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Development of Teaching Materials on Surface Area of Polyhedron Using Traditional Market Snacks Context and MathCityMap

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Abstract

This study aims to develop mathematics teaching materials on polyhedron surface area using traditional: Jadah, Wajik, Lapet, and Barongko. The cakes were selected for their similarity to geometric shapes as an ethnomathematical link to local culture. This teaching material uses MathCityMap with four activities to find the surface area based on traditional cakes used in different locations. The research employed a Research and Development (R&D) design with the ADDIE model, which includes the stages of analysis, design, development, implementation, and evaluation. Before limited implementation, the materials were validated by mathematics teachers and PPG Mathematics Education students on content, appearance, and language. The validation results showed that the teaching materials were 96.5% feasible and practical to use. Furthermore, implementation was carried out on a limited basis with 20 Mathematics Education students. It went well and all participants understood every problem presented. Finally, evaluation was used to improve teaching materials based on suggestions from validators.

Keywords: *teaching material; mathematics; ethnomathematics; polyhedron*

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INTRODUCTION

The learning process in the classroom is a space for students to build understanding through meaningful experiences. The learning process is a learning activity that requires planning, methods, teaching materials, and media that are suitable for learning activities (Putria et al., 2020). Educators must be able to design appropriate learning tools, including teaching materials that are in line with the applied curriculum (Senjayawati & Kadarisma, 2020). The independent curriculum provides flexibility for educators in developing learning according to the needs and characteristics of students. However, in reality, learning is still often done conventionally or the lecture method with the delivery of material that is far from students' daily lives. In fact, the use of contexts that are close to everyday life can help students understand and interpret the material well, especially in mathematics learning. In this case, learning can be done through a culture-based approach called ethnomathematics. This approach allows students not only to receive information, but to build understanding and meaning from the information obtained (Akmalia et al., 2023). However, the utilization of culture in mathematics teaching materials is still relatively

minimal. The lack of local culture-based teaching materials is a challenge, especially in integrating cultural elements into interesting and meaningful mathematics learning (Harahap, 2021).

Education and culture are aspects that cannot be avoided. Culture as a unity of values, norms, and traditions that apply in society is the basis for education (Ayuningtyas & Setiana, 2019). Indonesia has a variety of cultures, one of which is traditional food which has more than five thousand recipes. However, the existence of modern snacks or cakes that are increasingly widespread causes children to recognize less typical Indonesian food. Therefore, it is important to introduce traditional food to students during Mathematics learning. The use of traditional food as a context in learning helps students understand the material through real experiences. Contextual learning helps learners relate material to situations they often encounter and solve problems in various contexts (Muhartini et al., 2023).

One of the relevant contexts is local culture such as traditional food that has the potential of learning media on geometry material on the topic of polyhedron. Traditional food has a variety of shapes such as blocks, cubes, pyramids, and prisms so it is suitable to be used as a representation of flat space. Besides being easy to find, traditional cakes are also known by students. The use of traditional cakes in the ethnomathematics approach is the right contextual choice to develop meaningful teaching materials. Ethnomathematics can also change the view that mathematics is rigid and organized into something more appropriate in life. Thus, ethnomathematics is expected to improve students' ability to learn mathematics optimally (Deby & Yahfizham, 2023).

The use of ethnomathematics contributes to a better understanding for learners and creates a fun learning experience (Soebagyo et al., 2021). However, there are still students who think math is boring and difficult, so they are less motivated to learn. According to Siagian (2017), math learning will be more effective if it starts from students' experiences. Meanwhile, according to (Gazali & Atsnan, 2017), learning mathematics if it is related to problems that are often encountered, it will be easier for students to construct knowledge and not limited to memorizing formulas. The use of traditional cakes such as Wajik, Jadah, Barongko, and Lapet can help students develop creative thinking, problem solving, and reasoning skills to obtain the formula for the surface area of polyhedron. Moreover, traditional food is now easier to find in various regions, so it is more relevant to be used as a learning context. This can help the local community get to know other regional specialties. This approach is the right solution in developing student understanding, student motivation, and fostering love for local culture. Therefore, in introducing the process of finding the surface area of polyhedron, it will be approached with ethnomathematics-based learning, namely traditional cakes.

