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# When designer meets local culture: The promising learning trajectory on the surface area of polyhedron

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## Abstract

Polyhedrons present a challenging topic in elementary geometry education. The Indonesian Realistic Mathematics Education (IRME) approach, when contextualized within the Bukit Sulap tourism area, offers a promising solution to this challenge. This study aims to design a learning trajectory for teaching the surface area of polyhedron using IRME in the context of Bukit Sulap tourism. Employing a research design with a validation study type, the study was conducted in three phases: preparation and design, experimental teaching, and retrospective analysis. The participants were 27 elementary school students from Lubuklinggau City, Indonesia. Data collection instruments included surface area problem-solving worksheets, video recordings of in-depth learning interviews, field notes, and observation sheets. The findings suggest that the Bukit Sulap tourism context significantly enhanced students' understanding of surface area problems, specifically those involving combinations of cuboids and cubes. Additionally, IRME effectively facilitated students' comprehension of abstract mathematical concepts, particularly the surface area formulas for cubes and cuboids. The study concludes that using the Bukit Sulap tourism park context as a starting point for teaching the surface area of polyhedron aligns well with the principles of IRME.

**Keywords**: Bukit Sulap Tourism, Context, Cube and Cuboid, IRME, Surface Area

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Geometry, a fundamental element of mathematics, presents significant challenges for elementary school students, particularly in understanding and applying concepts related to the surface area of polyhedron (Nagy-Kondor & Esmailnia, 2021; Nailurrohmah & Murdiyani, 2022). On the other hand, Naidoo and Kapofu (2020) emphasize that difficulties in comprehending geometric concepts are pervasive, often hindering students' overall mathematical development. Furthermore, surface area is a crucial topic with numerous real-life applications, such as calculating the amount of wrapping paper needed for a gift or determining the quantity of paint required to cover a wall (Hwang et al., 2020; Nursyahidah & Albab, 2021). Despite its practical significance, students frequently encounter challenges in accurately solving surface area problems (Taylor & Jones, 2009; Smith III et al., 2016). Therefore, geometry often challenges elementary students, particularly in understanding surface area concepts of polyhedron, which are vital for practical tasks, yet many struggle to solve related problems, hindering their overall mathematical development.

Research has identified common errors in students' approaches to surface area calculations, including misinterpretations of questions, misunderstandings of spatial relationships, and an overreliance on rote memorization of formulas without a deep understanding of the underlying principles (Prahmana & D'Ambrosio, 2020; Fouze & Amit, 2021). These issues are further compounded by students limited spatial abilities, which impede their ability to visualize and manipulate geometric shapes mentally (Lowrie et al., 2019; Goktepe Yildiz & Ozdemir, 2020). Moreover, traditional methods (direct teaching) of teaching geometry often fail to engage students effectively, resulting in a lack of motivation and interest in the subject (Sarkar et al., 2020; Mensah & Nabie, 2021). Consequently, students struggle to connect abstract mathematical concepts with real-world applications, further complicating their understanding of geometry.

Given these challenges, there is an urgent need to explore alternative instructional methods that can make geometry more accessible and engaging for students. One promising approach is the Indonesian Realistic Mathematics Education (IRME) framework, which aims to bridge the gap between abstract mathematical concepts and students' everyday experiences (Juniarti et al., 2022). Rooted in the Realistic Mathematics Education (RME) model developed in the Netherlands (Van den Heuvel-Panhuizen & Drijvers, 2020), IRME emphasizes the use of realistic contexts to facilitate students' understanding of mathematical ideas (Zulkardi et al., 2019). This approach shifts the focus from rote memorization to active problem-solving, encouraging students to discover and construct mathematical knowledge through contextualized learning experiences (Zulkardi & Putri, 2019).

The IRME approach is particularly well-suited for teaching geometry, as it enables students to engage with mathematical concepts in a more concrete and relatable manner (Meryansumayeka et al., 2022; Lisnani et al., 2023). By situating learning within real-world contexts, IRME helps students see the relevance of geometry in their daily lives, thereby enhancing their motivation and engagement (Apsari et al., 2020). For instance, teaching the surface area of polyhedron using everyday objects (Arifah & Retnawati, 2020; Sagita et al., 2021), such as gift boxes or classroom walls allows students to relate the learning process to tangible experiences. This contextual approach not only makes the learning experience more meaningful but also fosters a deeper understanding of the underlying mathematical principles.

