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Luper Borubung (Surface Area Of A Sphere, Cone, Cylinder) Project On The Surface Area Of Curved Sided Template Figures(Brsl)

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Abstract
Mathematics learning on the topic BRSL, particularly the determination of surface area, is often hampered by the abstract nature of the concept and the lack of adequate visual representation. This condition has the potential to hinder students' conceptual understanding and mathematical reasoning abilities. We often find low student understanding and learning outcomes on this material. This luper borubung teaching aid is based on the urgency of developing learning aids that can bridge the gap between theory and visual reality. Students are introduced to the use of the luper borubung teaching aid, then given a test at the end of the activity containing BRSL material. The test results showed 71% of students in the good category. Students are enthusiastic, the learning atmosphere is more enjoyable and meaningful because they construct their own knowledge with the help of the luper borubung teaching aid.

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1. INTRODUCTION

Background

BRSL geometry is one of the essential materials in mathematics learning at the ninth grade of Junior High School (SMP). Curved-sided geometric shapes are important to teach at the SMP level because they help students develop spatial and logical thinking skills and apply mathematics to real-life situations. For example, calculating the volume and surface area of cylinders, cones, and spheres that are often found in everyday objects (Rianto & Santoso, 2014). This material is also an important foundation for more complex 3D geometry, mastering this concept since SMP helps build a strong foundation for subsequent mathematics subjects (Yamti, 2016).

Although BRSL concepts are frequently encountered and relevant in everyday life, many students reportedly still experience significant difficulties in mastering this topic (Yusmin, 2017). Various previous studies have shown that students often experience difficulties in understanding BSRL materials, such as cylinders, cones, and spheres. These difficulties generally arise because students are unable to connect three-dimensional concepts with two-dimensional representations, resulting in a less in-depth understanding of nets, surface area, and volume.

A study by Ardiyanti & Sutopo (2022) found that many students incorrectly identified the elements of geometric shapes and did not understand the relationship between diameter, radius, and height in calculations. Meanwhile, Rahmawati et al. (2021) reported that misconceptions about the formulas for the surface area and volume of a cone often occur due to learning that still focuses on memorizing formulas, rather than visual-spatial understanding. Another study by Sari & Hidayat (2023) also confirmed that limited spatial abilities and the minimal use of concrete

media are the main factors that make it difficult for students to solve BSRL problems correctly and consistently.

Other factors include students' lack of interest in the material, low focus during teacher explanations, and a tendency toward monotonous teaching methods, such as lectures dominated by students without the support of effective teaching aids (Marasabessy et al., 2021; Oksagita et al., 2021). Diversity in students' mathematical literacy skills in solving problems involving BRSL is also a contributing factor (Edriati & Mardiyah, 2019). Specifically, some students face significant challenges when working on BRSL-themed mathematical literacy problems (Rudi Syaali et al., 2023).

To address the aforementioned issues, the use of teaching aids can be integrated to create a more enjoyable and meaningful learning environment. Mathematical teaching aids are important learning media that help students understand abstract mathematical concepts more concretely and easily (Sagita et al., 2019). Teaching aids also strengthen interest and motivation in learning, creating a more active and participatory classroom atmosphere compared to traditional lecture methods (Purba et al., n.d.). A recent systematic literature review on mathematics learning at the secondary school level also supports the conclusion that teaching aids are an "effective bridge" to improving student understanding, engagement, and learning outcomes (Fitri et al., 2024).

However, the reality on the ground actually shows a different condition. Based on observations and interviews with mathematics teachers at SMP Negeri 1 Bonggo, it was discovered that the learning carried out at the school had never used teaching aids, causing many students to experience difficulty in understanding the material and a lack of student activity during the teaching and learning process. Several workshops have been conducted for teachers on teaching aids (Sartika, 2025; Ipah Muzdalipah, Ratna Rustina, 2016). Based on the results of one of the teaching aid training workshops, it was shown that teachers' knowledge and skills in designing and applying mathematical teaching aids increased (Hamidah et al., 2017).