Polyhedrons include cubes, blocks, pyramids and prisms. The shapes of pyramids and prisms used are rectangular pyramids and triangular prisms. Jadah is used to represent the cube, wajik represents the block, lapet represents the quadrilateral pyramid, and barangko represents the triangular prism. The culture will later be conveyed to students and invite students to explore the shape and surface area of these spaces. One of the learning tools that is often used is teaching materials. Teaching materials help educators and students because they contain material information that is organized in detail (Wahyudi, 2023).

One important component in learning is teaching materials in the form of Student Worksheet (SW). The purpose of SW is as a learning tool, reinforcement, and instructions for finding concepts, applying, and integrating the various concepts found (Prastowo, 2015). Therefore, SW is important in every learning process, especially in mathematics learning. SW can be designed, structured, and developed following the situation and conditions in the dynamics of learning (Umbaryati, 2016). One of the teaching materials

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on SW that will be used is MathCityMap (MCM), a GPS-based application that allows learning outside the classroom. MCM provides the location point of the problem to be solved. Learning using MCM helps learners to use their knowledge, relate theory to real life, and provide interesting challenges (Anggraini et al., 2023). The use of MCM in ethnomathematics problems will make it easier for students to develop the ability to solve mathematical problems mathematically and cultural recognition in Indonesia. In the material of the surface area of polyhedron, MCM is used to plot the placement points of traditional food used in the material of polyhedron.

Some researchers who have developed ethnomathematics-based teaching materials are research conducted by Astuti et al. (2021) developing SW with a cultural context on polyhedron material using food culture and traditional musical instruments which has a positive impact on learning because it is easily understood by students. Then, research conducted by Luthfi & Rakhmawati (2022) related to the development of ethnomathematics-based SW on curved-sided space building material using market snacks that can be used in the learning process because it is practical and can improve student learning outcomes. The use of ethnomathematics-based MCM can also be used to develop meaningful learning activities as done by Maheswari et al. (2023) who developed an ethnomathematics-based MCM on flat building material in the context of Fort Vredeburg.

These findings are the basis for researchers to develop teaching materials in the form of MCM-based SW with an ethnomathematics approach using the context of traditional cakes on the surface area of polyhedron. Meanwhile, the use of MCM is expected to improve teacher strategies in learning, encourage motivation, interest, and create fun learning for students. Thus, this study aims to develop ethnomathematics based teaching materials with MathCityMap while introducing culture to students through traditional cakes.

METHODS

The method used in this research is Research and Development (R&D). This research aims to produce products in the form of teaching materials for Space Building materials, especially the surface area of polyhedron. The research model conducted is ADDIE which has stages including Analyze, Design, Development, Implement, and Evaluate (Branson et al., 1975). In this study, the instruments used were SW assessment rubrics and teaching material validation questionnaires.

Stage 1 Analyze, this stage is carried out to collect information needed to support the manufacture of teaching materials to produce products. Educational games are the products produced in this study. Researchers analyzed the needs of learners such as the material and curriculum used by means of literature studies, analysis of software requirements and the location of Math Trails, in this case the location used is Campus III of Sanata Dharma University because this application is designed to simulate learning in a school environment. Therefore, the selection of the campus area is a major consideration in this research.

Stage 2 Design, analyzing teaching materials with MCM, namely designing material and questions about the surface area of polyhedron. The material presented is based on Merdeka Curriculum learning. At the end of this stage, ethnomathematics teaching materials with MCM were successfully compiled.

Stage 3 Development, making the design that has been made in stage 2. The result of this stage is an educational game. Development of each activity in teaching materials is carried out, such as the development of educational games that will be made using MathCityMap, namely making questions on each trail.