In this study, the context of Bukit Sulap tourism in Lubuklinggau is utilized as a practical example to teach the surface area of cube and cuboid. Bukit Sulap, known as the "lungs" of the city, offers a rich and engaging context for students to explore mathematical concepts in a real-world setting (Sukasno et al., 2024). By connecting the study of geometry to a familiar and significant local landmark, students are more likely to develop an interest in the subject and recognize its relevance beyond the classroom. This approach aligns with the principles of IRME, which advocate for the use of real-life contexts to make mathematics more accessible and meaningful for students (Zulkardi et al., 2019; Zulkardi & Putri, 2019).

The primary objective of this research is to design a learning trajectory using the context of Bukit Sulap as a starting point to enhance students' understanding of the surface area of polyhedron, particularly cube and cuboid. This study will investigate how IRME can be effectively implemented to help students build a solid conceptual foundation in geometry while also developing their problem-solving skills and mathematical reasoning. By engaging with contextual problems, students will be encouraged to think critically and creatively, applying their mathematical knowledge to real-world situations (Sitorus & Masrayati, 2016; Toheri et al., 2020).

Furthermore, the IRME approach emphasizes the importance of student-centered learning, where students actively participate in the learning process (Zulkardi et al., 2019; Prahmana et al., 2020). Instead of being passive recipients of information, students are encouraged to explore, question, and discover mathematical concepts independently, with the teacher acting as a facilitator rather than a traditional instructor (Herawaty et al., 2020). This shift in the teacher's role is crucial for fostering a more dynamic and interactive learning environment, where students feel empowered to take ownership of their learning.

On the other hand, understanding the surface area of polyhedron requires mastery of basic properties and formulas, especially when dealing with composite shapes, which demand a more complex approach to surface area calculation (Kurniawati & Amir, 2022; Romero et al., 2023). Through the IRME approach, students can develop a deeper understanding of these concepts by engaging with real-life problems that require the application of their knowledge in practical ways (Zulkardi et al., 2019; Prahmana et al., 2020). For instance, students might calculate the surface area of a combination of cube and cuboid by applying known formulas to each component before summing them to find the total surface area.

The process of calculating the surface area of composite shapes not only reinforces students' understanding of basic geometric principles but also encourages the development of critical thinking and problem-solving skills (Elia et al., 2018). By breaking down complex shapes into simpler components, students can approach problems in a more manageable way, applying surface area formulas to each part before combining the results. This approach aligns with the IRME philosophy of learning through exploration and discovery, where students are encouraged to develop their own strategies for solving mathematical problems (Zulkardi et al., 2019; Zulkardi & Putri, 2019).

Finally, in the IRME approach, the teacher's role is to design and facilitate learning activities that are both engaging and relevant to students' daily lives (Zulkardi et al., 2019; Risdiyanti et al., 2024). By using real-world contexts such as Bukit Sulap, teachers can help students see the connections between mathematics and the world around them, making the learning process more meaningful and enjoyable. Through IRME, students are not only expected to memorize formulas but also to develop a deeper conceptual understanding of geometry, which they can apply in various situations (Apsari et al., 2020; Arifah & Retnawati, 2020; Sagita et al., 2021; Meryansumayeka et al., 2022; Lisnani et al., 2023). Therefore, this research aims to contribute to the growing body of evidence supporting the effectiveness of IRME in enhancing students' mathematical understanding and problem-solving abilities.

In conclusion, this study seeks to address the question: "How can a learning trajectory using the IRME approach be designed to effectively teach the surface area of polyhedron within the context of Bukit Sulap tourism?" By answering this question, the research aims to contribute valuable insights into the application of IRME in teaching geometry, demonstrating how this approach can enhance students' understanding of the surface area of polyhedron while making the subject more accessible and engaging using the context of Bukit Sulap tourism. The findings of this study are expected to provide evidence-based recommendations for improving geometry instruction, ultimately leading to better learning outcomes for elementary school students.

## METHODS

This study employs a design research methodology to develop a learning trajectory for teaching the surface area of polyhedrons using the Indonesian Realistic Mathematics Education (IRME) approach. The primary goal is to create a local instructional theory that improves learning quality through collaboration between the researcher and the classroom teacher (Gravemeijer & van Eerde, 2009). Additionally, this study serves as validation research, focusing on the design and validation of learning trajectories to enhance theoretical understanding of the learning process and to document the development of instructional environments (McKenney & Reeves, 2014).

The research specifically aims to formulate a Hypothetical Learning Trajectory (HLT) based on the IRME approach, contextualized within the Bukit Sulap tourism area, to enhance students' comprehension of the surface area of polyhedrons. The study was conducted with 27 elementary school students in Lubuklinggau City, Indonesia, and followed three phases: preliminary design, implementation of the experiment in the classroom, and retrospective analysis, as outlined by Plomp and Nieveen (2013).

