

# Math BRAINO – Mathematics Braille Dominos for Visually Disabled Students

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**Abstract.** This research is categorized as Research and Development (R&D) as developed in this research is a learning media Math BRAINO, a Mathematics Braille Dominos for visually disabled students. This research adopted ADDIE as an R&D model that stands for Analysis, Design, Development, Implementation, and Evaluation. The purpose of this study was to describe the development process and to produce mathematics learning media for visually disabled students, as well as to determine the effectiveness of the Math BRAINO – Mathematics Braille Dominos. To determine its practicability and effectiveness, it requires validation from the experts and a trial. Based on the data analysis result, it can be concluded that the product, Math BRAINO, are valid, reaching 94,1% with the category of excellent for the learning media. The reviewer of media mentioned that by the aspect of physical and look, including size, material, durability, quality, and color, the product reaches 96% with the category of very good. From the viewpoint of its practicality and simplicity to use, the product developed is categorized as great in the score of 96%. While based on the Braille handwriting aspect, it reaches 80%, belonging to the category of good. Meanwhile, according to the mathematics content, the product falls into the score of 78,3 % with the category of good.

**Keywords:** *braille dominos, mathematics, learning media, visually disabled.*

## INTRODUCTION

Special need children are children with special characteristics which is different from others in general, that is not always shown in the inability of mental, emotional, or physical [1]. There are four major types of special need children: (1) Sensory Impaired such as blind, visually impaired, deaf, and limited hearing; (2) Behavioral / Emotional like ADD, bipolar, and oppositional defiance disorder; (3) Developmental, for example down syndrome, autism, dyslexia, and processing disorder; and (4) Physical for instance muscular dystrophy, multiple sclerosis, chronic asthma, etc [2]. Visually impaired/disabled children are children who experience obstacles in their eyesight that cause them to experience problems in daily activities, one of

which is learning [3],[4]. It can be concluded that the visually disabled child is a child who has lost some or all of his vision, which causes him to have barriers to his learning and thus requires special education.

Lowenfeld in [5] said that loss of vision results in three serious limitations, they are: 1) cognition; 2) orientation and mobility, and 3) social and emotional. Visually disabled children face low cognition due to lack of information and left behind in the quantity of information which is obtained through the senses of vision. In this case, the ability to process the information often ends in a fragmented sense and deviates from a simple concept. Therefore, visually disabled children experience limited visual information that affects a low understanding of concepts. This is in line with Hadi's point of view [6] which states that visually disabled children have difficulty in assimilation and accommodation at the pre-concept stage caused by limited environmental experience, difficulty in direct connection with objects, touch perceptions, and limited opportunities to expand language skills due to their basic experience.

Due to their limitation, visually disabled children find it difficult in learning visual materials. Moreover, understanding of the elusive symbols without using visuals is also a barrier for them in learning [7]. Mathematics become one of the subjects that are difficult to learn by visually disabled children because there are many mathematical symbols [8]. It also affects the difficulty in performing arithmetic operations which exist in mathematics subjects. Since it is useful for everyday life activities such as in the sale, purchase, measurement, and other activities, Mathematics become one of the important subjects to be learned by children. To play a role in society, visually disabled children need to understand the basics of mathematics [9]. Therefore, visually disabled children need help to overcome these obstacles so that children can learn independently [10],[11]. One solution to overcome this problem is by utilizing the development of mathematics learning media.

Based on the description above, the researcher was interested in conducting R&D research to develop Math BRAINO – Mathematics Braille Dominos for visually disabled students. This research aimed to develop a proper (valid, practical, and effective) mathematics learning media, Math BRAINO, and to find out the effectiveness of that learning media toward students' ability in solving basic mathematics operation (addition and subtraction).

**METHOD**

This research was conducted in Elementary Special School for visually disabled students, namely SDLB Pembina Tingkat Nasional, which is located at Jln. Pertanian Raya No. 12 RT.06/RW.04 Lebak Bulus, Cilandak, Jakarta Selatan. The type of this research is Research and Development (R&D) which is used to produce a particular product or develop the existing product as well as to test the effectiveness of the product. ADDIE that stands for Analysis, Design, Development, Implementation, and Evaluation was adopted as an R&D model to develop the Math BRAINO in this research. The development stages of the product, Math BRAINO, are as follows:

*Table 1.* The Math BRAINO Developmental Stages

Development Stage	Description
Analysis	It means conducting a needs analysis and identifying problems (needs) of the visually disabled students. In the activity of a needs analysis, an analysis is performed of the syllabus which includes Competence Standard and Basic Competence, characteristics of visually disabled students, teaching materials' media that have been used to obtain information about media needed by learners in learning the competencies that have been programmed.
Design	This is accomplished by arranging opaque media. Media development is initiated by compiling opaque media. The resulting media is expressed as opaque until the completion of the validation and testing. The design phase is the first step in making the learning media, and everything that will be required must be prepared, among other things: the creation of the design, etc.
Development	At this stage, the product was developed. The results of this phase is a product in the form of Math Braille Dominos that has been structured by the standards of the competence, basic competence, and indicator where the three were already contained in any description of the matter. In this development phase, the Math BRAINO cards is made according to the needs of the stage of development that has been designed, such as: the material, Braille typing, and coloring. Finally, at the end of this phase, the product was validated by the experts.
Implementation	This phase was conducted to determine the conformity/ validity of the media with the subject matter. The media that has been validated by the experts were given to the students, and they were asked to give their response about the media.
Evaluation	This phase is to determine the success of learning media developed whether or not it is in accordance with the original expectations. Evaluation aims to make improvements to the learning media that have been developed.