At this stage, researchers measured the feasibility of products assessed by material

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and media experts from junior high school teachers and Mathematics Education PPG students. There are several aspects that are assessed with several statements. The score categories are 1 to 4 with 1 representing very poor / strongly disagree and 4 representing very good / strongly agree, the following is how the percentage of the score obtained is calculated each aspect.

$$\frac{number\ of\ scores\ obtained}{total\ score} \times 100\%$$

The aspects assessed on the material are language feasibility, content feasibility, presentation feasibility, and ethnomathematics. In media validation, the aspects assessed are design feasibility, suitability of using learning media, feasibility of layout, and ethnomathematics. The data from the validator's assessment were analyzed by calculating the percentage of scores obtained based on predetermined criteria. The criteria table according to Riduwan (2015) is as follows:

Table 1. Criteria for Interpretation of Material and Media Validation Scores

Percentage	Criteria
$80\% < P \leq 100\%$	Very Feasible
$60\% < P \leq 80\%$	Worth
$40\% < P \leq 60\%$	Decent Enough
$20\% < P \leq 40\%$	Not Feasible
$0\% < P \leq 20\%$	Very Unfit

Stage 4 Implement, testing educational games as an application of products that have been made to find out the follow-up of teaching materials. The implementation stage will use feedback conducted by 20 Mathematics Education students class of 2021.

Stage 5 Evaluate, ensuring the product that has been made is in accordance with the learning objectives have been set and focuses on seeing the readiness of the instrument made is feasible and ready. This is done in order to achieve the expected learning objectives. At this stage will use several assessment instruments to evaluate teaching materials using MathCityMap. Assessment instruments are carried out by validating teaching materials and materials.

RESULTS AND DISCUSSION

Based on the research process carried out, the researcher wrote the results of the analysis of the development of teaching materials using ADDIE model.

Analyze Stage

Content/Culture Needs Analysis, all teaching materials created use the cultural context of traditional food, especially traditional cakes from the islands of Java, Sumatra, and Sulawesi. The traditional cakes used are *Jadah*, *Wajik*, *Lapet*, and *Barongko*. Raising the context of traditional food as a problem in learning will make students understand the material. Things that are close to learners can be easily imagined because they are often encountered. Besides being close to learners, this context can help in local knowledge about culture so that they can appreciate and preserve culture.

Jadah is a traditional food that is said to be favored by Sri Sultan Hamengkubuwono VII. Originally, *jadah* was a secret food of the Yogyakarta Palace and could only be enjoyed by relatives of the Palace. In addition, *jadah* is also part of the groom's offering to the bride with the hope thah the couple will become as close as the sticky *jadah* in the hand. It is made from glutinous rice cooked with grated coconut (Alya, 2019).

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Then, *wajik* represents the block space. This traditional *wajik* cake has a slightly soft texture and is usually brown in color. Its rectangular shape is the basis for the Javanes name *wajik* cake. It is usually served on special occasions, such as proposals and weddings. In these events, *wajik* cake symbolizes that the couple will last untill grandparents because of its sticky texture. Not only that, *wajik* cake can also symbolize patience in life.

The rectangular pyramid is represented using a *lapet* cake which is a traditional cake typical of North Sumatra, especially the Toba Batak tribe. *Lapet* is made from three ingredients: rice flour, grated coconut, and palm sugar. *Lapet* cake is wrapped using banana leaves that resemble a rectangular pyramid. *Lapet* is not served during mourning because its sweetness symbolizes happiness. It is often served to guests or at major celebrations in Toba Batak culture (Simanullang et al., 2022).

The triangular prism is represented by a traditional South Sulawesi cake called *Barongko. Barongko* resembles a triangular prism shape made from a micture of bananas, eggs, and coconut milk. It is usually served at weddings (Pradiati et al., 2023). The traditional cake will be presented to students and invite students to explore the shape and surface area of the cuboid, block, quadrilateral pyramid, and triangular prism.

Material Analysis, at this stage, the development of learning materials is carried out, with consist of the learning outcomes according to the Ministry of Education and Culture for phase D of the Merdeka Curriculum, the learning objectives, and indicator of success, as shown in the following table.