## Preliminary Design

During the preparation and design stage, the researchers engaged in three key activities to develop an initial design of the HLT (Bakker, 2018). The first activity involved administering a pretest to students on the concept of surface area. The pretest results provided insights into the students' cognitive processes in solving surface area problems, revealing that students required extended time to reach solutions. Second, the researchers conducted a comprehensive literature review on various teaching techniques for surface area. The review identified common contexts used in teaching surface area, such as calculating the area of a wall to be painted, determining the amount of cement needed for plastering, and assessing the fabric required to cover a performance area. Lastly, the researchers selected the Bukit Sulap tourist attraction as the context for their study and designed a series of learning activities focused on it. These activities included calculating the surface area of the cliff wall at Bukit Sulap, determining the surface area of the triangular-shaped gazebo roof, and solving more complex problems involving the trapezoidal and triangular upper surfaces of the gazebo.

## Teaching Experiments

The experimental teaching stage was conducted in two main activities: a pilot experiment and the actual experimental teaching. The pilot experiment served as an initial trial of the HLT design, involving five students working collaboratively in a group. This trial focused on reviewing the HLT design, particularly assessing the readability and clarity of the student worksheets, as well as the instructions and commands provided. Additionally, feedback was gathered on the attractiveness and relevance of using the Bukit Sulap Tourism context for teaching surface area concepts. Based on the insights gained from the pilot experiment, the HLT design was refined and subsequently implemented in a larger trial involving 27 students in a single class.

During the learning process, data were collected through various methods, including video recordings of the learning sessions, student responses on worksheets, field noted, and interviews with students. Group discussions and presentations of students' work in front of the class were integral parts of this process. Observations were conducted to assess the extent to which the HLT was implemented, while interviews were used to ensure alignment between the actual learning activities and the proposed HLT. Finally, field noted were also maintained to capture students' physical and mental engagement during the lessons, providing additional context to support the interview findings.

## Retrospective Analysis

During the retrospective analysis stage, the researchers compared the actual learning trajectories with the HLT. This involved identifying how students engaged in various problem-solving strategies, such as creating tables, identifying patterns, rephrasing problems to simplify them, using logical reasoning, drawing diagrams, and exploring alternative possibilities for designing mathematical models. The analysis of learning videos, field noted, and interview results provided insights into the students' initial understanding of the concept of multiplication rules.

The findings from this stage were instrumental in explaining the role of the Bukit Sulap Tourism context in enhancing students' ability to define the problem context, reflect on their understanding of the problem, develop and implement a problem-solving plan, and review their solutions in relation to surface area problems. Moreover, the study demonstrated how this context facilitated students in discovering the concepts and principles related to the surface area of polyhedrons.

## RESULTS AND DISCUSSION

This study resulted in the development of a learning trajectory for geometry instruction using the Indonesian Realistic Mathematics Education (IRME) approach. The research was conducted at an elementary school in Lubuklinggau City. The collected data were analyzed, with particular focus on the stages of the learning activities and the implementation of the learning trajectory. The findings of this study are detailed as follows.

### Activity 1: Observing the Buildings at Bukit Sulap

In the first activity, students were tasked with observing the various buildings located at the Bukit Sulap tourist site using videos and photographs provided in their student worksheets (SW). Following these observations, students were required to identify and label the different types of buildings according to the mathematical concepts they had been studying. The results of these observations are depicted in Figure 1.

