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# Development of Dartboard Math Learning Media on Large Whole Numbers Material for Class IV Students

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**Abstract**
Learning large whole numbers in elementary schools is generally given abstractly using conventional methods by educators so many students experience difficulty in solving the problems given. This research aims to create learning media that can help students solve several problems related to large whole numbers. The Dartboard Math learning media developed in this research is in the form of a box in which there is a circle board with categories of large whole number values. The method used was the Research and Development (R&D) method using the 4D development model. This research has carried out product trials by 27 class IV students at SDN Jakarta Timur. The result showed that the Dartboard Math media has demonstrated validity in the media aspect and material aspect with the same percentage of 92%, both of which are in the Very Appropriate category. This media has tested the practicality of products with a percentage of 89% falling into the Very Practical category. User respondents produced an average percentage of product attractiveness index of 89%, including the Very Attractive category. Based on these results, it can be seen that the Dartboard Math learning media is valid, practical, and effectively used as a learning media that can help the mathematics learning process in large whole number material.

**Keywords:** dartboard math, large counting numbers, learning media

## INTRODUCTION

Education is the main component in life to build a nation and state. Education in schools can be realized if there is teaching and learning interaction between educators who educate and students who receive education. To produce a superior generation, educators must be able to encourage and monitor each student's development so that they can form characters who have a broad range of thinking in the learning process. In creating a learning situation and process that is balanced with the needs of students, educators must utilize the skills they have so that the learning process can run according to the goals that have been set. The results of the current mathematics learning process are still in the unsatisfactory category because the learning carried out is still conventional with boring methods, namely lectures that only rely on handbooks without using media during the learning process (Batubara & Ariani, 2019) Learning mathematics is quite difficult to understand so most students have a negative view when facing this lesson and ultimately grow bored and lazy in participating in mathematics learning (Safrina et al., 2014). This happens because there are problems with educators who do not have professional skills and knowledge in the world of education (Rahim et al., 2023). Mathematics learning in elementary schools in the development of process skills and scientific attitudes of students must be given the direct understanding that is adapted to the actual conditions of the surrounding environment through inquiry activities. Providing mathematical processing skills to elementary school-age children must be changed to be simpler and adapted to the stages of cognitive development. Mathematics learning can be said to be meaningful if it is characterized by the cognition that students need to carry out and understand what students need to interpret regarding concepts, reality, relationships, and mathematical thinking procedures.

Learning large whole numbers in elementary schools is generally given abstractly, so many students have difficulty solving the problems given regarding large whole numbers. Large whole numbers are whole numbers whose value is greater than tens of millions, namely hundreds of millions, billions, trillions, up to quadrillions. Each digit in large whole numbers has its value according to the number layout (place value). When studying, students are often faced with problems that must be solved, especially in mathematics. It is necessary to use formulas that must be used carefully, regularly, and precisely. So most students think that with the formula given, students only need to memorize it. Even though mathematics is not a matter of memorization but rather reasoning and understanding, As a result, if given a problem, students often experience difficulty in completing it. The arithmetic operation in the form of the addition of large whole numbers is a basic arithmetic operation that needs to be mastered by students in elementary school, especially in class IV, but there are still errors in solving it. The problem that is often encountered during the teaching and learning process is that educators still do not maximize the use of learning media that has been adapted to what is needed and what the characteristics of the students are during the teaching and learning process, resulting in feelings of boredom and laziness in learning (Wibowo, 2016).

Therefore, during the learning process, educators are required to be more skilled in the classroom during the implementation of learning. To make the learning process feel more meaningful, educators can use and package interesting learning media, so that they can change students' negative views of mathematics lesson. One of the important facilities that needs to be used in the learning process is learning media that is interesting and can make students more active so as to create a comfortable and conducive learning atmosphere (Widaningsih et al., 2023). Learning media are all forms of communication tools that can be used to convey information in a structured manner to students in order to create a conducive learning environment, so that students can participate in learning

effectively and efficiently. Learning media is used as a learning tool to improve the quality of education. Learning packaged in the form of learning media makes students have an active role, and provides their own challenges, gets inspiration, is motivated to be creative and integrate among students (Shafira et al., 2018). It can be concluded that learning media is anything that can be used during the teaching and learning process by delivering learning material using a tool that can attract students' attention during the learning process. Learning is a process of interaction between educators and students, as well as with the learning resources and media used in an effort to change cognitive, affective and psychomotor aspects. Therefore, meaningful learning requires support from learning media to fulfill the delivery of the material studied. Learning media is defined as a tool that can attract students' attention to convey material during the learning process (Prawito et al., 2020).