Table 2. Teaching Material Design

Learning Outcomes	Learning Objectives	Indicators of Success
By the end of phase D, learners can create nets of spatial figures (prisms, tube, pyramids, and cones) and build them from nets. Determine the surface area and volume of shapes to solve related problems, explain the effect of proportional change of shape on length, area, and/or volume.	1. With the nets and working on SW using *MathCityMap* with a cultural approach, namely traditional food, especially on *Jadah, Wajik, Barongko,* and *Lapet* cakes, it is hoped that students can find the formula for the surface area of cubes, blocks, prisms, and lids. 2. Through the culturally based practice questions, learners can aplly the formula for the surface area of spatial building.	1. Learners can know the meaning of surface area. 2. Learners can find the surface area of polyhedron. 3. Learners can apply the surface area formula of flate-sided space.

Table 2 is a design of teaching materials with MCM activities that aim to determine the surface area of the flat side of traditional foods, namely *Jadah*, *Wajik*, *Lapet*, and *Barongko.* The material has been adjusted based on the minimum class that can participate in this activity, namely grade IX Students.

Software Requirements Analysis, this stage aims to analyze the functional and non-functional needs of the system, prerequisites, and software application capabilities. The software used is *MathCityMap.* The application is equipped with features that help researchers create learning dynamics outside the classroom, namely: (1) Math trail, is a feature used to determine the location used for learning activities. This feature can write titles and descriptions, time required, setting used, codes to access math trails, and input tasks that have been created in tasks for students; (2) Task, this feature is a feature for creating tasks/questions according to the material to be discussed. In this section there are several features to make it easier to complie questions, namely: (a) Basic data, used to writed task titles and questions; (b) Position & AR, used to determine the location point

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that will be used to work on the problem; (c) Answer format and solution, used to specify the answer type, answer ky, and solution displayed. Answer types can be interval, multiple choice, number, and fill the blanks; (d) Stepped Hints, used to display help/instructions from question. In this feature, it can provide three hints in the form of text, images, or videos; (e) Task metadata, used to describe the object, class, tools used, and hashtags of the task; (f) Author, used to write the name and email of the task creator.

Math Trails Location Analysis, the Math Trails location used by researchers is a traditional maeket. However, because the trial of this research was limited to 19 Mathematics Education student of class 2021, the location used was the Campus III enviroment of Sanata Dharma University, Yogyakarta. The selected stopping point can be accessed easily by stundents and makes it possible to complete the tasks according to the trails and achieve the desired goals.

Design Stage

In the design activity, researchers designed the content of teaching materials and MCM. The design of MCM is adjusted to the indicators to be achieved listed in Table 3. At the design stage of implementation in the field, at each stop, food is given according to the questions as a learning medium.

Table 3. MathCityMap Design

Competency Indicator	Contextual Problem	Time	Related Materials
Able to analyze the given problem and determine the surface area of each polyhedron. And apply the net-the net of building space.	1. Have you met Mr. Wajik yet? How do you think you can calculate the surface area of Mr. Wajik? Then, calculate the surface area! Write your solution on the paper! Use your knowledge from the previous meeting about the jigsaw puzzle!	10 minutes	Surface Area of polyhedron
	2. This time you arrive at Jadah's house. Just like before, how do you think you can find Jadah's surface area? Write your answer on the paper! Then, what is the surface area?	10 minutes	
	3. What do you think the Lapet resembles? Calculate the surface area of the Lapet. Write your solution on the paper!	10 minutes	
	4. In this Barangkos House, you are invited to discover how to find the surface area of Barongko. Find the method and calculate the surface area of the Barongko! Write down the answer to the surface area that you have found below and the solution on the paper!	10 minutes	

Develop Stage

The development of teaching materials is carried out with several activities, namely *Math Trails* activities, activities in the field, and the improvement stage with the direction of experts, namely teachers and students.

Math Trails Activity Development, compilation of *Math Trails* at Sanata Dharma University Campus 3 with 4 stopping points. Each point has 1 problem, and students are asked to solve each problem by considering the shape of the traditional cake that has been

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provided. *Math Trails* activities can be obtained with the *MathCityMap* application with code 1420155. Students will be challenged in solving each problem given and students are expected to come to Sanata Dharma University Campus 3. Assignments can be given individually or in groups. If given in groups, only group representatives *log in* to the application. The problems presented and alternative solutions are described as follows:

First Problem: Students were asked to determine the surface area of a diamond cake. This is interesting because students are invited to think about how to calculate the surface area of the diamond cake that has been provided. Figure 1 is the first problem located in the north gazebo of the pond.