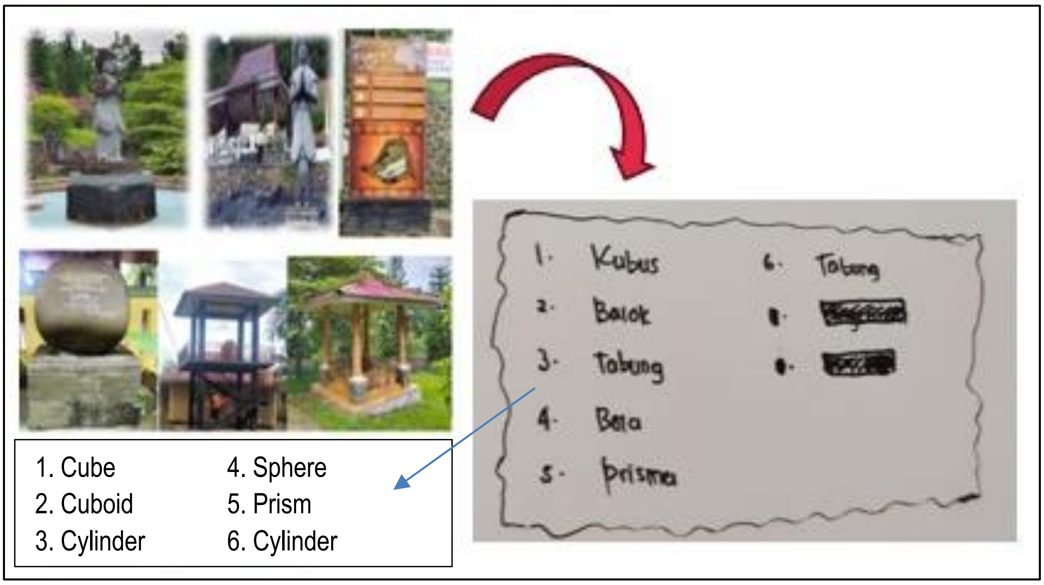



**Figure 1**. Students' observations of buildings at Bukit Sulap

Figure 1 illustrates the outcomes of students' observations, which were conducted through visual media in their SW. The students were able to mentally reconstruct the buildings they had previously seen at the Bukit Sulap tourist attraction, demonstrating a high level of familiarity with the site. This observation is further corroborated by interviews conducted between the researcher and student, as evidenced by the following exchange:

Researcher : What did you observe regarding the geometric shapes present in the Bukit Sulap tourist park?

Student : I recalled my visit there. As seen in the video, I identified cube, cuboid, cylinder, sphere, and prism.

This interview excerpt validates the accuracy of the student's depiction in Figure 1, confirming that students were able to correctly identify and name the geometric shapes observed in the Bukit Sulap Park, including cube, cuboid, cylinder, sphere, and prism.

### Activity 2: Examination of Surface Area using Cardboard Models

In Activity 2, students engaged in a hands-on exploration by selecting cardboard models of a cube and a cuboid. The purpose of this activity was to unfold these models into their corresponding nets to facilitate a deeper understanding of the concept of surface area for both shapes. The process and outcomes of this activity are illustrated in Figure 2.

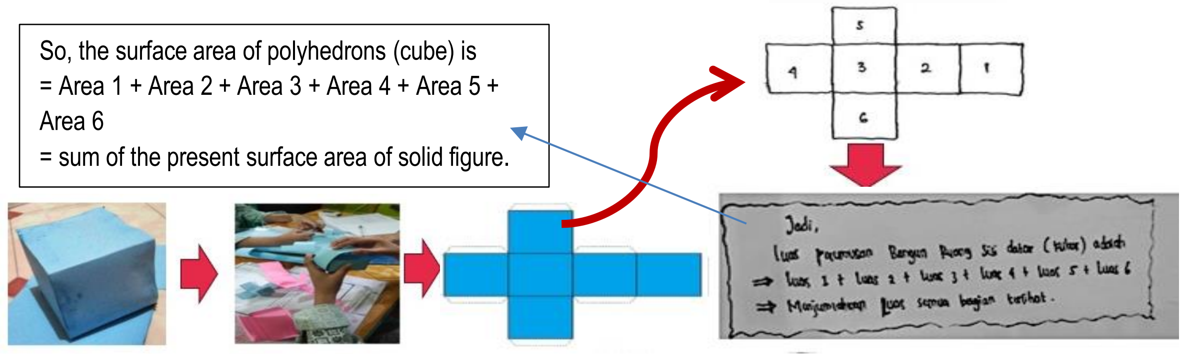



**Figure 2**. Students unfolding the cube and calculating the surface area

Figure 2 depicts the students as they unfold the cardboard cube into its net. This approach effectively aids students in grasping the concept of surface area, as it allows them to visualize and calculate the total surface area of the cube by summing the areas of its constituent faces. This understanding is further supported by the following interview excerpt:

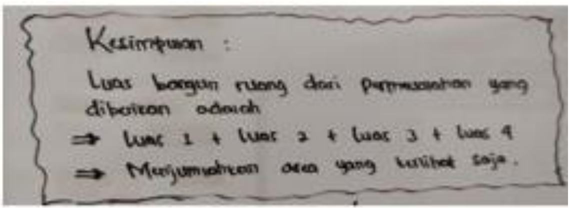
Researcher : How do you determine the surface area of polyhedron you mentioned earlier?

Student : Sure, sir. First, I selected the cardboard cube. I then unfolded it to obtain the net. By analyzing the net, I calculated the surface area as the sum of Area 1 + Area 2 + Area 3 + Area 4 + Area 5 + Area 6. This represents the total surface area of the cube, which includes all the visible surfaces.

