

Fostering Christian Values through Ethnomathematics: A Study on Geometry and Cultural Appreciation in Early Education

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Abstract

This study explores the intersection of mathematics, particularly geometry, with spiritual values in Christian education. It poses a fundamental question: Can teaching mathematics also foster character development and enhance cultural appreciation in line with Christian principles? By employing a mixed-methods approach that combines quantitative and qualitative analyses, the study evaluates the effect of this teaching method on children's cognitive abilities and character development. The results indicate that using traditional Minahasa cakes significantly enhances children's grasp of geometric concepts and helps instill cultural values, accounting for a notable 36.9% of the variance in learning outcomes. Ultimately, the research demonstrates how integrating ethnomathematics can build a sense of community and cultural identity among students, while aligning educational practices with Christian values of love and service, thereby supporting holistic development in early childhood education.

Keywords: *Christian education, geometry, cultural appreciation, ethnomathematics, early childhood education*

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INTRODUCTION

Mathematics is a basic science that is very close to human life. So that mathematics plays an important role in the development of human civilization (Nur & Massang, 2016). As one of the basic sciences, mathematics is viewed from the aspect of reasoning and its application, which plays an important role in the development of science and technology (Zagoto, 2018). Mathematics deals with abstract concepts, which can be mentally challenging. (Muhammad et al., 2023) Based on this, mathematics in everyday life needs to function as a means of shaping personality, intelligence, abilities, and skills (Rakhmawati & Alifia, 2018). The closeness of mathematics to human life in building civilization, then there is integration in mathematics and culture. A variety of ancestral cultural creativity that has been passed down from generation to generation which has artistic value contains mathematics. Mathematics is contextualized, developed, and practiced by

the community according to the local culture as stated by Hartoyo (Sumayani et al., 2020).

Based on the description above, it is important to introduce mathematics to children, to prepare children as well as possible so that they can contribute to their success and life in the future. However, based on the mathematical ability of Indonesian students according to the PISA (Programme for International Student Assessment) order, in 2018 Indonesia was ranked 73rd and 79th of the participating countries (Hewi & Shaleh, 2020). Based on the opinion of experts who stated that 80% of development at an early age or commonly called (golden age) it is necessary for children to be introduced to mathematics as early as possible.

One of the fields of mathematics that can be introduced to children is geometry. Geometry plays a significant role in developing abstract concepts. (Fauzi & Arisetyawan, 2020) (Nur et al., 2022) Geometry is the branch of mathematics that focuses on shapes, spatial relationships, and space. Culture-based learning in mathematics reflects the core principles of ethnomathematics. (Rosa & Orey, 2012). Ethnomathematics examines how mathematics interacts with and is influenced by different cultural traditions and practices. (Mansion, 2022) Ethnomathematics promotes knowledge from cultural groups to foster peace and address global challenges. (Rosa et al., 2017) Ethnomathematics has long been present, reflected in mathematical concepts embedded in societal traditions and daily life. (Susiana et al., 2020) One way that can be done to introduce mathematics to children while playing is with a cultural approach (ethnomathematics) where children grow and develop in certain areas or regions, namely with Minahasa typical cake media. Minahasa has a variety of typical cakes that have geometric shapes. One example of a typical Minahasa cake that has a block shape is the Lampu-lampu cake.

Several previous studies that examined ethnomathematics in early childhood include: first, research by Sumayani, et al regarding the traditional food of the Sasak tribe which has geometric shapes, such as triangles, quadrilaterals, and circles which have noble values inherited by their ancestors (Sumayani et al., 2020). The second research by Huda which examines the market snacks in the Yogyakarta area contains mathematical elements of the geometric aspect of the plane and the geometry of space in it. Flat geometries such as rectangles, triangles, ellipses, circles and trapezoids, as well as spatial geometries such as blocks, spheres, cones, and tubes (Huda, 2018). Based on the results of several previous studies, this study does not intend to look for shortcomings but intends to develop previous research. This research was carried out in the Minahasa area and measured the effect of using traditional Minahasa cake media which integrates learning patterns while playing with traditional cake media which is rich in the meaning of Minahasa cultural heritage to be passed on to children on children's cognitive intelligence.