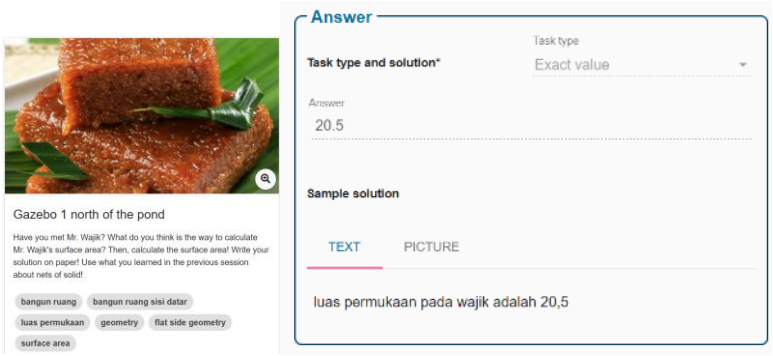

Figure 1. First Problem and Answer

Alternative solutions: Students can solve it by measuring each length, width, and height of the wajik cake. Then, students find the formula and how to calculate the surface area of the diamond cake written on the paper.

Second Problem: Students were asked to determine the surface area of a Jadah cake. This is interesting because students are invited to think about how to calculate the surface area of the Jadah cake that has been provided. The second problem point in the hexagon gazebo is shown in Figure 2.

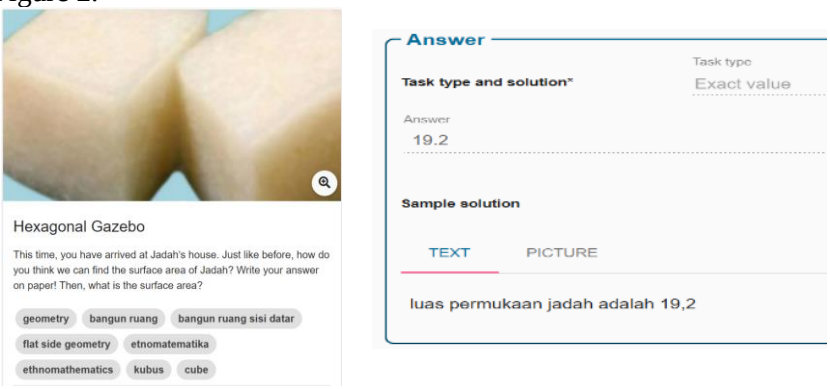

Figure 2. Second Problem and Answer

Alternative solutions: Students can solve it by measuring each length, width, and height of the *jadah* cake. Then, students find the formula and how to calculate the surface area of the *jadah* cake written on the paper.

Third Problem: Students were asked to determine the surface area of a *lapet* cake. This is interesting because students are invited to think about how to calculae the surface area of the cake that has been provided. The third problem point in the Gazebo can be seen in Figure 3.

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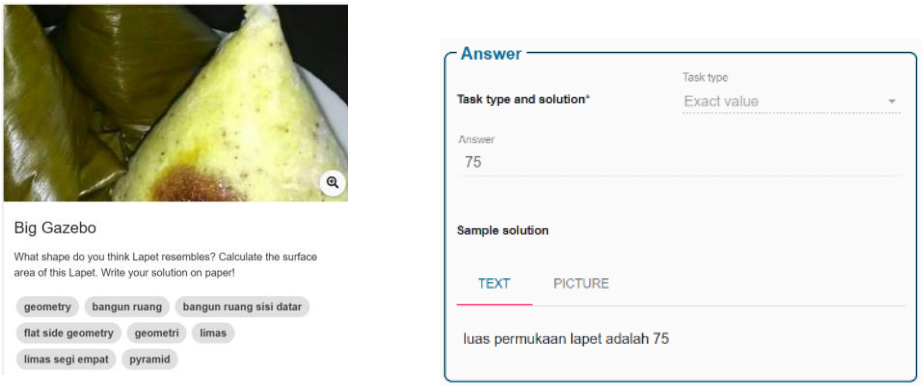

Figure 3. Third Problem and Answer

Alternative solutions: Students can solve it by measuring each length, width, and height of the *lapet* cake. Then, students find the formula and how to calculate the surface area of the *lapet* cake written on the paper.