The interview confirms that students effectively use the net of the cube to determine its surface area. This method involves summing the areas of all visible faces, thereby validating their understanding of the concept.

### Activity 3: Application of the Princess Silampari Statue Context

In Activity 3, students applied their understanding of surface area to a real-world context by using the Princess Silampari statue. The goal was to enhance their comprehension of the surface area of polyhedron. In this activity, students worked with a cube that was missing both a lid and a base. They were tasked with creating a net for this cube, as illustrated in Figure 3.


Conclusion:
The area of three-dimensional space of the given problem is
= Area 1 + Area 2 + Area 3 + Area 4
= Only sum of the visible area

**Figure 3**. Surface area calculation using the context of the Princess Silampari statue

Figure 3 shows the students as they arrange the net of the cube, which lacks a bottom and a cover. The students determined the surface area of this incomplete cube by calculating the sum of the areas of the four exposed faces. This approach is supported by the following interview excerpt:

Researcher : How did you determine the surface area of the figure based on the context of the Princess Silampari statue?

Student : I examined the surface of the cube that represents the base of the statue. It is a cube with neither a bottom nor a cover.

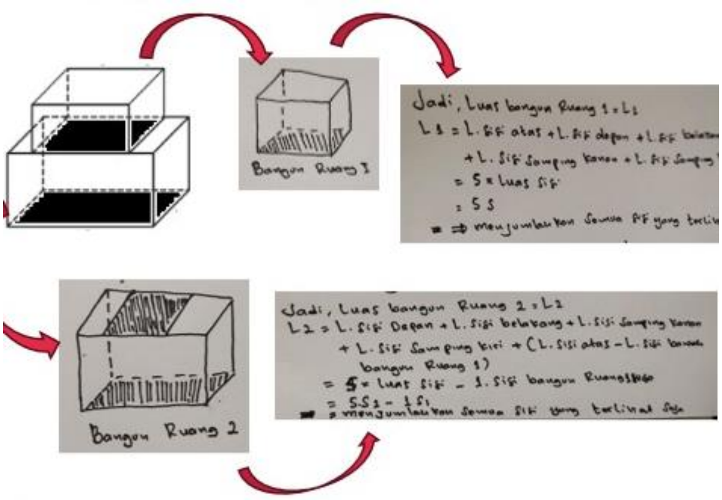
Researcher : How did you calculate the area?

Student : I used the cube grid without the lid and base. There are four squares, so I calculated the area by summing the areas of square 1, square 2, square 3, and square 4.

The interview confirms that students successfully calculated the surface area of the cube structure underlying the Silampari statue. This calculation involved summing the areas of the four visible squares, demonstrating their ability to apply theoretical knowledge to practical contexts.

### Activity 4: Determining the Surface Area of Composite Two-Dimensional Figures

In Activity 4, students engaged in calculating the surface area of composite two-dimensional figures in a formal manner and derived formulas for these calculations. The focus was on determining the surface area of shapes composed of both cuboids and cubes, as evidenced by the results presented in Figure 4.




So, the area of three-dimensional shapes 1 = $L_1$
$L_1$ = Top side area + Front side area +
Back side area + Right side area + Left side area
= 5 x (Side area)
= 5S
⇨ Adding up the areas of all visible sides.

So, the area of three-dimensional shapes 2 = $L_2$
$L_2$ = Front side area + Back side area +
Right side area + Left side area + (Top side area – Bottom side area of three-dimensional shapes 1
= 5 x (Side area) – 1 x Side area of three-dimensional shapes 1
= $5S_2 - 1S_1$
⇨ Adding up the areas of all visible sides only.

**Figure 4**. Surface area calculation for composite figures

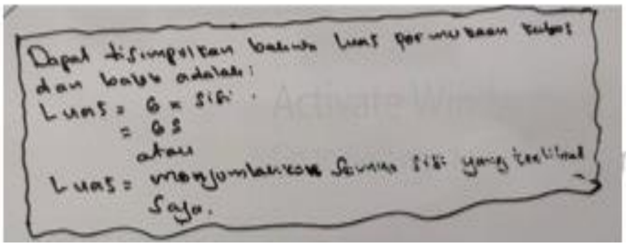
Figure 4 demonstrates the students' work in identifying a shape that combines both a cuboid and a cube, based on the context of Bukit Sulap Tourism. Students were instructed to calculate only the visible surface area of these composite shapes, with invisible surfaces shaded black. For Figure 1, which represents the cube, the calculation involved finding the surface area of the cube excluding its base. For Figure 2, the surface area was calculated by determining the surface area of the cuboid without its base and subtracting the area of one square face of the cube. This approach is confirmed through the following interview excerpt with the student:

