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Mathematics Operation Card (MOC): Mathematics Operating Number Educational Game Cards for Elementary School Students

Hanim Faizah[1], Annisa Dwi Sulistyaningtyas[2]
[1,2]Universitas PGRI Adi Buana Surabaya, Surabaya, Indonesia
[1] fhanim@unipasby.ac.id, [2]annisadwistyas@unipasby.ac.id

ABSTRACT

Mathematics is a subject with very abstract material, so the existence of learning media is very necessary. The purpose of this research is to develop an educative game card learning media "Mathematics Operation Card (MOC)" aimed at low-grade elementary school students. The development stage was carried out using the ADDIE model which consisted of five stages, namely Analysis, Design, Development, Implementation, and Evaluation. The instruments used in this study were interview guides, observation sheets, student response questionnaires, and learning achievement tests. Based on the results of expert validation and materials as well as limited trials, MOC received a good category that was suitable for use and received positive responses from students. So that MOC can be applied in the process of learning mathematics in class.

Keywords: learning media, ADDIE, development, game cards

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Corresponding Author:
Hanim Faizah,
Department of Mathematics Education,
Universitas PGRI Adi Buana Surabaya,
Jl. Dukuh Menanggal XII-4, Surabaya, Indonesia.
fhanim@unipasby.ac.id

1. INTRODUCTION

Education plays a very important role in the development of the nation and state. Educational reform through curriculum revitalization is needed and must be carried out continuously to create better and quality education (Samsidar, 2018). Changes in the educational paradigm imply the need for repositioning of educators and students in the education and learning process (Baharuddin, 2018). Education must be able to produce human resources who have complete competence, this competence is known as 21st-century competence (Etistika Yuni Wijaya et al., 2016). 21st-century competence provides students with provisions so that they can develop and compete globally and play a role in the real world. Thus, skills in creative thinking, critical thinking, communication, and collaboration are very much needed by teachers and students today (Septikasari & Frasandy, 2018). With these skills, teachers can present learning creatively and can increase student competence to the maximum. Mathematics learning for the majority of students is still considered a scary and difficult subject to learn.

Mathematics is also studied to develop several aspects of ability, including conceptual understanding, problem-solving, reasoning, and mathematical communication (Isnaini Handayani & Afifah Fitria Ramadhani, 2020). The implementation of mathematics learning does not always go well and there are many obstacles faced by educators (Prayitno & Faizah, 2019). Many factors cause mathematics to be considered a difficult subject to learn, namely, the characteristics of mathematics which are abstract, systematic, logical, symbolic, and full of various formulas that confuse students (Faizah et al., 2022). One of the goals of learning mathematics is to learn to communicate (mathematical communication) (Hafifah & Bharata, 2018). Mathematical communication skills are students' abilities to convey mathematical ideas both orally and in writing. In the process of learning and solving mathematical problems, students need to understand the problem, express it in mathematical models, and connect between concepts, so mathematical communication skills are very important for students to have (Utami & Cahyono, 2020). Students'

mathematical communication skills can be developed through the learning process at school, one of which is the mathematics learning process (Hidayat et al., 2020; Ikhtiar et al., 2021). Thus, mathematics has an important role in the development of mathematical communication skills. Thus, innovation is needed in mathematics learning in schools to be able to increase student motivation while improving student learning outcomes.

The higher the student's learning motivation, the higher the mathematics learning outcomes obtained by the students. Various methods and strategies can be used by teachers to make learning more interesting and meaningful. Learning motivation makes a major contribution to student success in learning, especially in integer material (Budiyani et al., 2021). Many methods can be used to increase student motivation, including through videos, image media, games, and others (Febrita & Ulfah, 2019). New variations of methods are needed to teach mathematical concepts, especially to elementary school children, so that they can understand the material provided by educators and make mathematics a fun learning material. One way that can be done is to design learning by inviting students to learn and play at the same time (Setiawan et al., 2020). Play activities can help children improve their aspects in an integrated and comprehensive manner(Hayati & Putro, 2017). Through games, they will be able to devote attention, feelings, and thoughts in the playing process and be able to stimulate aspects of development in children(Salminen et al., 2021). One example is implementing mathematics learning using cards which can be an alternative and very effective for elementary school students (Wulandari et al., 2020).