To get good interaction during the learning process, students must be given an active role and be involved in every learning activity provided by the educator. (Setyorini, 2022) stated that educators are required to be more creative and innovative in developing and using learning media to achieve a pleasant teaching and learning process. The Dartboard Math learning media developed in this research is in the form of a box and inside it, there is a circle board with large whole number value categories. Meanwhile, the arrow uses a toy gun to find the value of large whole numbers listed on the circle board. The Dartboard Math Learning Media developed is a learning media that can train students in cognitive aspects, psychomotor aspects, and affective aspects. *Darts* is an activity that uses a bow and arrows which are shot at an Archery Board. The advantages of Dartboard Math learning media include (1) using an attractive design to trigger students' attention; (2) can be adjusted to the characteristics of students; (3) can be adapted to various subjects; (4) equipped with supporting components that help make it easier for educators and students to operate. Meanwhile, the shortcomings of Dartboard Math media include (1) the use of Dartboard Math media is still limited; (2) this media is still rarely used in schools (Sukriyah, 2018).

By implementing Dartboard Math learning media in the classroom, students will be helped to understand the concept of large whole number material in a fun way to eliminate negative perceptions, so that students can increase their learning activities in in class. Dartboard Math media can also increase the professionalism of educators in designing creative and innovative learning, especially in mathematics subjects involving large whole numbers. The material on large whole numbers is basic material that must be mastered by elementary school level students, but in reality, there are still errors in writing, reading, and operating large whole numbers up to middle and even high school levels. This error is caused by a lack of understanding of the concepts in the large whole-number material provided by educators. The statement by (Wahab et al., 2021) explains something abstract in nature, educators need learning media to explain the material to manage time as best as possible in conveying an understanding of concepts to students. Learning large whole numbers in elementary schools is generally given abstractly, so that in solving problems given regarding large whole numbers students experience more difficulties. Therefore, researchers will develop Dartboard Math learning media for large whole number mathematics subjects using a wooden box complete with question cards and a guidebook for using the media. This research will produce a Dartboard Math learning media package that contains a large whole number board that is valid, practical, and effective for honing students' abilities in solving the large whole number problems given.

## METHOD

The method applied was the research and development method. Research and development aims to demonstrate a product and then test its effectiveness (Sugiyono, 2019). The results of the development become the basis for developing the product that will be created. In this research and development, researchers used the 4D development method. 4D development consists of 4 important phases, namely (1) Define; (2) Design; (3) Develop; and (4) Disseminate. Researchers used observation and questionnaire data collection techniques to collect research data. The types of data obtained during the development of Dartboard Math learning media are quantitative data and qualitative data. Quantitative data is data generated through validation tables and user response tables. Meanwhile, qualitative data is generated through validator reviews and user responses.

Validation was carried out by providing learning media devices in the form of Dartboard Math learning media on large whole number material to find out what the advantages and disadvantages of the media being developed were. The product validation test stage uses a rating scale instrument given to the validator along with the learning media products that have been developed. Validators consist of media experts and material experts. Media experts consist of 2 teaching media lecturers at Muhammadiyah University, Prof. Dr. HAMKA. The material expert consists of 1 lecturer in mathematics education at Muhammadiyah University, Prof. Dr. HAMKA. A product can be said to be ready for testing if the results from the three validators state that the media is suitable for testing. Product practicality trials are made for educators who master and know the characteristics of each student in daily teaching and learning activities before being tested by students. The product implementation was tested on 27 students as research samples in class IV of SDN Jakarta Timur.

The data collection and selection technique in this research is in the form of a questionnaire as a tool to measure the quality of the media and the suitability of the media being developed. This research questionnaire instrument was taken from media experts, material experts, educators, and students. In preparing questionnaires and questionnaires, 4-score Likert scale data was used. Qualitative data analysis techniques are provided in the form of suggestions and input from media experts, material experts, and educators. Qualitative data from media experts, material experts, and educators regarding Dartboard Math learning media will be converted into quantitative values in the form of product quality data. If you have obtained validation results and responses, carry out descriptive percentage analysis techniques. The formula used to calculate the percentage of results from completing the questionnaire is:

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

with P = questionnaire percentage, $f$ = frequency of respondents, and N = number of respondents (Jumi et al., 2018).