Fourth Problem: Students were asked to determine the surface area of a *barongko* cake. This became interesting because students were invited to think about how to calculate the surface area of the *barongko* caje that had been provided. The fourth problem point in Gazebo 2 South can be seen in Figure 4.

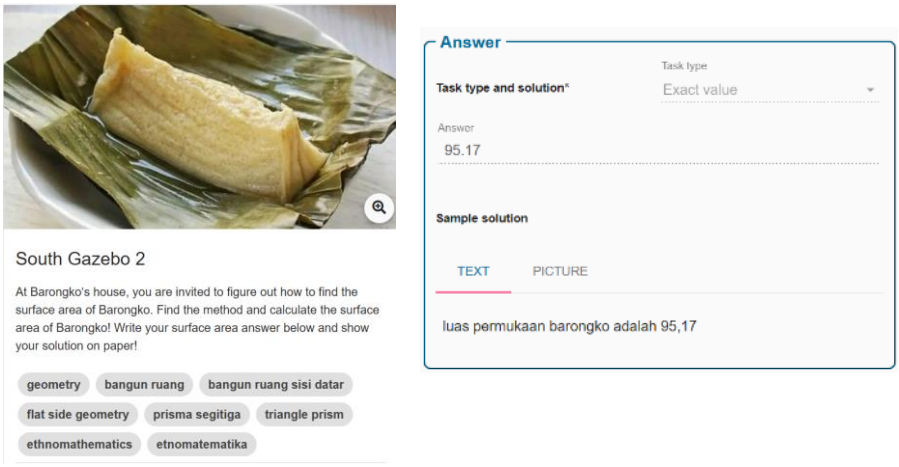

Figure 4. Fourth Problem and Answer

Alternative solutions: Students can solve it by measuring each length, width, and height of the *barongko* cake. Then, students find the formula and how to calculate the surface area of the *barongko* cake written on the paper.

In each alternative, students directly measured the length, width, and height of the traditional cakes provided. In the process of finding the formula, students are asked to calculate the area of all the nets of the spaces represented by the four types of traditional cakes. Furthermore, students are asked to observe whether there is a pattern from the results of the calculation of the net area. The teacher then facilitates students to convey the ideas they find during group presentations and at the end of the lesson the teacher provides feedback on the findings of each group.

Feasibility Validation, the feasibility assessment of this teaching material was carried out by material and media experts, namely junior high school mathematics teachers and Mathematics Education PPG students. The results of the development of teaching

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materials with the R&D method and the ADDIE model are considered very feasible to use in learning which is explained in the following table:

Table 4. Material Validation Results

Validator	Assessment Aspect	Total Score	Percentage	Criteria
Expert Material	Language Feasibility	18	75%	Worth
	Content Feasibility	26	81,25%	Very Feasible
	Presentation Feasibility	21	87,5%	Very Feasible
	Ethnomathematics	18	75%	Worth
Total		**83**	**79,81%**	**Worth**

Table 5. Media Validation Results

Validator	Assessment Aspect	Total Score	Percentage	Criteria
Expert Media	Graphic Feasibility (Design)	50	89,29%	Very Feasible
	Appropriateness of Learning Media Use	16	66,67%	Worth
	Layout Feasibility	26	81,25%	Very Feasible
	Ethnomathematics	18	75%	Worth
Total		**110**	**80,89%**	**Very Feasible**

Table 6. Analysis of Teaching Material Validation

No	Validator	Total Score	Percentage	Criteria
1	Material Expert	83	96,5%	Very Feasible
2	Media Expert	110		

Based on the analysis of teaching material validation, it states that this teaching material has met the feasibility of language, content, presentation, graphics (design), use of learning media, and ethnomathematics. The percentage of material validation of 79.81% means that it is feasible in learning. Not only that, the percentage of media validation of 89.89% means that it is very feasible to support learning. PPG students rated 1 (disagree) and commented that the learning media has not achieved the learning objectives because it has not facilitated the discovery of formulas, only determined the surface area and suggested changing the learning objectives. Then, the validation analysis has a percentage of 96.5%. This shows that the teaching materials that have been made are very feasible to use on the material of the surface area of polyhedron.