Based on the description above, it is necessary to carry out community service activities regarding teaching aids targeting students directly with the title: Teaching Aids TUBE LUPER (surface area of a spherical cone tube) on the Surface Area Material of Curved Sided Solid Shapes in Class IX of SMP Negeri 1 Bonggo.

Making Teaching Aids

The teaching aids used in BRSL Surface Area learning are nets of cylinders and cones in various sizes and colors, while for spheres, toy balls are used. The use of these teaching aids aims to make it easier for students to understand the concept of surface area of curved solid shapes in a more realistic and concrete way.

a. Tube

Figure 1. Cylinder Net

Tool:

1) Hot glue gun
2) Scissors
3) Grinding
4) Ruler
5) Term
6) Hospital

7) male cat
8) Okay.
9) Hooks shot

Material:

1) Clear plastic with a thickness $0{,}4\ cm$
2) Glue gun
3) Plywood
4) Double Tape
5) Noken Thread
6) Asturo Paper
7) Adhesive
8) Cat
9) Shooting hectare filling
10) Thinner

Making process:

1) First: Cut the triples to size $79\ cm \times 59\ cm$ as a base board, then cut6triples of size$79\ cm \times 3\ cm$ 6 $plywood\ measuring$ $59\ cm\ x\ 3\ cm$as a frame.
2) Second: Paint the three large plywood panels in different colors, namely blue, black, and brown. Do the same steps, namely, paint the small plywood panel black.
3) Third: Glue the four pieces of plywood together$79\ cm \times 3cm$on the sides of the baseboard using a shooting hekter to form a frame.
4) Fourth: Picture 3 of a tube net pattern on green, purple, and blue asturo paper using a ruler, marker, and compass with the size of the tube cover.$43\ cm\ \times 24\ cm$Next, draw the base and lid of the cylinder in the form of a circle with its radius$7\ cm$.
5) Fifth: Cover the net pattern of the tube with clear plastic, then cover the base and lid of the tube with yellow and blue cardboard so that you can distinguish the base and lid of the tube. Then, cut according to the pattern neatly.
6) Sixth: Make holes in the edges of the blanket, base, and lid of the tube at equal distances using a soldering iron, then use noken thread to tie the holes so that when pulled, they can form a complete tube.
7) Seventh: Attach the tube nets using a hot glue gun and adhesive to the plywood board according to the base color that has been painted.
8) Eighth: Make sure all parts are attached firmly and do not come loose easily, so that when the teaching aids are used in learning, there are no loose parts.

b. Cone

Figure 2. Cone Net

Tool:

1) Hot glue gun
2) Scissors
3) Grinding
4) Ruler
5) Term
6) Hospital
7) male cat
8) Okay.

9) Hooks shot

Material:

1) Clear plastic with a thickness $0{,}4\ cm$
2) Glue gun
3) Plywood
4) Double Tape
5) Noken Thread
6) Asturo Paper
7) Adhesive
8) Cat
9) Shooting hectare filling
10) Thinner

Making process:

1) First: Cut the triples to size$60\ cm \times 58\ cm$ as a base board, then cut6 triples of size$60\ cm \times 3\ cm$ and 6 triples of size$58\ cm \times 3\ cm$as a frame.
2) Second: Paint the three large plywood panels in a different color, namely brown.2 And 1blue, do the same steps, namely, paint the small plywood black.
3) Third: Glue the four pieces of plywood together$60\ cm \times 3cm$ and $58\ cm \times 3cm$on the sides of the baseboard, using a shooting heater to form a frame.
4) Fourth: Picture 3 of the cone net pattern on green, purple, and blue asturo paper using a ruler, marker, and compass with the size of the cone base being the radius.$7{,}5\ cm$and the painter's lines$15\ cm$
5) Fifth: Cover the cone net pattern with clear plastic, then cover the base of the cone with yellow cardboard, then cut it out neatly according to the pattern.
6) Sixth: Make a hole at each end of the net using a hot soldering iron to insert the noken thread so that the cone net can be pulled to form a cone-shaped geometric shape.
7) Seventh: Attach the cone nets using a hot glue gun and adhesive to the plywood board according to the base color that has been painted.
8) Eighth: Make sure all parts are attached firmly and do not come loose easily, so that when the teaching aids are used in learning, there are no loose parts.