Table 1. Questionnaire Assessment Criteria

| Category | Value Weight |
|---|---|
| Strongly Agree (SA) | 4 |
| Agree (A) | 3 |
| Disagree (D) | 2 |
| Strongly Disagree (SD) | 1 |

Source: (Mulyatiningsih, 2011)

Table 2. Product Feasibility Scale

| Achievement Rate % | Category |
|---|---|
| ≥80 | Very Worth It |
| 66-80 | Worthy |
| 56-65 | Not Worth It |
| ≤56 | Not feasible |

Source: Mulyatiningsih (2011)

The results of the student response sheet are in the form of qualitative data which will describe students' responses after using the Dartboard Math learning media in learning. The hypothesis of this research is the creation of valid, practical, and effective learning media. A media is said to be valid if the verification results of media experts and material experts are ≥76% (or at least in the Very Appropriate category). Media is considered practical if the results of educators' trials on product usability show ≥76% (or at least in the Very Practical category) and if the results of the recapitulation of students' responses to product use show that the media is ≥76% effective (or at least in the Very Interesting category).

## FINDINGS AND DISCUSSION

### Findings

The development of Dartboard Math learning media on large whole number material will be tested on class IV students at SDN Jakarta Timur. The following is a description of the development process based on the 4D stages.

**1. Define**

The observations that were carried out were during the Introduction to Schooling Fields (PLP) 2 which was carried out at SDN Jakarta Timur, by observing the classroom atmosphere, the learning media used for learning activities, and the readiness of the learning tools used by students in the classroom. Observation results stated that most students were not interested in the mathematics learning atmosphere, because educators still used conventional methods in their learning. The analysis carried out was in the form of students' responses in participating in mathematics learning in class. Mathematics learning carried out conventionally tends to produce a passive response. Based on this analysis, it can be seen what needs to be developed and what learning media specifications need to be developed. One type of learning media that can increase students' learning activities and make them actively involved in learning mathematics is the use of Dartboard Math learning media on large whole number material.

**2. Design**

In general, Dartboard's original colors are only black and white. This Math dartboard has been modified with pink, yellow, green, red, blue, and black to make it look more attractive. Each color on the arrow board (Board) has its place value, this is made to differentiate the results of bullet shots made by students in determining the place value obtained. The numbers 0-9 on the outer circle can also be changed with a whiteboard marker because they are coated with acrylic. This is made to provide different positions of the numbers for each group that shoots their darts so that the results obtained by each group can vary. Dartboard Math media ensures that the problem-solving process occurs in each colored section. The color pink has a place value "Trillions", yellow has a place value "Billions", green has a place value "Millions", red has a place value "Thousands", blue has a place value "Units", and black has no place value but there is question card as "BOM". On the outermost part, there are numbers 1-9 as place value numbers.

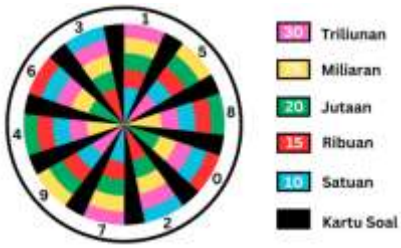


Figure 1. Math Dartboard Design and Place Value of Numbers

In contrast to Dartboard, which mostly uses a sharp-shaped throwing tool (*Dart*), the learning media developed is modified by using a toy gun with harmless bullets made from *Styrofoam*. This toy gun functions as a tool for determining numbers and place values which will be questions for students to solve.

Figure 2. Shots and Bullets (Darts)

The "BOM" question card design is black with each card having a score in the upper right corner that varies depending on the level of complexity. If students can solve the questions listed on the card, their scores will increase. Vice versa, if students cannot answer the questions listed on the card, the score will be reduced. The letters of the alphabet located in the bottom left corner of the card are used as a grid of questions to make it easier for educators to find answers.

Front look Back view


Figure 3. “BOM” Question Card

The Dartboard Math learning media box contains complete game components along with a user manual. This user manual also contains (1) an understanding of large whole number material, (2) examples of LKPD, instructions for use, (3) game steps, and (4) a grid of "BOM" question cards.

Front look Back view

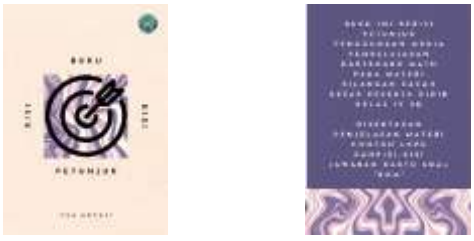

Figure 4. Instructions for Using Dartboard Media

The design of the Dartboard Math learning media pays attention to the practical aspect of storage, one of which is packaging a media package in a box. The packaging for Dartboard Math learning media is made from durable materials, namely wood-based so that it can be used for a long period, so it is designed in such a way as to produce practical media.

