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THE DEVELOPMENT OF *GEOMETRY SONG*-BASED AUDIO LEARNING MEDIA USING *REALISTIC MATHEMATICS EDUCATION MODEL* ON PLANE FIGURE MATERIALS

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ABSTRACT

This research is motivated by students who often mistakenly determine the formula for perimeter and area of plane figures. Therefore, we need a learning media to help students remember and understand the formula for the circumference and area of a flat shape. The purpose of this research is to determine the process, feasibility of developing audio learning media based on Geometry Song using the Realistic Mathematics Education model. This study uses the Research and Development (R&D) method. The subjects in this study were 10 fourth grade students during the limited test and 26 students during the broad test in one of the elementary schools in West Bandung. The research instrument used consisted of field notes and validation sheets. Field note sheets are used to determine the process and results of the development of the developed learning media and validation sheets to determine the feasibility of the developed media. The results of the study showed that the Geometry Song-based audio learning media using the Realistic Mathematics Education model obtained a percentage of 98.7% from the assessment of material experts, while the assessment of media experts and practitioners obtained a percentage of 100%, from the results of these percentages it can be said that the developed media is "Very Eligible" to use. This media can create a fun learning atmosphere, and listening to this song can train students' memory on plane figures.

Keywords: Geometry Song, Realistic Mathematics Education, Plane Figures.

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INTRODUCTION

Mathematics is one of the subjects is considered difficult by students. One of its learning materials is plane figure (Martiasari & Kelana, 2022). Among several things learned in this subject are including the circumference and area of plane figure. This material is one of the materials in class IV SD. The perimeter and area of flat shapes studied at this level include squares, rectangles and triangles.

In students' learning, it is not enough if you only have the ability to solve a math problem, this causes them not understand the meaning of a mathematical formula or theory. Based on the experience of the researchers, while participating in Field Experience Practice (PPL) activities at a public elementary school in the West Bandung

Regency; learning mathematics was often considered a subject that is considered difficult by students, one of which is in flat shape material students often mistakenly place the area and perimeter formulas, two-dimensional figure. In addition, the teacher often presented mathematics learning only by relying on textbooks, without being accompanied by learning media or using certain learning models. Presenting mathematics learning in this way resulted in the students being bored, tired, and even afraid of mathematics. Presentation of mathematical material at least needs to consider two things, namely the right concept and the right way.

The problems seem to be in line with the result of study by (Febiasari, (2018) at SDN Cisaat Rambay regarding the understanding of the plane figure concept which is still low and their learning outcomes have not yet reached the minimum completeness criteria (KKM), namely 75, out of 40 students in the class, only 4 people or around 10% of students achieve KKM. One of the things becoming a problem is that students have difficulty operating the calculation method. So, does the result of the study by (Sari & Fitrianawati (2018) at SD Muhammadiyah Tamantirto based on the results of observations that have been carried out, the fact is that 60% of grade IV students do not understand the circumference and area of plane figure because of the limitations of teachers using learning media.

Learning mathematics in elementary schools must connect real contexts in everyday life with the mathematical problems being studied. In its application, one of the learning models that apply real contexts when learning is the Realistic Mathematics Education learning model. This Realistic Mathematics Education model utilizes environmental reality so that it can be easily understood by students to provide fluency in the learning process, so that learning objectives can be achieved properly (Lugina & Artiani, 2022); (Sidik et al., 2020). The purpose of reality in this learning is to learn through real or concrete things so that students can observe and understand them (Handayani & Irawan, 2020). In addition, it would be better if the teacher can benefit from appropriate learning media suitable with the materials being taught. According to Haerani (2017), learning media can be used by teachers to help the process of delivering messages, learning content and can increase students' interest in learning. There are many types of learning media that can be used by teachers in learning, one of which is audio learning media. Song is a part of audio learning media. Through songs, a child can learn about various things. There are simple children's songs that can be easily

sung by children. Learning while singing is also something children like because it can create a more enjoyable learning atmosphere. A fun learning process makes it easy for students to remember the material being taught (Sandri, 2018).