Data were collected through three aspects in which each aspect is used to make sure that the media developed meets the criteria of validity, practicality, and effectiveness. (1) Validation; to get the data about expert validation, the validation sheet was used in this research. The validation sheet of the learning media by the expert aims to determine the extent of the validity of the developed learning media, Math BRAINO. In this sheet, researchers use a scale of 5 (Very Good), 4 (Good), 3 (Fair), 2 (Poor), and 1 (Very Poor). The validation sheet for the media expert contains aspects of physical and look, terms of practical and simplicity, and terms of Braille handwriting. Next, the assessment sheet by the material and learning expert contains the aspects of the content. (2) Observation; the observation is conducted to see the implementation of the media Math BRAINO for visually disabled students. Moreover, (3) Students' response; questionnaires were used in this research to obtain student responses. The student response questionnaire is aimed to find out the students' point of view about the Math BRAINO, Mathematics Braille Dominos. The questionnaire is prepared with five alternative answers "VG" to Very Good, "G" to Good, "F" for Fair, "P" for Poor, and "VP" to Very Poor.

**RESULT**

This research is an R & D research which is aimed to describe the process and result of developing a proper (valid, practical, and effective) mathematics learning

media Math BRAINO for the topic of addition and subtraction for visually disabled student grade III developed by using the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. The process of developing the Math BRAINO and its result is described as follows:

The first stage is Analysis. The development of this media begins with analyzing the characteristics of students, curriculum, and learning tools. As a result, the visually disabled students need mathematics learning media to help them understand the materials, one of which is basic operation such as addition and subtraction. The results of the analysis were used to design a draft of the media that would be used as a guide to develop the media.

The second stage is the Design. In this stage, the product Math BRAINO was sketched and designed. The content that will be discussed in this media are limited to the addition and subtraction operation, and the number used is not more than 30. The important things that should be noted are that the problem and solution in the Braille dominos card should not be a one-to-one function. For each problem, there will be at least four possible solution cards, so that the game will not be stuck. The layout of the packaging box of this media was also designed in this stage.

The next stage is Development. The Math BRAINO product was made of 310 grams of glossy paper. Its measurement is 10 × 3 cm with rounded cutting at its right side. There is a thick vertical line in the middle of the card to divide between the problem and the solution. All of the texts and symbols in these cards are written in Braille handwriting using reglet and stillus (a tool to write Braille). The preliminary product was then validated by experts. Based on the result of testing the product by experts, the product, Math BRAINO, is valid and can be further tested to assess their feasibility in the learning process. That learning media is considered to be valid because of the score of 94,1% with the category of excellent for the learning media. Through the data obtained, it can be interpreted that the reviewer of media mentioned that the aspect of physical and look including size, material, durability, quality, and color, the product reaches 96% with the category of very good or excellent. From the viewpoint of its practicality and simplicity to use, the product developed is categorized as great in the score of 96%. While based on the Braille handwriting aspect, it reaches 80%, belonging to the category of good. Meanwhile, according to the mathematics content, the product falls into the score 78,3 % with the category of good. After obtaining the validation results and suggestions from experts, researchers revise the device according to expert advice. Next, the device was piloted in the test class.

Once tested, the learning media was revised in accordance with the evaluation results after the prototype trial process. Then, the learning media was implemented in the class, which in this case was in class III SDLB Pembina Tingkat Nasional.

Considering the suggestions from the experts and response from the students, the learning media developed needs to be revised slightly in order to be judged worthy of being used in the field. Based on the analysis of qualitative data in the form of advice, there are some parts that need to be revised. The revision was carried out in the Braille text that has some typography, and the text on the media, which is difficult to read by the low vision students.

#### CONCLUSION

Based on the result of testing the product by experts, the product, Math BRAINO, is considered valid and can be tested to assess their feasibility in the learning process. That learning media was considered to be valid because of the score of 94,1% with the category of excellent for the learning media. Through the data obtained, it can be interpreted that by the aspect of physical and look including size, material, durability, quality, and color, the product reaches 96% with the category of very good. From the viewpoint of its practicality and simplicity of use, the product developed was categorized as great in the score of 96%. While based on the Braille handwriting aspect, it reaches 80%, belonging to the category of good. Meanwhile, according to the mathematics content, the product falls into the score of 78,3 %, with the category of good.

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