Researcher : How do you determine the surface area of the combined shapes?
Student : Yes, sir. I identified the shape as a combination of a cuboid and a cube. In my worksheet (Figure 4), you can see the calculations I performed. For Figure 1, I calculated the surface area of the cube without the base, and for the cuboid, I excluded the base area and subtracted the area of the top face of the cube.
Student : The shaded area corresponds to the square face of the cube

The interview validates that student effectively computed the surface area of the composite figures by focusing solely on the visible surfaces. They correctly avoided calculating the area of the entire cuboid and cube surfaces and instead concentrated on the visible portions, demonstrating their understanding of the surface area of composite shapes.

### Activity 5: Deriving the Surface Area Formulas for Cuboids and Cubes

In the final activity, students were tasked with deriving the formulas for calculating the surface area of a cube and a cuboid. The students were required to conclude that the surface area of these shapes is determined by summing the areas of all visible faces only. The results of their conclusions are illustrated in Figure 5.




It can be concluded that the surface area of cube and cuboid is
Area = 6 x sides = 6s
or
Area = sum of all visible sides only

**Figure 5**. Student's conclusions on surface area formulas

Figure 5 presents the student's conclusions regarding the formula for the surface area of a polyhedron that combines both a cube and a cuboid. The student correctly identified that the surface area should be calculated by adding the areas of all visible sides of the shape. This conclusion was further supported by the following interview excerpt:

Researcher : How do you determine the surface area of combined shapes?
Student : I calculate it by summing all the visible surfaces. I applied this method to the combination of a cuboid and a cube.

The interview confirms that students accurately determined the surface area of the composite solid figure by focusing solely on the visible surfaces. They understood that it is not sufficient to simply add the total surface areas of the cuboid and cube without considering visibility, demonstrating their ability to correctly conclude the formula for surface area (Junaedi et al., 2021).

## Evaluation of Learning Trajectory Practicality

Observations were conducted to assess the practicality of implementing student learning trajectories using the Bukit Sulap tourism context. The evaluation focused on the effectiveness of these learning trajectories as applied to student learning groups in the experiment. The practicality of the learning trajectories was reviewed based on the implementation across various lesson plans (RPPs), as depicted in Figure 6.

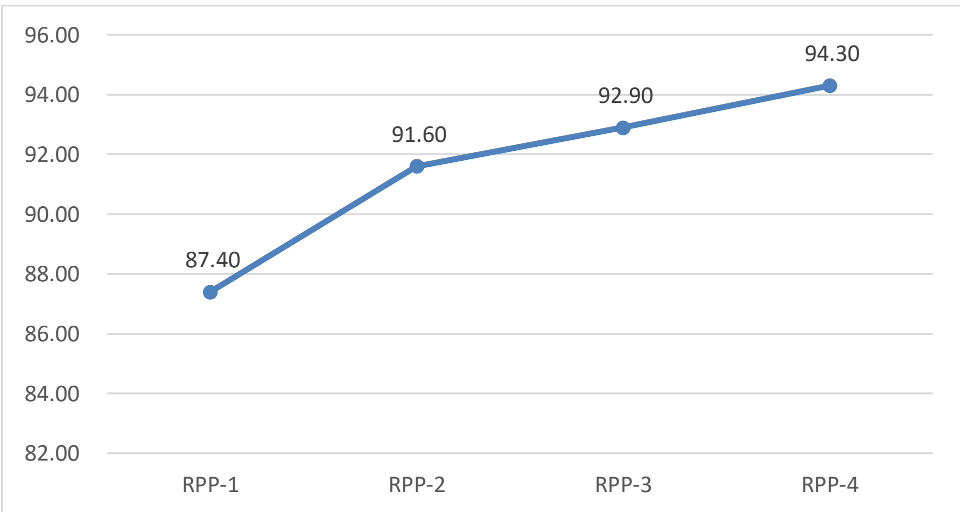



**Figure 6**. Implementation percentage of learning trajectories for each RPP

Figure 6 illustrates that the implementation of learning trajectories from RPP-1 through RPP-4, utilizing the Bukit Sulap tourism context, was executed effectively. The data reveals that the implementation rate increased from 87.40% in RPP-1 to 91.60% in RPP-2, reaching 92.90% in RPP-3, and achieving a high of 94.30% in RPP-4. This indicates that the overall implementation of the learning trajectory exceeded 85%, reflecting a high level of effectiveness. The detailed performance across various stages of the learning trajectory is shown in Figure 7.