Study of using song as learning media was also done by Gusti & Indra Martha Rusmana (2020) in learning mathematics on geometric material, based on the results of media assessments that have been tested and validated by experts, it has produced several positive responses that this formula song media is a brilliant idea, this song will be easily memorized. In addition, the validation results of this song media get an average good score from the experts so that this mathematical formula song media is said to be feasible to use. Likewise with research conducted by (Sandri, 2018), that is, regarding the effect of song media on the flat wake material, the value obtained by students when learning to use song media is higher, namely 72.04 compared to the value obtained by students when learning without song media, which is 60.21. It can be concluded that there is an influence of song media on mathematics learning in schools

The researchers were looking for alternatives in learning about flat shape material so that it is not boring and is not considered difficult, namely by creating a song product called Geometry Song. Making songs as learning media is to help students remember and understand the concepts of circumference and area of flat shapes. What makes it different from previous research is that the song contains lyrics about the characteristics and formulas of square, triangular and rectangular shapes. The melody of the song and the strains of the piano instrument being played are made into a happy rhythm to attract students' attention. The lyrics of the songs created are combined with the learning context according to the Realistic Mathematics Education model which is related to things that are real in nature. In accordance with the material chosen, namely the teacher's flat shape gives real examples of various forms of flat shapes that exist in the classroom environment. Based on the problems above, the researcher feels the need to focus his research on the title "Development of Geometry Song-Based Audio Learning Media Using the Realistic Mathematics Education Model in Plane Figure Materials."

METHODS

The method used is Research and Development using the development stages according to Borg & Gall stages of research development or Research and Development (R&D) from Borg and Gall (Effendi & Hendriyani, 2016) The method used consists of

several steps, namely: 1) Preliminary research or pre-survey, 2) Research planning, 3) Initial model or product development, 4) Expert trials and limited field trials, 5) Revision of limited field test results, 6) Implementation wide field test, 7) Revision of wide field test results, 8) Feasibility test or operational field test, 9) Final revision of due diligence results, 10) Dissemination and implementation of the final product. As stated by Borg and Gall there are several considerations when choosing a research method, the method used has a simple and complete form, including elements of identification, development and revision, so, that, the method chosen will consider the existing situation and conditions (Rokhmawati et al., 2019). As for this study, it still refers to the model above, but is limited to only referring to 7 stages out of the 10 stages that have been proposed by Borg and Gall.

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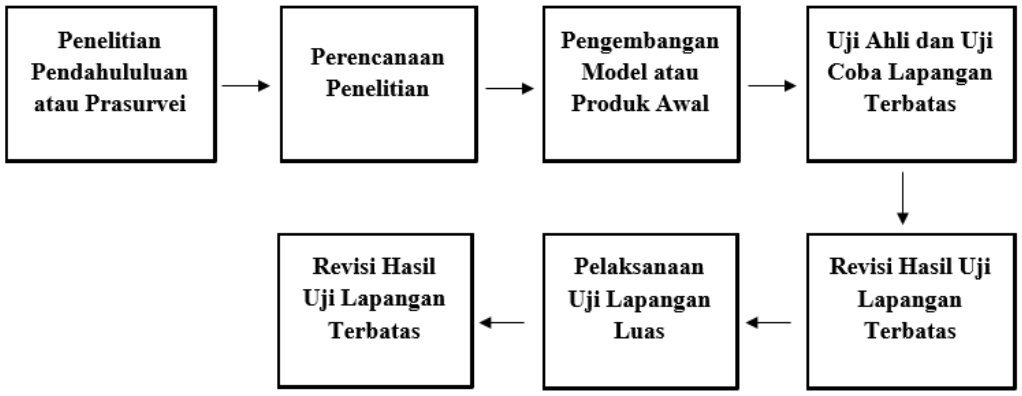