In Christian education, mathematics is often seen as a discipline that sharpens logic and critical thinking skills. However, the exploration of how mathematics can

be integrated with spiritual values is still relatively rare. This research seeks to uncover new insights by asking an important question: can the teaching of mathematics, particularly geometry, also contribute to character development and the appreciation of cultural values aligned with Christian principles? This study aims to explore this question by examining how traditional Minahasa cakes, rich in geometric shapes, can be used as media to teach geometry to young children. Moreover, it will investigate whether this approach can help children better understand local cultural values while internalizing Christian principles. Therefore, the research problem focuses on how this teaching method, which combines mathematics, culture, and Christian education, can influence children's cognitive intelligence and character formation.

RESEARCH METHOD

The type of research used in this research is a mixed methods approach, incorporating both experimental quantitative research and qualitative analysis. The experimental design used is pre-experimental using a one-shot case study design. Through this model, the researcher will measure the post-test value in the experimental class given the treatment and the post-test value in the control class. This research paradigm is described as follows:

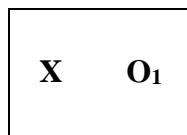


Figure 1. Research Design

The populations in this study were all students of Kindergarten Dharma Wanita Kalasey. The sampling technique in this study is the saturated sample. So, the number of samples in the study was 22 students as the sum of the population. Data collection techniques used in this study used observation sheets and children's worksheets. The instruments arranged in the study consisted of instruments using the Minahasa traditional cake learning media as the instrument variable X and the children's worksheet instrument as the instrument variable Y. Observation sheets are used to observe and assess student learning activities during learning and Children's Worksheets (LKA). Observations of children on the observation sheet are divided into 4 assessment criteria, namely not yet developing (BB), starting to develop (MB), developing according to expectations (BSH), and developing very well (BSB). Children's Worksheets (LKA) to obtain data on children's cognitive aspects. The data analysis technique used in this study uses a regression analysis approach. The form of regression of this research is simple regression which only has one dependent variable and one independent variable.

Alongside the quantitative analysis, this study will also include a qualitative component that involves a literature review. This review will focus on identifying

Christian educational values that resonate with the research findings. The goal is to determine how these values can be incorporated into a proposed model for Christian education, which utilizes traditional Minahasa cakes to teach geometric concepts. By combining these two approaches, the research aims to develop a well-rounded educational model that not only teaches mathematical principles but also fosters Christian values in early childhood education.

RESULTS AND DISCUSSION

Results

Before conducting the hypothesis test to determine the effect of using traditional Minahasa cake media, which integrates learning patterns through play, a normality test was first performed using the Kolmogorov-Smirnov test with a 5% error margin. The analysis was carried out using SPSS 26 software. The results of the normality test are presented in Table 1.

Table 1. Normality Test Results

| One-Sample Kolmogorov-Smirnov Test | |
|---|------|
| Asymp. Sig. (2-tailed) | .139 |

The basis for determining whether the data in this study is normally distributed is if the significance value (Asymp. Sig. 2-tailed) is greater than 0.05, then the data is considered normally distributed. According to Table 5, the Asymp. Sig. 2-tailed value is 0.139, which is greater than 0.05, indicating that the data in this study is normally distributed.

After confirming the normality of the data, the next step is to conduct the hypothesis test. The hypothesis testing is done using a simple regression analysis through SPSS 26.0, which will generate several outputs, as shown in Tables 2 and 3.

Table 2. Model Summary of Simple Regression Test on the Use of Traditional Minahasa Cake Media for Students' Cognitive Learning Outcomes

| Model Summary ^b | | | | |
|----------------------------|-------------------|----------|-------------------|----------------------------|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | .607 ^a | .369 | .337 | 15.785 |

a. Predictors: (Constant), X

b. Dependet Variable: Y

Table 3. Simple Regression Coefficients of the Impact of Using Traditional Minahasa Cake Media on Students' Cognitive Learning Outcomes