Figure 5. Dartboard Math Media Packaging

**3. Develop**

Dartboard Math Learning Media at this stage needs to be validated and tested for feasibility. The media expert validators consisted of 2 learning media lecturers at Muhammadiyah University, Prof. Dr. HAMKA. Media experts provided suggestions and input on the Dartboard Math media being developed, as shown in Table 3.

Table 3. Media Expert Validation

| Aspect Evaluation | Percentage (% | | Category |
|---|---|---|---|
| | Media Expert 1 | Media Expert 2 | |
| Aspect Utility | 88% | 88% | Very Worthy |
| Aspect Function | 100% | 100% | Very Worthy |
| Aspect Appearance | 83% | 92% | Very Worthy |
| Average | 92% | | Very Worthy |

The material expert validator consists of 1 mathematics lecturer at Muhammadiyah University, Prof. Dr. HAMKA. The results of the material assessment can be seen in Table 4.

Table 4. Material Expert Validation

| Aspect Evaluation | Percentage (% | Category |
|---|---|---|
| Aspect Content Eligibility | 89% | Very Worthy |
| Aspect Appropriateness Media Presentation | 95% | Very Worthy |
| Average | 92% | Very Worthy |

The practicality trial of the Dartboard Math learning media product was tested by the fourth-grade homeroom teacher before it was used in class for learning. Product practicality trials are made for homeroom teachers who master and know the characteristics of each student in daily teaching and learning activities before being tested by the students. The results of the product practicality assessment can be seen in Table 5.

Table 5. Product Practicality Testing

| **Aspect Evaluation** | **Percentage (%** | **Category** |
|---|---|---|
| Aspect Appearance | 96% | Very Practical |
| Content Aspect | 88% | Very Practical |
| Aspect Media Use | 83% | Very Practical |
| **Average** | **89%** | **Very Practical** |

**4. Disseminate**

Dartboard Math learning media was implemented to SDN Jakarta Timur Elementary School students in class IV, totaling 27 people, to spread the benefits of the product being developed related to the attractiveness of the Dartboard Math learning media used, understanding of the material presented, and suitability of the application of the illustrations used, as well as to ensure whether Dartboard Math learning media that has been validated, evaluated and revised can be applied in the mathematics learning process regarding large whole numbers.

Table 6. Recapitulation of Student Responses

| Indicator | Information (% | | | |
|---|---|---|---|---|
| | SA | A | D | SD |
| Media Attraction | 0% | 0% | 18% | 82% |
| Convenience Usage | 0% | 18% | 62% | 21% |
| Convenience Understanding Guide | 0% | 9% | 37% | 54% |
| Brightness Color | 0% | 0% | 21% | 79% |
| Clarity Letters and Figures | 0% | 0% | 52% | 48% |
| Convenience Language Comprehension | 0% | 9% | 33% | 58% |
| Attraction Against the Media | 0% | 2% | 42% | 56% |
| Involvement Participant Educate | 0% | 11% | 13% | 77% |
| Convenience Processing Question | 0% | 8% | 13% | 79% |
| Average Percentage | 86% | | | |
| Category | Very Interesting | | | |

**Discussion**

In Table 3, the recapitulation of media expert validation results, and Table 4, material expert validation, each obtained the same results, namely 92%, both of which are in the Very Appropriate category and do not need to be revised. These results have reached the validity indicator, so it can be decided that the Dartboard Math learning media is valid to use. In Table 3, it can be seen that the usability aspect, function aspect, and appearance aspect are all included in the Very Appropriate category. In the usability aspect, media experts 1 and 2 showed the same assessment percentage of 88% because the Dartboard Math learning media was considered to be easy, safe, and efficient to use. In the functional aspect, both media experts showed the same assessment percentage of 100% because the Dartboard Math learning media was considered to function well. In the appearance aspect, the two media experts showed a consecutive assessment percentage of 83% and 92% because the Dartboard Math learning media was considered to have very good quality, and the design and color choice were also attractive. By paying attention to these three aspects, it is appropriate to develop a Dartboard Math learning media package to help students during the learning process. This is in line with one of the criteria for determining learning media according to (Khairunnisa et al., 2019) namely that the media must be practical, adaptive, and of good quality. The material validator assessed that the content feasibility aspect and the media presentation feasibility aspect included the indicators in the Large Numbers material which can be seen in Table 4. In the content feasibility aspect, the material expert showed an assessment percentage of 89% because it was assessed from the questions listed on various "BOM" question cards. In the aspect of the appropriateness of media presentation, material experts showed an assessment