Fig 1. *R&D Plot Research*

The data collection process was obtained based on field note sheets to find out the process and results of the development of the developed learning media as well as the validation sheet to determine the feasibility of the developed media. The data obtained in this study consisted of qualitative and quantitative data. Qualitative data in the form of results from field note sheets as well as suggestions or notes based on the validation of material experts, media and practitioners on the developed learning media. Meanwhile, quantitative data comes from evaluating the results of media validation based on the assessment of material experts, media and practitioners. As for scoring on the validation sheet, the following calculations are used:

Table 1. Guidance of Rating Assessment on Validation Sheet

Score	Description
1	Very Less
2	Less

3	Very Good

Then, the score obtained based on the results of the validation sheet from each expert is added up using the media eligibility percentage calculation formula, as follows:

$$\text{Final Score} = \frac{Total\ Score}{Indicator\ Sum\ x\ 3} \text{ x } 100\%$$

In this study, the media feasibility criteria were also determined. The feasibility is presented by using the conversion of achievement level according to Damayanti et al. (2018) like in the following table:

Table 2. The Conversion of Achievement and Media Qualification

No	Achievement Level	Qualification
1	81% – 100%	Very Feasible
2	61% – 80%	Feasible
3	41% – 60%	Feasible Enough
4	21% – 40%	Less Feasible
5	0% – 20%	Very Less Feasible

RESULTS AND DISCUSSIONS

Results

The design process and results of developing audio learning media based on Geometry Song using the Realistic Mathematics Education model consist of several stages according to the Research and Development research stages according to Borg and Gall, for the process will be described in the following description.

1. *Previous Study and Pre-Survey*

The researchers identify problems and analyze needs related to relevant research according to the product to be developed. Based on the results of the interviews it was found that learning mathematics is often considered a difficult subject by students, some of the students stated that mathematics is a complicated subject because it is always related to remembering formulas and numbers. In addition, teachers often present mathematics learning only by relying on textbooks, without being accompanied by learning media or using certain learning models.

The researchers, then, chose learning media in the form of audio as an alternative answer to the problem, then the researcher chose basic competencies and materials that were suitable for the media to be developed, selected material regarding the circumference and area of flat shapes. The material was chosen because the researcher

felt that the perimeter and area formulas could be made part of the song lyrics to help students remember and determine these formulas correctly.

2. *Research Planning*

The researchers make a product draft which contains an overview of the product description, the purpose and benefits of making the product, the steps for making the product, and the steps for using the product to be developed. The initial draft of the product that has been made is then consulted with the supervising lecturer so that input and directions are obtained from the supervising lecturer regarding the development of this learning media

3. *Model or Initial Product Development*

The researchers started to make audio learning media based on Geometry Song using the realistic Mathematics Education model with the following stages:

a. The first stage is making song lyrics; then, the lyrics are adjusted to the material to be discussed, namely flat shapes. The lyrics are made related to objects in the form of square, rectangular and triangular shapes that are around students along with the formulas for their circumference and area respectively. The lyrics are as follows:

Geometry Song
Lihatlah benda di sekelilingmu
Ada pintu, lantai, penggaris dan yang lainnya
Beragam bentuknya ya… ya… ya…
Lihatlah lantai ini bentuknya persegi
Punyai 4 sisi sama panjang
Mari bersama tentukan rumusnya
Keliling persegi itu 4 kali sisi
Untuk luasnya sisi kali sisi
*Reff:
Ingat.. Ingat.. Ingat.. Ingatlah rumusnya
Berbeda bentuknya, juga cara hitungnya

Lihatlah pintu bentuknya persegi panjang
Punyai sisi panjang juga lebar
Mari bersama tentukan rumusnya
Kelilingnya 2 kali (panjang tambah lebar)
Untuk luasnya panjang kali lebar
Kembali Ke Reff
Lihat penggaris ini bentuknya segitiga
Punya 3 sisi serta alas tinggi
Mari bersama tentukan rumusnya
Luasnya alas kali tinggi bagi 2
Kelilingnya jumlah ketiga sisinya
Kembali Ke Reff