| Model | Coefficient ^a | | | t | Sig. |
|------------|----------------------------|------------|--------------------------|-------|------|
| | Unstandardized Coefficient | | Standardized Coefficient | | |
| | B | Std. Error | Beta | | |
| (Constant) | 35.833 | 13.479 | | 2.658 | .015 |
| X | 1.033 | .302 | .607 | 3.419 | .003 |

a. Dependent Variable: Y

Table 2 shows that the R value, or R-squared, is 0.369, indicating that the use of traditional Minahasa cake media influences children's cognitive development in learning mathematics, specifically in the area of geometry, by 36.9%. The remaining 63.1% is affected by other variables. The table also indicates a regression coefficient of 0.607, which means that for every one-unit change in the use of traditional Minahasa cake media, students' learning outcomes will change by 0.607, assuming other variables remain constant. The simple regression model obtained is $Y = 35.833 + 0.607X$.

The significance of this effect can be assessed based on the probability (p) value; according to Table 3, it is 0.003, which is less than 0.05, and the calculated t-value is greater than the critical t-value. The calculated t-value is 3.419, while the critical t-value at a 5% significance level and degrees of freedom (df) of $22 - 2 = 20$ is 2.086. This indicates a significant effect of using traditional Minahasa cake media on children's cognitive development in learning mathematics, particularly in the field of geometry.

DISCUSSION

Building Student Motivation and Engagement through Ethnomathematics

The findings from the previous section reveal that using traditional Minahasa cake as a learning medium positively influences children's cognitive development. This aligns with the perspectives of Ambarawari et al. and Edy, as cited by Mahendra, who highlight several benefits of integrating ethnomathematics into education: a) it provides an accessible way to communicate mathematical concepts; b) it makes mathematics feel more relevant and relatable to students; c) the ethnomathematics aspect (through observation) boosts students' motivation to engage with math; d) it fosters collaboration among students; e) it encourages the development of communication and reasoning skills; f) it offers hands-on experiences in project organization, time management, and resource allocation, including tools and materials needed to complete tasks; g) it involves students in

gathering information while also introducing them to cultural elements; and h) it creates a lively and enjoyable learning atmosphere, allowing students to be active participants, which makes the learning process enjoyable for both students and teachers. (Mahendra, 2017)

Early childhood learning is most effective when it takes the form of play and is enjoyable for the children, (Andriono, 2021). In line with the findings of Supriyadi's research, the use of ethnomathematics in education offers significant benefits. It encourages students to engage in playful learning with their peers, creating an enjoyable atmosphere. According to the results, 163 students reported feeling happy, 49 expressed enthusiasm for learning mathematics, another 49 stated that they found math easy, and 12 were able to overcome misconceptions regarding reduction operations. Additionally, simplifying mathematical concepts can help promote Indonesian cultural products while fostering innovative approaches to math education.(Supriadi, 2019). Some people have a slightly wrong view of learning mathematics. They assume that mathematics in learning at school is less relevant to be brought to real situations. Therefore, educators need to think of an appropriate method in order to reduce the negative view of some people towards learning mathematics. The way that is considered appropriate is to bring mathematics learning contextually or lead students to exist in real learning situations, (Abi, 2017).

Mathematics consistently plays a vital role in driving the progress of civilization.(Muniri & Swalaganata, 2018) Blending mathematics with cultural aspects can greatly enrich the learning experience. (Park & Nuntrakune, 2013) Integrating cultural elements into math education can improve learning outcomes. (Mania & Alam, 2021) Incorporating traditional Minahasa cake into education highlights how ethnomathematics can effectively boost cognitive development. By making math concepts more relatable and engaging, this method encourages collaboration and communication skills among students. Additionally, it helps dispel negative attitudes toward math while fostering cultural appreciation, resulting in a lively and enriching learning environment.

Tye emphasizes that at its core, education is about building relationships. Even those who consider themselves "self-educated" have engaged with others through the books they've read and the experiences they've encountered. The key issue isn't whether education is relational but rather the quality and nature of those relationships. We can connect with one another in different ways. For instance, we might relate through hierarchical and paternalistic models, where a select few impose their views and beliefs on others. Alternatively, we can engage as competitors, focused on proving who is right or wrong. On a more positive note, we can form genuine friendships that prioritize each other's well-being or work together as partners dedicated to achieving a common goal.(Tye, Karen B., 2000)

From a Christian educational perspective, incorporating traditional Minahasa cake into learning exemplifies the value of relationships and community. This approach enhances cognitive development through ethnomathematics while fostering appreciation for cultural heritage. Education, rooted in meaningful connections, aligns with Christian principles of love and service. By creating supportive and collaborative learning environments, students can overcome negative attitudes toward subjects like math, ultimately nurturing their knowledge and character in a vibrant, enriching atmosphere.