Implementation Stage

This stage was tested with 20 students of Mathematics Education Class of 2021. However, because the trial was limited, researchers were unable to practice in the market, so the practice was carried out in the campus area. The purpose of this implementation stage is to ensure that the design and development of teaching materials can be applied effectively. In addition, it can measure the extent to which learning objectives are achieved and make improvements if there are parts that need to be improved. Furthermore, this phase also aims to measure the extent to which learning objectives have been achieved and to make improvements if any areas need improvement (Azwar et al., 2017).

The integration of cultural elements into learning aligns with culturally responsive teaching and ethnomathematics approaches, which have been proven to improve students' motivation, conceptual understanding, and problem-solving skills (Harahap et al., 2020).

Researchers conduct learning practices with students in the classroom in accordance with the teaching modules that have been prepared. The initial activity is to open the learning by greeting students. Then, make an apperception about the culture used, namely

Lapet, Barongko, Jadah, and Wajik. After that, students work on activities in MCM in groups of 4–5 students so that there are 4 groups. At this stage, the researcher who became the teacher guided the group discussion activities. Each group was asked to determine the surface area of polyhedron written on paper. However, in the MCM answer column, the group only wrote how much the surface area of the flat shape was. This collaborative activity aligns with the findings of Maulidawati et al. (2020), who stated that cooperative learning can improve students' mathematical and connection ability.

After doing these activities, each group was asked to present the results of the discussion in front of the class and other groups gave responses or questions. The results of the discussion on MCM obtained that each group got the maximum score of 400. This process aligns with the cooperative learning model, which prioritizes interaction between students to strengthen conceptual understanding (Syamsuddin, 2018).

Students' reactions to the activities were very good and enthusiastic. They were enthusiastic in carrying out the activities because of the interesting teaching materials. This was shown by the activeness of students asking questions to the teacher and cooperation in groups and comments on the forms given. In addition, when the teacher asked questions, students were active to answer and when presenting the results of each group, all students listened carefully.

At the end of the pilot test, some students were asked to fill out a *Google Form* as a response and suggestion for teaching materials. A more detailed explanation is in Table 7.

Table 7. Teaching Material Responses and Suggestions

No.	Response and Suggestion
1.	The size of the props and those listed in the application need to be corrected because the size in the application and calculating are different. So the results we get are different from the results in the application.
2.	In determining the surface area, the SW provided has contained instructions and steps in determining the surface area to make it easier for students.
3.	Interesting learning through traditional food makes students recognize traditional food. Overall, it was interesting.
4.	The learning process is good, but the *Math City Map* should be improved. Such as the placement location is sorted according to the easier to harder space and the answer column. It would be nice to be given a range, where the answers can vary because the size of the object must be different from the size results of each group.
5.	It is in accordance with the material presented, the concept and culture are already there, and it is easy for students to understand.

Based on the suggestions given, the researcher improved the size of the props in the application to minimize calculation errors. The researcher also realized that each student could obtain different measurement results on an object. Therefore, the researcher changed the scoring system in the application, namely by not displaying the final score automatically to students. Instead, the teacher will accumulate scores based on the calculation results obtained.