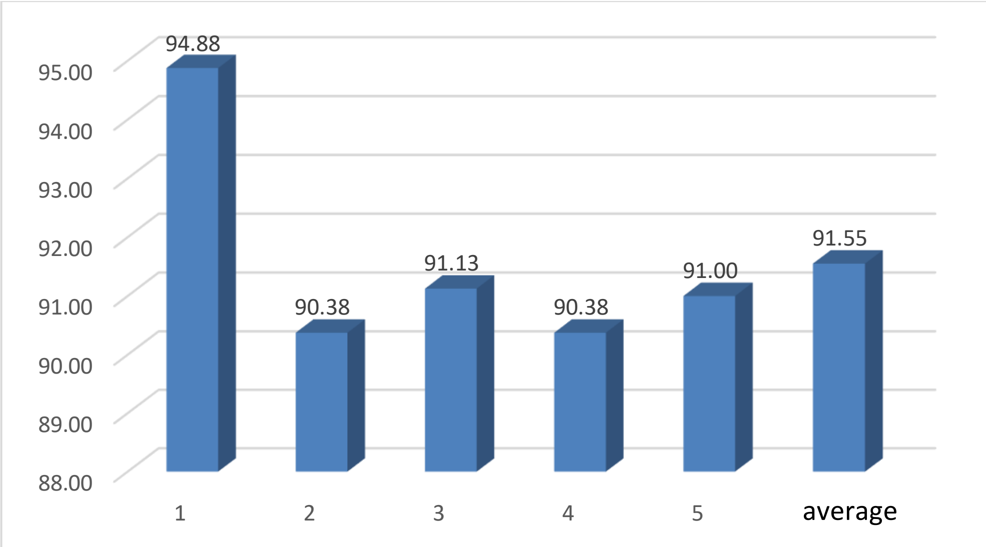



**Figure 7**. Percentage of activities completed in learning trajectory stages

Figure 7 demonstrates that 94.88% of students were proficient in observing the buildings at Bukit Sulap; 90.38% effectively selected cardboard cubes to determine the surface area of polyhedron; 91.13% utilized the context of the Princess Silampari statue successfully; 90.38% calculated the surface area of solid figures in formal terms accurately; and 91.00% concluded the formulas for the surface area of cubes and cuboids effectively. Overall, 91.55% of students successfully completed all stages of the learning trajectory.

The learning trajectory, utilizing the Bukit Sulap tourism context, is structured as follows:

1. Activity 1: Observing the Buildings at Bukit Sulap
2. Activity 2: Examination of Surface Area using Cardboard Models
3. Activity 3: Application of the Princess Silampari Statue Context
4. Activity 4: Determining the Surface Area of Composite Two-Dimensional Figures
5. Activity 5: Deriving the Surface Area Formulas for Cuboids and Cubes

This analysis confirms that the learning trajectory was effectively implemented, demonstrating its high practicality. The application of this local instructional theory (LIT) for teaching surface area using the Bukit Sulap tourism context addresses common errors associated with calculating the surface area of combined cuboids and cubes, as noted by Quiroz et al. (2015) and Richit et al. (2021). Specifically, it corrects the oversight of including the base area of the cuboid and the areas covered by the cube's side faces, by using the context of the Princess Silampari Statue to guide accurate calculations.

## Integration of Bukit Sulap Tourist Context in Learning Geometry

The Bukit Sulap tourist attraction offers breathtaking natural landscapes, which enhance students' engagement in learning geometry through experiential travel. The rugged terrain and dramatic vistas provide a compelling backdrop that stimulates interest and motivation among elementary school students as they explore geometric concepts in a real-world setting (Sukasno et al., 2024). Understanding the surface area is crucial in various engineering and design fields, including architecture, vehicle manufacturing, and product packaging (Velten et al., 2024). This research highlights the necessity for students to grasp fundamental formulas for calculating the surface areas of common geometric shapes—such as cubes, cuboids, cylinders, and spheres—to effectively apply these concepts in more complex scenarios (Arifah & Retnawati, 2020; Kurniawati & Amir, 2022).

A strategic approach to calculating the surface area involves decomposing complex shapes into simpler, manageable components (Widodo et al., 2018; Naidoo & Kapofu, 2020). Factors such as dimensions, geometric shape, and orientation significantly impact the surface area of an object, necessitating careful consideration in practical applications (Seah & Home, 2020; Junaedi et al., 2021; Nailurrohmah & Murdiyani, 2022). Accurate surface area calculations are essential for effective design and analysis across diverse applications (Taylor & Jones, 2009; Nagy-Kondor & Esmailnia, 2021). The foundational knowledge gained from understanding these geometric concepts equips students to tackle practical design challenges and problem-solving tasks in the future.