Ethnomathematics and Christian Education: Building Character Through Traditional Games and Foods

Education and culture are inseparable aspects of daily life, as culture represents a comprehensive unity within society. (Sunzuma & Maharaj, 2019) Integrating ethnomathematics requires teachers to have expertise in mathematics, its history, education, and local culture. (Sunzuma & Maharaj, 2019) Ethnomathematics positively influences the learning process. The core idea of ethnomathematics is to explore and value the mathematics used by cultural groups, rather than focusing solely on Western mathematics (Rodríguez-Nieto & Alsina, 2022).

Etymologically; Ethno has the meaning of ethnicity, while mathematics means mathematics. According to Gerdes, ethnomathematics is mathematics learning that is implemented by a certain cultural entity, farmers, workers, and children from certain social strata, certain professional groups, and other community groups, (Abi, 2017). One example of the application of ethnomathematics is through traditional games. Based on research from Chatarina Febriyanti that in the traditional Sundanese game, namely *Engklek*, there are elements of learning mathematics such as geometry of flat shapes, namely rectangular, square, and semi-circular shapes contained in the plots of the *Engklek* game. In addition to these elements, the *Engklek* game has an element of counting in the implementation of the game. As for the traditional top game, there are elements of mathematics learning such as the shape of a tube. In the whole process, the two traditional games have educational elements such as the values of integrity, sportsmanship, and the value of the character of togetherness, (Febriyanti et al., 2018).

Learners should study mathematics through real-life contexts and their own activities, rather than the traditional approach. (Umoru & Abah, 2021) Using an ethnomathematics approach makes math learning more engaging and relevant for students. Warmansyah argues that learning mathematics for early childhood can be easier if you use a simpler, less complex, uncomplicated approach that is close to the real life context that every child can encounter in their daily lives, (Amalina, 2020). The play method uses games as a tool for learning in early childhood. (Astuti

& Enawaty, 2023) Early childhood teaching methods strengthen genuine participation from children.(Ranta, 2023) In a participatory approach, children engage with the situation and aim to make a change.(Nikkola et al., 2022) Especially in the current situation, children have a lot of time to directly learn various activities at home, as well as the environment related to learning mathematics so that they can improve their cognitive abilities. Parents play an important role in helping children's learning process starting from the family environment. However, many parents are less sensitive to this, (Amalina, 2020). Children learn best when they can see and do things for themselves.(Maryatun, 2016)

Researchers see that the application of ethnomathematics can not only be done with traditional games but also through traditional foods, especially traditional cakes. Traditional food is people's daily food, such as staple food, snacks, or special menus that have been available from the time of their ancestors and inherited until now by certain people. This traditional food is usually enjoyed by tribal or ethnic groups originating from a particular area, which is derived from processed local recipes and ingredients that have been adapted to the tastes of the community. Minahasa traditional food which is consumed and offered by the Minahasa people in their daily habits has a unique and special taste, including recipes that are rich in spices. This traditional food attracts the attention of not only Minahasa people, but also tourists, guests and visitors who visit the land of Nyiur Melambai, (*Resep Kuliner Tradisional Minahasa Sulawesi Utara (Yelly A. Walansendow Joseph J.A. Turambi) (z-Lib.Org).Pdf*, n.d.).

Traditional cakes that are popular among the Minahasa ethnic group are part of the traditional Minahasa cuisine or in general the province of North Sulawesi. In this study, traditional cakes originating from the Minahasa ethnic group include: Cucur, Apang, Bangket, Bagea, Kue Kuk, Lampu-lamp, Fried Brot, Lalampa, Nasi Jaha, Halua Kacang, Bangket, Halua Kenari, Bepang, and others. Etc. Based on the results of the research above, it shows that the use of traditional Minahasa cake learning media in the form of cucur cakes, lalampa, onde-onde, banket, halua and bepang in geometry learning has a significant influence on the cognitive development of early childhood in Dharma Wanita Kalasey Satu Kindergarten in Minahasa.