Translation:

Look at the objects around you
There are doors, floors, rulers and others
Various forms yes... yes... yes...
Take a look at this floor in a square shape
has 4 equal sides
Let's determine the formula together
The perimeter of the square is 4 times the side
For the area of side times side
**ref:*
Remember.. Remember.. Remember.. Remember the formula
Different forms, also how to count

Look at the rectangular shape of the door
Have a long side as well as width
Let's determine the formula together
Circumference 2 times (length increases width)
For breadth, length times width
back to ref
See this ruler is triangular in shape
Has 3 sides and a high base
Let's determine the formula together
The area of the base times the height divide by 2
Its perimeter is the sum of its three sides
back to reff

b. The second stage is making musical arrangements with the help of the n-track studio application. The musical instruments used are the piano and drums in the application

Fig 2. Drum and Piano Instruments

c. The third stage is recording, after the tone arrangement is finished, the lyrics previously made are sung using a recording device assisted by the Ez Voice application. Then the results of the singing recordings and tone arrangements were combined again with the help of the n-track studio application. After that, the song is saved as mp3 format.

Fig 4. *The Process of Arrangement*

d. The fourth stage is making a CD / DVD display design for the songs that are made to make it more attractive with the help of the sketchbook and Canva-applications

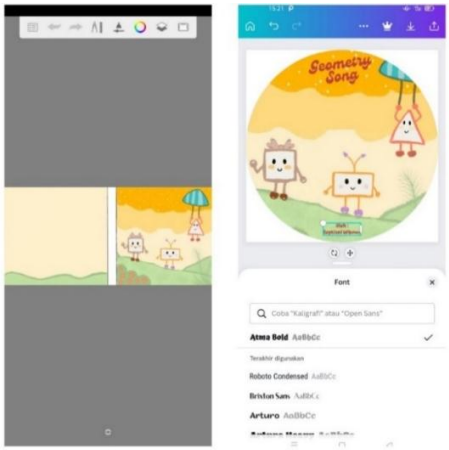

Fig 5. *The Design of Picture in Sketchbook Application* (Left) and *Canva* (Right)

The following is an image of the final product of Geometry Song-based audio learning media using the Realistic Mathematics Education model

Fig 6. *The Final Product of Geometry Song–based* Audio Learning Media Using *Realistic Mathematics Education* Model

1. Expert Test and Limited Preliminary Test

The stages, after the product draft is corrected; the product can be validated by material experts, media and practitioners just before the limited test is carried out. The validation results related to Geometry Song-based audio learning media using Realistic Mathematics Education are as follows:

Table 3. The Result of *Geometry Song*-based Audio Learning Media Validation Using *Realistic Mathematics Education* Model

Validator	Result (%)	Criteria
Material Expert	98,7	Very Feasible
Media Expert	100	Very Feasible
Practitioner	100	Very Feasible

The validation results from the validation of material experts get a percentage of 98.7% after carrying out two validation stages because there are notes about the lyrics which cause misinterpretation, while the results of the validation by media experts and practitioners get a percentage of 100% because there are no notes or corrections added. The limited test was carried out on 10 students of class IV-C at one of the public schools in West Bandung Regency. Giving treatment during learning used audio learning media based on Geometry Song using the Realistic Mathematics Education model is carried out for 3 days. This developed learning media is used after students work on worksheets regarding the circumference and area of flat shapes. The playback of the song is carried out in stages based on each fragment of the song lyrics, starting from the first day the lyrics are about the perimeter and area of a square shape, then the next day about the circumference and area of a rectangular shape, and finally about the circumference and area of a triangular shape.

