2 class 4 is to use cards that can help students make it easier to solve problems.

b. Format Selection

In this stage, the research designs learning content, selecting approaches, methods and learning resources. The content of the learning material that will be used in the media is about the understanding of fractions and examples of daily problems with fractions. The research chooses a scientific approach and discussion method that will be used in learning activities using domino card media. The learning resource used is a grade 4 math thematic book

c. Initial Design

In this stage, the research has made the initial product and then is given input by the lecturer. The input from the lecturer is used to repair the domino card media before repairs are made. Then make revisions after getting advice from the lecturer. After that, the researchers also made research instruments that were validated by the lecturers

3. *Develop* Stage (Development)

a. Expert or Practitioner Validation

This stage serves to validate the product that has been made by the researcher. Researchers validate the validators of the media and materials that have been made. The validation results of the validators are used as the basis for making revisions

Table 2. Research Results of Grade 4 Teachers

No	Research Aspect	Expert Theory	Expert Theory	Teacher Class	Average	Category
I	Media selection criteria	4.0		4.8	4.4	Very good
2	Media utilization	3.5		4.7	4.1	Well
3	Physical form of media		4.0	5.0	4.5	Very good
4	Learning		4.0	5.0	4.5	Very good
5	Material / content truth		5.0	4.6	4.8	Very good
6	How to play		4.0	5.0	4.5	Very good
Average					**4.46**	**Very good**

score for the validation of the product discussed by the researcher, namely the *domino card media,* was 26.8 with an overall average of 4.46. Based on table 3.6 classification scale 5, the score is in the very good category, so the *domino card product* is feasible to use.

b. Revision

After passing the validation stage by the validator, the researcher revised the *domino card media product* based on comments and suggestions from the validators. Materials and suggestions from the validators as well as the revisions that have been made are presented in the table below

Table 2 Product Revision Results Based on Validator Suggestions

Before revision	**After revision**
Comments and breakfast:	Repair :
1. On the repaired card that is - The shape of the card is too small so the font is also small - There are two numbers on the card, one should be one so students don't get too confused - The lack of color makes the card less attractive - No user manual	After repair - The card shape is bigger and the fonts are more clearly visible - There is one number so that students are easier and less complicated - More interesting because there is a color on each end of the card - There's a manual
2. Improved material - Adjusting to KD and indicators	- Adjusted KD and indicators

c. Development testing

After the researchers revised the *domino card product* , the next step was to test the product on the 4th grade students of SDN Ciandur 2 who were sampled in the study.
The next steps are product trials referring to the lesson plans that have been made by researchers. The product trial begins by giving the material to the students. Then proceed with giving test questions that must be answered using *domino card media.*

Table 3 List of Student Learning Outcomes

No	**Student's name**	**Score**	**Information**
1	Alpine	100	Complete
2	Ayu	80	Complete
3	Emut	100	Complete
4	Eka	80	finished
5	Curly	70	Complete
6	Jihan	90	Complete
7	Rendi	70	Complete
8	Sunarti	50	Not finished yet
The highest score			**100**
Lowest value			**50**
Average			**80**
Number of students who completed			**7**
Number of unfinished students			**1**

Based on the table above, it was obtained student data that from 8 students it was known that 7 students had completed. While students who have not completed as many as 1 person. If it is converted into a percentage, then the students who complete are 87%. These results certainly have increased from student learning outcomes in daily tests of fraction material

before using *domino card media.* Thus the *domino card media* can be said to be effective for fractional material in class IV SDN Ciandur 2.

4. ***Desseminate* Stage (Spread)**

The *Dessimenate* stage is the final stage of research and development. The purpose of this stage is to disseminate the products that have been made in this study, the researchers only carried out a limited distribution, namely by distributing *domino card products* on a limited basis to fourth grade teachers at SDN Ciandur 2.

The distribution of the product was carried out on August 23, 2021, which was attended by the principal and 2 teachers consisting of grade 1 and grade 4 teachers. In the distribution process, research on several important points including the background of making *domino card media* , the purpose of making *domino card media* , b and how to use *domino* card media

The teacher's response to the *domino card media* was very good. All teachers are interested in using *domino card* media because *domino card media* can help students understand the subject matter and make learning more fun so that students are motivated to learn. In addition, not only students but also teachers be motivated to innovate on learning

B. Domino Caard Media Development Effectiveness

Based on the results of the calculation of the percentage of mastery learning, it was found that the *domino card media users* had a positive influence on student learning outcomes. This is indicated by the students' learning mastery who reached a percentage of 87%. According to the Ministry of National Education (2004) in his book Ahmad Susanto, learning is said to be effective if student learning outcomes have reached >75% of the total number of students against the KKM.

Giving tests at the trial stage aims to determine the extent to which higher-order thinking skills in fractional material use *domino card* media . From the tests that have been carried out, the students' average score is 80 with a presentation of 87.%. This percentage has exceeded the predetermined graduation percentage of 75%. Therefore, The development of *domino card* media can be said to be effective for use in class IV fraction material at SDN Ciandur 2.

CONCLUSION

Based on the results of the research and discussion that have been described, the following conclusions are obtained (1) The procedure for developing domino card media using the 4D research and development method (Four D Models) according to Thigaraja, with the following steps: 1) Define there are early-late analysis, student analysis, concept analysis, task analysis, and specification of learning objectives. 2) Design consists of media selection, format selection, and initial design. 3). Decelop (Development) consists of expert or practitioner validation, revision 1 and development testing. 4). Desseminate (Spread); and (2) The domino card media developed in this study can be said to be feasible because the validation test obtained an overall average value of 4.46 from the validators in the very good category. Based on field trials, it shows that domino card media is also effective for use in learning mathematics for class IV fractions at SDN Ciandur 2. This can be seen from the learning of students who have a percentage greater than 75%, which is 87% with an average learning outcome of 80 .

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