The learning that has been carried out so far tends to only use picture media in teaching and learning activities carried out by educators. This is considered by students to be a boring activity. Understanding of mathematical concepts can be improved through various relevant educational game media. Srintin et al., (2019) conducted a study on the development of UMINO card game media in Mathematics Learning for Integer Operations which showed that the UMINO game was able to sharpen the brain in calculating and could improve students' learning outcomes. Adawiyah & Kowiyah (2021) also developed Domino game media in Mathematics Learning for Multiplication Operations for Elementary School Students which showed that there was an increase in student motivation in memorizing multiplication operations. Based on research that has been conducted by other researchers, it has been shown that the use of educational game cards is indeed very effective in improving students' abilities to identify and solve mathematical problems (Sari & Juwita, 2021). However, the majority of the development of game card media on number material still has almost the same game concept which is monotonous as in general card games that already exist. So, in this study, the development of an educational game card was carried out which is called the Math Operation Card (MOC).

Math Operation Card (MOC) is a mathematical number operation card consisting of character cards as symbols for each player, operation cards, and number cards. Implementing MOC in learning, especially mathematical number operation material, is expected to increase student motivation through game media and create collaboration between students. Thus, the MOC innovation can make it easier for students to learn and increase motivation in learning mathematical number operation material and can create an active learning environment.

2. RESEARCH METHOD

This research aims to develop a math educational game card "*Math Operation Card* (MOC)" for elementary school students. MOC is expected to help students in understanding the concept of number operations through games. In addition, using MOC game cards is expected to increase students' learning motivation.

The development of this MOC educational game card uses the ADDIE development model which consists of 5 stages, namely, Analysis; Design; Development; Implementation; and Evaluation. Each step of the MOC Educational Game Card development can be explained as follows.

a. Analysis

The analysis stage was carried out using two methods, namely observation and interviews. The analysis stage is carried out to obtain data and information related to learning media needs in the school field, especially at the elementary school level. Where elementary school students are still in the concrete operational cognitive domain.

b. Design

Based on the data obtained at the analysis stage, the appropriate teaching aids were designed. At this design stage, the design of props in the form of MOC cards, the design of playing card techniques, and the packaging design of MOC props were obtained. The researcher also adjusted the props to the basic concepts of number operation material in elementary school.

c. Development

At the Development stage, researchers develop MOC educational game card products in accordance with the design that has been made in the design stage. At this stage also developed validation instruments for material experts and learning media experts, as well as tool trial instruments which include response questionnaires, learning outcomes tests and student activity observation sheets.

d. Implementation

After the MOC educational game card product is produced, then at the implementation stage, expert validation and limited trials are carried out on 20 grade 3 elementary school students. Expert validation is carried out to test the validity of MOC math game cards according to the material and media feasibility according to experts. Expert validation was given to media experts and mathematics material experts. Furthermore, from the validation results, the average of all validators was calculated and then the percentage was calculated using the following formula.

$$p = \frac{R}{n} \times 100\%$$

From the percentage results obtained, they were converted according to the criteria presented in Table 1 below.

Table 1.
Conversion of Textbook Quality Based on Expert Validation Results

Percentage (%)	Qualification	Interpretation
90 - 100	Very good	Very feasible and does not need to be revised
75 - 89	Good	Feasible, but needs minor revisions
65 - 74	Simply	Feasible, but needs major revisions
55 - 64	Less	Not Feasible, but can be used with major revisions
0 - 54	Very Less	Not worth using

While from the limited trial, data on student responses and learning outcomes tests were obtained. Both data will be analyzed quantitatively descriptively to conclude the feasibility of MOC educational game cards.

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e. Evaluation

Based on the data that has been obtained from the implementation stage, further evaluation and revision of MOC educational game cards are carried out in accordance with the results of validation and limited trials, so that MOC educational game cards are ready to be implemented in the classroom.

