BRAINO – Braille Domino (*Fraction Series*) as Learning Media for Visually Disabled Students

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ABSTRACT

The background of this research is limitations of mathematics learning media for visually disabled students, especially in fraction basic operations. The purpose of this study was to develop learning media Braille Domino (BRANO) fraction series. This research was conducted at SLB A Pembina Jakarta National with two students of class VII A and four students of class VIII A as the research subjects. This research used research and development model or commonly called Research and Development (R&D) with the stages of ADDIE development (Analysis, Design, Development, Implementation, Evaluation). The research instruments used were questionnaires and interviews. The questionnaire consists of a media validation questionnaire and a material validation questionnaire which used to determine validity of the product, as well as a teacher response questionnaire to determine practicality. The interviews consisted of interviewing student responses which were also used to find out practicality. The results showed that BRAINO media in the fraction series was declared very valid with an average score of 4.52 for media experts and an average score of 4.41 for material experts. The results of student responses in the 1st stage trial obtained an average score of 3.72 in the practical category, while the teacher's response obtained an average score of 4.50 in the very practical category. The results of student responses in the 2nd stage obtained an average score of 4.66 in the very practical category and for teacher responses obtained an average score of 5 in the very practical category. Thus it can be concluded that the learning media Braille Domino (BRAINO) fraction series for blind students is declared valid and practical to use. The results of this study are expected to be useful for related parties such as teachers, blind students and future researchers.

Keywords: Braille Domino, Learning Media, Visually Disabled Students, Fraction

INTRODUCTION

Playing is an activity that children really like. The fun and challenging characteristic are one of the factors that make games liked by all ages, especially children. Along with the times, many teachers have used games as an alternative in the field of education, such as combining learning media and games with the hope that the learning process will be fun, enjoyable and not boring. Learning media is an important component that used as a tool to achieve learning goals. Innovative learning media can have a positive impact on both students and teachers, one of which is increasing student involvement in learning (Andrijati, 2014). Learning media are designed according to the learning objectives and competencies to be achieved.

In learning mathematics, the use of learning media is familiar. However, the mathematics learning media is basically more focused and intended for ordinary students, even though students with special needs also need mathematics learning media. Children with special needs are children who have limitations or special characteristics that are different from others. One category of children with special needs is the blind or visually disabled. A person

is said to be blind if he/she has limitations in his vision, so he/she receives information using other senses such as the sense of touch. The limitations they have may affect their daily activities, one of which is learning. However, this is certainly not to be as a barrier for someone to continue learning.

The prior observations at SMPLB A Pembina Jakarta show that the teachers use conventional teaching models in learning process due to the limitations of learning media for blind students, especially in mathematics subject. The conventional teaching model applied by the teacher makes learning less effective because the teacher give the material and the also question by reading them aloud and the students pay attention on it, however sometimes students forget what the questions is and then ask the teacher to repeat it. This resulting a lot of wasted learning time so that the questions given are limit, only two questions or even one. Whereas in learning mathematics the practice of questions is an important thing because the more you practice and the more accustomed students are to working on questions, it makes it easier for students to understand the material being taught.

This research is also based on previous research conducted by Ismah, Muthmainnah and Damayanti (2019) regarding "Math BRAINO - Mathematics Braille Dominos for Visually Disabled Students". The results of this study indicate that Braille Domino is said to be valid and superior to be used as a learning medium by obtaining a presentation of 94.1%. Domino Braille made in the research of Ismah, Muthmainnah and Damayanti (2019) is a development of research conducted by Nurajab (2016). The Braille Domino developed from these two studies is intended for blind students in the total blind category. Therefore this research was conducted to redevelop Braille Domino as a valid and practical mathematics learning media that has different forms and variations and is aimed at blind students with total blind and low vision categories who focus on ordinary fraction operations.

RESEARCH METHOD

This research was conducted at SMPLB A Pembina Jakarta National Level, with research time from February to March. The research subjects were blind students with total blind and low vision categories who had received learning operations on ordinary fractions. The subjects were 2 students in class VII A (1 totally blind person and 1 low vision person) and 4 students in class VIII A (3 totally blind person and 1 low vision person).

This research uses a research and development model or Research and Development level 3. Research and development at level 3 is researching and testing to develop existing products by perfecting existing products both in terms of form and function (Sugiyono, 2017). The stages used are ADDIE (Analyze, Design, Development, Implementation, and Evaluation).

The analyze phase is used to carry out needs analysis, curriculum and analysis of student characteristics. The design phase is used to design learning media for Braille Domino series of ordinary fraction operations. The development stage is used to validate media and materials from Braille Domino by experts to determine the validity of the media. The implementation stage was carried out to try out the media, the tryout was divided into two, namely the first trial and the second trial and asked students and teachers' responses to the media in order to find out the practicality of the media. The final stage, namely evaluation, is used to revise the media based on the suggestions and opinions that have been given.