There were several obstacles that occurred including when the volume sounded small, also students who had difficulty remembering the lyrics of the song being played. These obstacles can be overcome because the researcher adds volume to the song and repeats parts of the song lyrics that are difficult to remember so that eventually students get used to it, learning becomes less stressful so students can follow the learning process well using Geometry Song-based audio learning media using the Geometry Song model using this Realistic Mathematics Education. The following is the documentation of limited test student activities when singing.

Fig 7. Group of Preliminary Test Students Singing *Geometry Song*

2. Revision of Limited Preliminary Test Result

At this stage, there are no revisions or things that need to be corrected according to practitioners during the limited field trial activities, so that the product can be immediately re-validated by experts so that it can then be used in extensive trials.

3. Implementation of Secondary Field Test

The extended test was carried out on 26 students of class IV-B located at the same elementary school during the limited test. Learning using audio learning media based on Geometry Song using the Realistic Mathematics Education model is carried out for 3 days. The treatment was more or less the same as during the limited test, it's just that the constraints faced were quite different. There were more students who were the subject of research in this broad test. In this broad test students also seemed more confident when singing songs together. The learning process when using this media from day to day also seems to show a positive response, one of which is based on the state of the students who look cheerful when the song is played. The repetition of the song made students accustomed to hearing this song so that it seemed that students were able to memorize and sing this song well.

4. Revision of Secondary Field Test Result

At this stage there are also no revisions or things that need to be corrected according to the practitioners during the wide field trial activities, so that the product can be used.

Discussions

This research produces an audio learning media product based on Geometry Song using the Realistic Mathematics Education model. The development model in this study uses seven stages of development according to Borg and Gall (Effendi & Hendriyani, 2016), namely: 1) preliminary research or pre-survey, 2) research planning, 3) initial model or product development, 4) expert testing and field trials limited, 5) Revision of limited field test results, 6) implementation of wide field tests, 7) revision of wide field test results. The results of the feasibility of the learning media developed obtained a percentage of 98.7% from material experts and 100% from media experts and practitioners. From these results as a whole the audio learning media based on Geometry Song using the Realistic Mathematics Education model gets the criteria of "Very Eligible".

The treatment using the developed media was carried out for 3 meetings in each class during the limited test and wide test. Even though there were some obstacles when it was implemented, this can be overcome so that learning using audio learning media based on Geometry Song using the Realistic Mathematics Education model can be received with positive responses from students, namely the state of students who look cheerful when the song is played.

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Based on the results of the research that has been carried out, it shows that with audio learning media students can carry out learning to be more enjoyable. In line with (Sari & Fitrianawati (2018) stating that the characteristics of elementary school students are basically happy to play. By using audio learning media in the form of songs, the learning that students go through becomes fun because it feels like learning to play while playing. In addition, according to Dwi Lestari et al (2017);(Mariam & Kelana, 2020), simple language in a song lyrics given in learning can help students understand and remember a learning material, students will also feel happy, calm and peaceful. The Realistic Mathematics Education model was chosen to help the process of developing

the media to be used, this learning model was chosen based on Piaget's theory (Chisara et al., 2018), that the students in elementary school are classified in the concrete operational stage. At this stage, they are able to understand learning materials and mathematical operations through the help of concrete objects that are close to the their environment (Murni et al., 2021).

CONCLUSION

The process and results of developing Geometry Song-based audio learning media using the Realistic Mathematics Education model are measured using field note sheets. Based on the results of the field note sheets, it can be seen that the students get progress from day to day when applying this learning media in learning. It can be seen from the positive responses given by them. The feasibility of audio learning media based on Geometry Song using the Realistic Mathematics Education model is measured using a validation sheet from material experts, media and practitioners. Based on the results of the validation sheet, it is found that audio learning media based on Geometry Song uses the Realistic Mathematics Education model. . Geometry Song-based audio learning media using the Realistic Mathematics Education model can make learning mathematics more enjoyable. Apart from that, listening to this song can also train students' memorization and memory, especially in flat shape material.

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