Bukit Sulap Lubuklinggau provides a promising context for students to learn about the surface area of cubes and cuboids interactively. By leveraging the natural and architectural features within the tourist environment, such as building facades, cliff formations, and natural rock structures, students can engage in hands-on observation, measurement, and calculation of various polyhedron (Woodward et al., 2012; Nagy-Kondor & Esmailnia, 2021; Junaedi et al., 2021). This student-centered approach facilitates a deeper comprehension of mathematical concepts and fosters critical thinking and creative problem-solving skills (Sukestiyarno et al., 2023). Additionally, learning in this context can instill a greater appreciation for the environment, while also enhancing students' collaboration and communication skills (Schwarz et al., 2021; Hendriana et al., 2022).

Bukit Sulap Lubuklinggau is intrinsically linked to the educational goals of understanding the surface area of geometric shapes. Students can directly observe and interact with geometric forms present in the tourist environment, such as large rock faces, cliff edges, and unique building structures (Hendroanto et al., 2018; Sagita et al., 2021). Utilizing Bukit Sulap as a learning context allows students to apply geometric concepts in a tangible manner, improving their ability to connect theoretical knowledge with real-world phenomena (Apsari et al., 2020; Sukestiyarno et al., 2023). Through visual exploration, students can identify geometric shapes around the tourist area and perform measurements using tools like tape measures or rulers. This hands-on experience is further enriched by creating simple geometric models from natural materials, which aids in practicing surface area calculations (Hwang & Hu, 2013; Sukirwan et al., 2018; Hwang et al., 2020). Teachers can support this process by facilitating interactive discussions on the relationship between surface area concepts and the surrounding geometric shapes, as well as addressing problem-solving related to the tourist context (Sukestiyarno et al., 2023; Hartutik et al., 2024). Finally, the context of Bukit Sulap serves as a valuable first step in learning about geometric shapes, aligning with the principles of Indonesian Realistic Mathematics Education (IRME). By integrating this tourism context into mathematics education, students engage in meaningful learning experiences that combine travel with academic exploration.

## CONCLUSION

This study investigated the impact of using the Bukit Sulap tourism context on students' understanding of the surface area of combined cuboids and cubes. Initially, students encountered difficulties in accurately determining the surface area of these combined polyhedra. However, the implementation of a learning trajectory grounded in the Bukit Sulap context significantly enhanced their problem-solving abilities. By observing the buildings through prepared media such as pictures and videos, students could identify geometric shapes, conceptualize their nets, and apply the surface area formulas effectively. The Indonesian Realistic Mathematics Education (IRME) approach proved to be an effective pedagogical strategy, as it facilitated students' progression from concrete to abstract mathematical concepts, thereby improving their comprehension of surface area calculations for solid figures. The contextualization of learning within the Bukit Sulap tourism environment demonstrated its relevance and efficacy in making abstract concepts more accessible and engaging for students.

Despite the positive outcomes, this study has certain limitations. The research was confined to a specific location, Bukit Sulap, and focused on a limited range of geometric shapes—cuboids and cubes. This narrow focus may affect the generalizability of the findings to other contexts or more complex polyhedra. Additionally, the study was conducted with a small sample of elementary school students, which may not represent the broader student population. The duration and scope of the study also limited the depth of exploration into other potential factors influencing students' understanding of surface area.

Future research should address these limitations by exploring a broader range of geometric shapes and contexts to enhance the generalizability of the findings. Expanding the sample size and including diverse educational settings could provide more comprehensive insights into the effectiveness of contextual learning approaches. Additionally, investigating the long-term impact of using tourism contexts on students' mathematical understanding and problem-solving skills would be valuable. Incorporating feedback from educators on the practical application of such contextual approaches could further refine and enhance the effectiveness of the IRME strategy in various teaching environments.

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### Declarations

| | | |
|---|---|---|
| Author Contribution | : | IA: Conceptualization, Writing - Original Draft, Editing, Formal analysis, Methodology, and Visualization.<br>Z: Writing - Review & Editing, Methodology, Validation, and Supervision.<br>RIIP: Writing - Review & Editing, Formal analysis, Validation, and Supervision<br>S: Validation and Supervision. |
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Conflict of Interest : The authors declare no conflict of interest.

Additional Information : Additional information is available for this paper.

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