A child needs guidance and education.(Simatupang et al., 2022) In daily life, children enjoy playing and develop emotional and social skills, learning to express appropriate emotions and behaviors in line with social norms.(Hamidulloh Ibda, 2022) Integrating traditional games and foods into education embodies the relational values central to Christian teaching. Engaging students in culturally rich activities like ethnomathematics nurtures a sense of community that reflects Christian principles of love, respect, and collaboration. These experiences enhance cognitive development while fostering strong relationships among students,

families, and their cultural backgrounds. As learners participate in these communal activities, they deepen their understanding of their identity and strengthen the connections to their community and faith, exemplifying the holistic approach inherent in Christian education.

Partnerships are built on mutual respect, acceptance, and equality. When we see partnership as central to Christian education, we acknowledge that everyone is created in God's image, each with unique gifts. This perspective encourages collaboration, as both children and youth can share valuable insights. In our roles as educators, we must recognize our students as equal partners in learning, fostering relationships that align with the core values of Christian education and community. (Tye, Karen B., 2000) In the Gospel, it is shown that Jesus cared about the character and faith of children. When parents brought their children to Him, He welcomed them and blessed them (Mark 10:13-16). (Stevanus & Yulianingsih, 2021) A Christian Education teacher needs to be creative and able to make the most of opportunities, especially in using teaching media to create a more effective and efficient learning environment for both teachers and students. (Zega, 2022)

Incorporating traditional Minahasa cakes into education not only supports cognitive development in young children but also reinforces community connections and the relational values central to Christian education. By engaging students in culturally relevant activities, they can embrace their unique identities while fostering collaboration. This method creates a holistic learning environment that reflects the principles of love, respect, and partnership inherent in faith-based education.

Fostering Cultural Identity and Community Through Ethnomathematics

The previous sections highlight the transformative power of incorporating ethnomathematics into education, especially through traditional Minahasa cakes and games. This approach not only enhances young children's cognitive development but also helps them forge a strong cultural identity and deepen community connections. When students engage in activities that reflect their heritage, they not only learn mathematics but also embrace their unique cultural narratives. This empowerment fosters pride and belonging, making mathematics feel more relevant and significant in their lives.

Moreover, these culturally relevant experiences promote collaboration among students, allowing them to work together in ways that reflect shared values and mutual respect. As they explore mathematical concepts through traditional practices, they learn not just about numbers and shapes but also about teamwork, integrity, and the importance of supporting one another. This holistic learning experience aligns beautifully with the core values of Christian education, which emphasize love, respect, and service to others. Theories of learning offer a deeper understanding of how childhood experiences relate to Christian commitment in early adulthood. (Davis, 2021) In this nurturing environment, students are

encouraged to grow academically and personally, creating a vibrant community that values both individual identity and collective belonging.

CONCLUSION

This study highlights the vital role that traditional Minahasa cake media can play in enhancing cognitive development in early childhood mathematics education. By employing a mixed methods approach that combines both quantitative and qualitative analyses, we gain a richer understanding of how culturally relevant teaching tools can significantly influence learning outcomes for young students. The statistical findings indicate a noteworthy connection between the use of Minahasa cake as a learning medium and improvements in children's cognitive skills, particularly in geometry, with 36.9% of the variance in learning outcomes attributed to this method.

Furthermore, these results align with the concept of ethnomathematics, showcasing how integrating culturally meaningful activities not only deepens mathematical comprehension but also fosters collaboration, motivation, and a sense of community among learners. This approach resonates with core Christian educational values, emphasizing the importance of relationships, respect, and belonging. By connecting with their cultural heritage through traditional foods and games, students cultivate a strong sense of identity while embracing the interrelatedness of their learning experiences. Ultimately, this research advocates for incorporating cultural elements into education, enriching learning environments and promoting the development of essential values that support both personal and community growth.

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