Evaluation Stage

Evaluation of teaching materials is carried out in accordance with suggestions from validators. In this study, several revisions were made, namely changing the learning objectives and design of teaching materials in accordance with the culture used. Evaluation is a crucial stage in developing teaching materials to ensure alignment between learning objectives, materials, and student needs (Neri et al., 2023). The suggestions for improvement from the validator are as follows**:** **(**1) Overall, the learning media is interesting. It allows students to be active and move in finding information from the

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problems given. This finding aligns with the constructivist perspective, which emphasizes active student involvement in constructing knowledge through learning experiences (Papageorgiou et al., 2025). However, this learning media has not fully facilitated the discovery of the surface area formula. The use of culture has not fully facilitated the discovery of the formula. Culture here is still used to determine the surface area. Suggestions for improvement replace the learning objectives by determining the surface area. Previously, the learning objective of this teaching material was to find the surface area; (2) Overall, the teaching materials use food image media. This approach aligns with the principles of Contextual Teaching and Learning (CTL), which link subject matter to students' real-life experiences, making learning more meaningful (Misqa et al., 2024; Amidi et al., 2025). This becomes its own attraction for students in learning about building space. The design of teaching materials used before being assessed by the validator is forest nuanced. The validator gave suggestions so that the design theme was in accordance with the topic brought, namely the traditional market. The use of a cultural context close to students' lives aligns with the culturally responsive teaching approach, which has been proven to increase learning motivation, material relevance, and conceptual understanding (Abdulrahim & Orosco, 2020).

Therefore, researchers improved the design of teaching materials with traditional market nuances. The improved teaching materials can be seen at https://bit.ly/BahanAjarLuasPermukaan.

CONCLUSION AND SUGGESTIONS

The development of teaching materials on the surface area of polyhedron based on ethnomathematics with MathCityMap is carried out to build contextual and meaningful learning for students. The development process was carried out through the ADDIE stage which resulted in several findings. At the analysis stage, learning needs were analyzed based on curriculum material, cultural context in the form of traditional cakes, and MathCityMap software. The design stage produces the initial design of Student Worksheet and MCM which includes competency indicators, contextual questions, time allocation, and integration of the forms of jadah, wajik, barongko, and lapet. At the development stage, teaching materials were further developed by inputting problems into the MCM platform, compiling problem location points, and conducting expert validation. The validation results showed that the teaching materials were in the very feasible category with a feasibility percentage of 96.5%. The implementation stage was carried out with a limited trial to 20 mathematics education students. The results of the trial showed that the teaching materials were classified as interesting, easy to understand, motivated students because they combined local culture and outdoor learning, and the learning outcomes of each group got the maximum score of 400. The evaluation stage was carried out by revising the learning objectives and visual design of teaching materials in accordance with the input of validators and suggestions from students so that the teaching materials became more suitable for use in the classroom.

Overall, ethnomathematics-based learning helps students build understanding of mathematical concepts through real experiences that are close to their culture. Meanwhile, the use of MathCityMap as a learning media enriches learning activities through explorative activities outside the classroom. The combination of ethnomathematics and MCM can encourage interest in learning, increase student involvement, and introduce and preserve local culture in the mathematics learning process. Thus, this research contributes to the development of ethnomathematics-based mathematics teaching materials, the use of technology, and becomes a reference at the junior high school level.

Suggestion for researchers who wish to develop ethnomathematics-based teaching

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materials on the surface area of flat-sided shapes for ninth-grade junior high school students is that these materials should be directly implementable in the school environment, for example through observation activities at markets or bakeries to link the material to the local cultural context. This activity is believed to increase students' interest in learning about surface area concepts. Researchers may also conduct long-term effectiveness studies to measure the extent to which the use of ethnomathematics-based teaching materials influences students' understanding of mathematical concepts, their engagement in learning, and improvements in academic outcomes. In addition, exploratory qualitative research can be conducted to explore the responses, perceptions, and interests of students and teachers toward teaching materials that incorporate local cultural elements. Further development can also be directed toward teaching materials for curved surface area to expand the application of ethnomathematics in mathematics learning. The implications of using ethnomathematics-based teaching materials on the mathematics curriculum include contextualizing the material, strengthening the Merdeka Curriculum, and integrating cultural values into learning, while the implications for mathematics teaching practices include more contextual and meaningful learning, strengthening observation and exploration skills, increasing student motivation and participation, and encouraging teachers to develop creative and relevant teaching materials that align with the surrounding environment.

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