c. She was

Picture 3. Toy Ball

2. METHOD

The method used in community service activities is training. The steps taken during community service include:

(1) Making teaching aids. Making teaching aids by the Chairperson and Community Service Members.

(2) Conduct training according to the specified schedule. Training activities are carried out by the Chairperson and Community Service Members at the target school.

(3) Conducting simulations for students who have been trained to use teaching aids in mathematics learning in accordance with the Worksheet (LTK). Simulation activities by the Chair and Community Service Members.

(4) At the conclusion of the community service program, a comprehensive written test is conducted to determine the program's success. The evaluation is conducted by Community Service Members.

3. RESULTS AND DISCUSSION

After the learning activity was completed, students were given three individual test questions. This test aimed to measure their understanding of the surface area of curved solids after using the teaching aids.

The final score uses a scale of 1 to 100.

Calculation of the final score using the formula:

$$Final\ Score = \frac{score\ obtained}{total\ shoes} \times 100$$

Shoes : 100

Evaluation Criteria:

Very Good (A) : when getting a score$80 < score \leq 100$

Good (B) : when getting a score$60 < score \leq 80$

Enough (C) : when getting a score$40 < score \leq 60$

Less (D) : when getting a score$20 < score \leq 40$

Very Poor (E): when obtaining a score$0 \leq score < 20$

Table 1: List of Individual Test Score Results

No.	Student Initials	Mark	Criteria	Information
1.	ASR	75	B	Good
2.	LIVE	75	B	Good
3.	YES	70	B	Good
4.	DAB	70	B	Good
5.	EY	80	B	Good
6.	FFFD	70	B	Good
7.	FRR	65	C	Enough
8.	HMD	65	B	Good
9.	IDR	75	B	Good
10.	JBA	65	C	Enough
11.	MJMS	60	C	Enough
12.	SAP	75	B	Good
13.	WAS	60	C	Enough
14.	WRS	75	B	Good
15.	YSAM	70	B	Good
16	YWAS	60	C	Enough
17.	YFS	70	B	Good

From the data above, the following data was obtained:

1. There were no students who obtained very good (A) criteria.
2. Students who obtain good criteria (B) are there12people.
3. Students who obtained sufficient criteria (C) are there5.
4. There were no students who obtained a grade of less than (D).
5. There were no students who obtained very poor (E) criteria.

Based on the data above, it can be seen that the learning outcomes of students are that out of 17 students, there are...12students who have fulfilled the KKM (Complete) in the individual test, and there are5Students who have not met the KKM (Not Completed) set by the school, namely70.This means that 71% of students meet the KKM

By using the results of the knowledge assessment of class IX B students from Permendikbud No. 81A of 2013 (Pendidikan et al., 2013)

Thus, the results of the individual test assessment show that the average student score is:

$$\frac{Total\ scores\ of\ all\ students}{Number\ of\ students} = \frac{1.180}{17} = 69{,}41$$

So the knowledge assessment criteria is Good.

4. CONCLUSIONS AND SUGGESTIONS

Conclusion

1. Based on the results of the individual test assessment, it can be seen that the average student score is69,41 is in the good category, and 71% meets the KKM.
2. Teaching aids can help students understand concepts, attract students' attention, and make students actively involved.

Suggestion

Based on the results of community service activities, it shows that the application of the use of teaching aids as learning media can help teachers in teaching the material on the surface area of curved-sided solid shapes, so it is highly recommended for mathematics teachers to apply teaching aids in learning activities.

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