percentage of 95% because they were assessed on how to obtain large whole number values and then operate them. Supported by the statement of (Achmad et al., 2021) that abstract material such as large whole number values can be easily understood because it uses concrete media such as Dartboard Math. Apart from validation, the media was also tested on product practicality by the class teacher to test the three aspects in Table 5, namely the appearance aspect, content aspect, and media use aspect. This trial showed an assessment percentage of 89% which was also included in the Very Practical category. In the appearance aspect, educators showed an assessment percentage of 96% because they were assessed on the uniqueness of the media design, the attractiveness of the colors, and the clarity of the appropriate material. In the content aspect, educators show an assessment percentage of 88% because they are assessed based on the suitability of the media to the material being developed. In the aspect of media use, educators showed an assessment percentage of 83% because they were assessed for the security, convenience, and durability of the Dartboard Math learning media. Paying attention to these aspects can help educators explain abstract mathematics subjects so that they can be visualized in the form of the developed Dartboard Math learning media. This is by the aim of using learning media according to (Winda, 2014) the importance of maintaining content harmony with the presentation of the process, as well as increasing efficiency to facilitate the continuity of teaching and learning.

Interpretation of students' responses to Dartboard Math Learning Media in Large Whole Numbers material in class IV in Table 6 obtained a percentage of 86% which was included in the Very Interesting category. There were no students who responded that the Dartboard Math learning media was not attractive, the colors used were not bright, and the letters and numbers were not clear. There were 18% of media responses that it was not easy to use because most female students were less skilled in using toy guns. In succession, there were 9% of responses that were not easy to understand the guidance given, 9% of responses were not easy to understand the language given, 2% of responses were not interested in media, 11% of responses were not involved in learning, and 8% of responses were not easy to do the questions given. The difficulties felt by some students are because they are not used to using learning media in the teaching and learning process, so as stated by (Sumarsih, 2016) not using learning media can be an obstacle in the learning process. However, other student responses were dominant, most of them in succession, 37% responded that it was easy for students and 54% very easy to understand the guidance given, 33% responded that students were easy and 58% very easy to understand the language used, 42% responded that the students were interested and 56% were very interested in the Dartboard Math learning media, 13% responded that the students were involved and 77% were very involved in the learning process, and 13% responded that the students were easy and 79% were very easy in working on the questions given. The solution to the existing problem is to use learning media that is adapted to what is needed so that it can attract the attention of students. In line with (Azmi, 2015) statement that media can be said to be a complement to learning.

Several previous studies also developed Dartboard learning media as a tool in the learning process. There are several similarities and differences in previous research but obtained similar results. Research conducted by (Sutraningsi et al., 2021), with the title "Development of Dartboard Bio Learning Media on Digestive System Material". This research uses the 4D development model. The difference with this research is only in the choice of subjects used, namely Biology. The research that has been carried out strengthens previous research, that the Dartboard learning media has met the criteria of being valid, practical, and effective to be applied in any field and any class. The second and third research, conducted by (Kurniawati & Bekti, 2020) with the title "Development of Dartboard Learning Media on Flat Building Material" and research conducted by

(Siamti, 2020) with the title "Development of Dartboard Figures Proclaimer of Indonesian Independence to Improve Understanding of Class 5 Students at Caturtunggal 1 Elementary School. Sequentially, it has similarities with this research, namely that they both use the same development model, namely 4D, but the limitation of this research is that it only reaches the development stage and has not yet been disseminated. This is different from this research which has carried out all stages. The results of this research respectively obtained an average of 3.83 and 3.90 which states that the criteria are very valid and very feasible. So from these two studies, the research that has been carried out can complement previous research that Dartboard learning media, which has been tested for validity at the development stage, when entering the distribution stage, has a positive impact and is very helpful in the learning process for educators and students. Based on the results of the three previous studies, it can be stated that using the Dartboard media that has been developed can make it easier for students to understand learning, even though the material and classes are different, the results still show the same, namely satisfactory.

## CONCLUSION

Based on the research results, after media and material validation tests were carried out, and it was declared feasible, a valid learning media was created for potential users, namely Dartboard Math learning media. Before the Dartboard Math learning media developed was used by prospective users or students, the class teacher had tested its practicality first and stated that this media was very practical because it was easy to use and store. After it is stated that this media is valid and practical, then this Dartboard Math learning media can be used by students in the learning process. After being implemented in schools, students gave a positive response to the Dartboard Math learning media that was developed, so researchers have succeeded in creating a learning atmosphere and conditions that are more enjoyable and make it easier for students to understand and master the large whole number material presented so that learning becomes effective. Based on these results, it can be seen that the Dartboard Math learning media is valid, practical, and effective as a learning media that can support the mathematics learning process in large whole number material.

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