3. RESULTS AND DISCUSSION

3.1. Research Results

The MOC Educational Game Card development steps can be explained as follows.

a Analysis

In this phase, observations and interviews with teachers in elementary schools were conducted to explore information related to learning media needs. Based on the information obtained, the availability of learning media in schools is still very minimal, both conventional learning media and ICT-based learning media. In low-grade students, learning media is still needed to strengthen the concept of number operations in students. Based on the results of observations and interviews in the field, researchers analyzed teaching materials, and it was found that mathematics materials in the lower grades prioritized the cultivation of number concepts and number operations. So it was decided to make a math learning media that is useful for planting the concept of numbers and number operations. To attract students' attention, the learning media to be developed will focus on the concept of games, namely number operation cards named "*Mathematics operation Card* (MOC)".

b Design

At the design stage, researchers designed the MOC Educational Game Card. The design in question is planning the content contained in the card and designing the shape of the card to be developed. During the design process, researchers always ask for input from teachers at school and appropriate media experts. The MOC Educational Game Card design is as follows.



Card Back Layout Design



Fig 1. One of the Card Front Layout Designs

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c Development

At the development stage, the realization of printing cards that have been designed previously is carried out. At this stage, the rules of the card game are also compiled, so that anyone can use it by reading the rules of the game made. The shape of the developed cards is as follows.



Fig 2. Shape of MOC Educational Game Card

d Implementation

After the cards have been printed and are ready to use, the researchers then conduct product validation and trials. Product validation was carried out by 2 experts, namely media experts and material experts. The media assessment was obtained from the day of validation results. The product trial was carried out in 2 stages, namely the first stage of testing using game cards for 10 students, then a test was carried out with the completion using the product that had been developed and given a student response questionnaire. To find out student interest when using MOC educational game cards. The number of results obtained from the validation of media and material experts is 156, which can be converted into a percentage of 78 and can be categorized in the qualification "Good" so that the media is feasible to use with minor revisions. The revisions made are based on the input provided by the two experts. Material experts provide input on aspects of material relevance and evaluation, while media experts provide input on aspects of design, size, and type of material used. The researcher then adjusted the media design and added card components so that it could be used in the limited trial stage.

Based on the results of the limited trial, it is known that students gave a positive response to the use of learning media, and from the results of student tests it was known that 9 students could answer the questions correctly, while 1 student still made 2 mistakes out of 10 questions given.

e Evaluation

Based on the data that has been obtained at the implementation stage, researchers conduct data processing and conclude the development of educational game card media "MOC". At this stage, it can be concluded that the educational game card learning media "MOC" is feasible to use, and can be used by teachers in the learning process in the classroom on number operation material.

3.2. Discussion

This study aims to develop an educational game card learning media named "*Mathematics Operation Card* (MOC)". This game card was developed based on a needs analysis conducted at MI Hasanuddin Tebel Sidoarjo Elementary School. Observations and interviews were conducted which revealed the need for media that can help teachers teach number operation material in low grades. Based on the development process, it is known that the MOC educational game card learning media is feasible to use and can be implemented in

the classroom during the learning process. The need for learning media is very high because mathematics is an abstract subject. (Andi Rustandi & Rismayanti, 2021). The effectiveness of media on learning is very high in helping to achieve the learning objectives set by the teacher in the classroom. (Nababan, 2020). Learning media can improve learning outcomes, and student activeness, and can provide a positive student response to the material being taught.

4. CONCLUSION

Educational game card learning media named "Mathematics Operation Card (MOC)" has been successfully developed in this study. The learning media was developed using the ADDIE development model which consists of 5 stages, namely Analysis, Design, Development, Implementation, and Evaluation. As for the Analysis stage, a needs analysis and teaching materials were carried out at the school, and information was obtained that there was still a great need for learning media for planting concepts about number material and number operations in low grades. The second stage is Design, at this stage, the layout of the MOC is designed and continued at the Development stage, namely, the learning media that has been designed is made a prototype that is ready to be tested at the Implementation stage. At the implementation stage, validation was carried out by two experts, namely media experts and material experts to validate the developed media, and the results showed that the media was in a good category and was suitable for use with minor revisions. Revisions made based on material experts are on the addition of card components on odd numbers and division operations, while from media experts it is recommended to change the color of the media to be more attractive and the addition of designs that are more suitable for low-grade students so that the appearance of the media becomes more attractive and by the target age of learning media users. From the results of the media revision, a limited trial was conducted and obtained positive responses from students and good test results. Based on the results of validation and trials, it can be concluded that the MOC educational game card learning media is suitable for use in the classroom during the learning process.

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