Data collection techniques in this study are using questionnaires and interviews. The questionnaire used was a media expert validation questionnaire and a material expert validation questionnaire used to determine the validity of the media, as well as a teacher response questionnaire used to ask for responses regarding Braille Domino as learning media, while for student responses it was carried out by conducting interviews with blind students. Teacher and student responses are used to determine the level of practicality of the learning media Braille

Domino (fraction series) based on the practicality indicator which measures the ease and interest level given by students and teachers (Nieveen in Rochmad, 2012). The Guidelines of Media Validation Questionnaire Instrument as follows

Table 1. The Guidelines of Media Validation Questionnaire Instrument

Aspect	Indicator	Questionnaire Item
Graphic and Feasibility	Size	1
	Cover Design	2, 3, 4, 5, 6, 7, 8, 9, 10
	Content Design	11, 12, 13, 14, 15, 16, 17
Aspects of Language Feasibility	Compatible with Student Development	18
	Legibility	19
	Motivate Students	20, 21
	Directness	22, 23
	Conformity to the rules of the Indonesian Language	24
	The use of Mathematical Symbols	25

Source: Djuandji (2014:BSNP) which has been modified

Table 2. The Guidelines of Content Validation Questionnaire Instrument

Aspect	Indicator	Questionnaire Item
Aspects of Content Eligibility	Coverage of Learning Materials	1, 2, 3
	Material Accuracy	4, 5, 6, 7
	Coverage of Students Skill	8
Aspects of Presentation Component	Presentation	9, 10
Aspects of Language Feasibility	Compatible with Student Development	11
	Legibility	12
	Motivate Students	13, 14
	Directness	15, 16
	Conformity to the rules of the Indonesian Language	17
	The use of Mathematical Symbols	18

Source : Djuandji (2014:BSNP) which has been modified

Table 3. The Guidelines of Teacher Response Questionnaire Instrument

Indicator	Questionnaire Item
Coverage of Learning Materials	1, 2
Compatible with Student Development	3, 4
Conformity to the rules of the Indonesian Language	5
The use of Mathematical Symbols	6
Characteristics of Media	7
Quality of Media	8

Source : Purwono (2008:BSNP) dan Rusdi (2018) which has been modified

Table 4. The Guidelines of Student Response Interview Instrument

Indicator	Questionnaire Item
Content	1,2
Language	3, 4, 5, 6, 7, 8
Interest	9, 10, 11, 12, 13, 14

Source : Purwono (2008:BSNP) dan Rusdi (2018) which has been modified

The analysis techniques in this study were divided into two, namely qualitative data analysis and quantitative data analysis. Analysis of the validity and practicality of the media using ideal assessment criteria.

Table 5. Ideal Assessment Criteria

Score Average Interval	Category
$\bar{x} > Mi + 1.8\,SBi$	Excellent
$Mi + 0.6SBi < \bar{x} \leq Mi + 1.8\,SBi$	Good
$Mi - 0.6\,SBi < \bar{x} \leq Mi - 0.6\,SBi$	Average
$Mi - 1.8\,SBi < \bar{x} \leq Mi - 0.6\,SBi$	Poor
$\bar{x} \leq Mi - 1.8\,SBi$	Very Poor

Source : Widyoko in Indriyanti dan Wijaya (2016)

RESULT AND DISCUSSION

Needs analysis is divided into two, namely analysis of prior products and analysis of student needs. The prior Braille Domino product requires an update in some aspect: (1) in terms of card shape, the product being developed must be able to make it easier for students to know the position of questions and answers to make it easier for students to stack the cards; (2) in terms of cards text, the text letters must use a large and clear font so that it can be seen by blind students in the low vision category; and (3) in terms of card boxes, must be considered to the materials used so that they are more durable and should add the Braille letters on the card box as identity. In addition, based on the analysis of students' needs, data was obtained that blind students at SMPLB A Pembina Jakarta need mathematic learning media, especially in fraction material that could be used by students which both total blind or low vision that were valid and practical to use. The second analysis is the analysis of the curriculum used at SMPLB A Pembina Jakarta, and the curriculum used is the 2013 curriculum.

Based on some of these analyses, the initial design of the Braille Domino (fraction series) is as follows

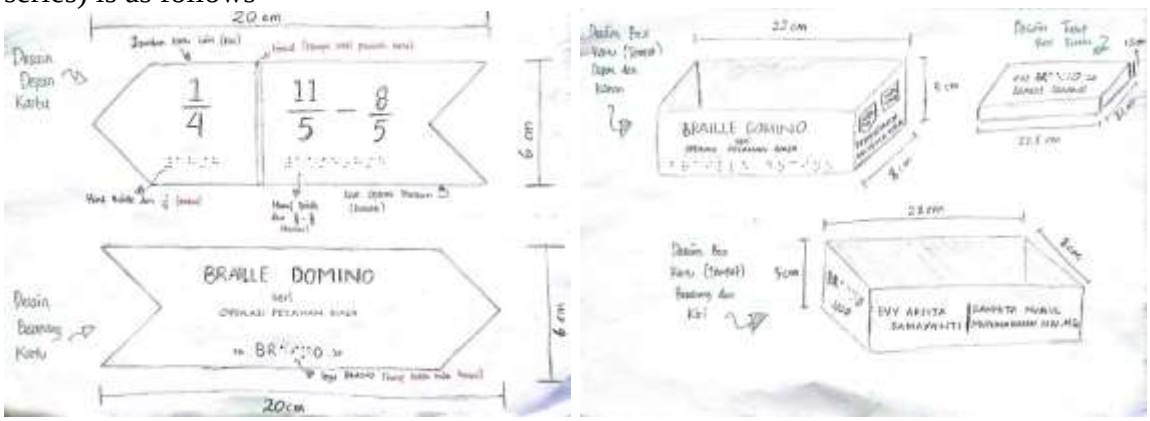

Figure 1. Initial Design of Braino Cards and Box

Furthermore, at the development stage, product creation and product validation are carried out. The initial form of the Domino Braille product series of ordinary fraction operations and the results of media and material validation by experts are as follows

Table 6. The Results of the Assessment by Media Experts

No.	Aspect	Score	Category
1.	Graphics	4.39	Very Valid
2.	Language	4.66	Very Valid
	Overall Rating	**4.52**	**Very Valid**

Table 7. The Results of the Assessment by Content Experts

No.	Aspect	Score	Category
1.	Isi	4.56	Very Valid
2.	Komponen Penyajian	4	Valid
3.	Bahasa	4.68	Very Valid
	Overall Rating	**4.41**	**Very Valid**

The next stage is implementation, namely the trial phase, the trial is divided into two stages, namely the 1st trial and the 2nd phase trial. The 1st phase trial was carried out with 2 blind student subjects (1 totally blind and 1 low vision) selected by purposive sampling and 1 teacher who is a mathematics educator in the class. Students and teachers try out the media and then give their responses. The results of student and teacher responses in the phase 1st trial are as follows

Table 8. The Results of the Students Response on the 1st Trials

No.	Aspect	Score	Category
1.	Content	3,25	Neutral
2.	Language	4,08	Practical
3.	Interest	3,83	Practical
Overall Rating		**3,72**	**Practical**

Table 9. The Results of the Teachers Response on the 1st Trials

No.	Aspect	Score	Category
1.	Coverage of Learning Materials	4	Practical
2.	Compatible with Student Development	4	Practical
3.	Conformity to the rules of the Indonesian Language	5	Very Practical
4.	The use of Mathematical Symbols	5	Very Practical
5.	Characteristics of Media	5	Very Practical
6.	Quality of Media	4	Practical
Overall Rating		**4,50**	**Very Practical**

Next, the 2nd trial was carried out with 4 blind student subjects in which 3 totally blind and 1 low vision students, and 1 mathematics educator in the class. The results of student and teacher responses in the phase 2nd trial are as follows

Table 10. The Results of the Students Response on the 2nd Trials

No.	Aspect	Score	Category
1.	Content	4,75	Very Practical
2.	Language	4,50	Very Practical
3.	Interest	4,75	Very Practical
Overall Rating		**4,66**	**Very Practical**

Table 11. The Results of the Teachers Response on the 2nd Trials

No.	Aspect	Score	Category
1.	Coverage of Learning Materials	5	Very Practical
2.	Compatible with Student Development	5	Very Practical
3.	Conformity to the rules of the Indonesian Language	5	Very Practical
4.	The use of Mathematical Symbols	5	Very Practical
5.	Characteristics of Media	5	Very Practical
6.	Quality of Media	5	Very Practical
Overall Rating		**5**	**Very Practical**

The last stage, namely evaluation, is the stage of product improvement. After conducting validation tests both by media, content experts, and product trials, various suggestion were obtained which required revisions. The final results of the Braille Domino (fraction series) after revision are as follows

CONCLUSION

The developing BRAINO - Braille Domino (Fractions Series) learning media for blind students use the Research and Development model with the ADDIE stages namely Analyze, Design, Development, Implementation and Evaluation. The results of the validity test of the BRAINO for media validation got a score of 4.52 with very valid criteria, content validation got a score of 4.41 with very valid criteria. The results of the media practicality test were assessed based on the user's response after the trial was carried out, the 1st trial for student responses scored 3.72 with practical criteria, while the teacher's response scored 4.50 with very practical criteria. Moreover the 2nd trial for student responses received a score of 4.66 with very practical criteria and the teacher's response gets a score of 5 with very practical criteria. Therefore, it can be concluded that the learning media BRAINO - Braille Domino (Fractions Series) is said to be valid and practical for use by blind students as learning media on the material basic operations of fractions such as addition, subtraction, multiplication and division.

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