

Systematic Literature Review: Ethnomathematics Builds A Flat Side Space in Mathematics Learning

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Abstract

The large number of ethnomathematical studies results that are almost the same makes the results of the study monotonous. Based on this background, researcher conducted research with the aim of exploring various ethnomathematical studies on building flat-sided spaces in mathematics learning in the 2017-2024 period. The research method applied was a systematic literature review using the Google Scholar database with the keywords “ethnomathematical exploration, building flat-sided spaces, and learning mathematics”, so that as many as 14 articles were obtained as research objects. The results of the literature review show that the objects of ethnomathematical study are related to the concept of building a flat side space in the form of mosques, historical buildings, traditional houses, traditional clothing, tourist attractions, traditional food, and artifacts. Build the flat-sided space discussed in the ethnomathematical study in form of cubes, blocks, prisms, and limas. Cubes and beams are mostly found in building structures, while prisms and pyramids are widely found in roofs of buildings. Ethnomathematics studies that are linked to concept of building a flat-sided space have a positive impact on mathematics learning, namely increasing motivation and understanding, as a source of learning, shaping students' critical thinking, and making learning more innovative and fun.

Keywords: Build a flat side space, ethnomathematics, mathematics learning

Abstrak

Banyaknya hasil kajian etnomatematika yang hampir sama menjadikan hasil kajian yang monoton. Berdasarkan latar belakang tersebut peneliti melakukan penelitian dengan tujuan mengeksplorasi berbagai penelitian etnomatematika mengenai bangun ruang sisi datar dalam pembelajaran matematika pada periode 2017-2024. Metode penelitian yang diterapkan adalah tinjauan literatur sistematis menggunakan basis data Google Scholar dengan kata kunci “eksplorasi etnomatematika, bangun ruang sisi datar, dan pembelajaran matematika”, sehingga didapatkan sebanyak 14 artikel sebagai objek penelitian. Hasil literature review menunjukkan bahwa objek kajian etnomatematika yang dihubungkan dengan konsep bangun ruang sisi datar berupa masjid, bangunan bersejarah, rumah adat, pakaian tradisional, tempat wisata, makanan tradisional, dan artefak. Bangun ruang sisi datar yang dibahas dalam kajian etnomatematika tersebut berupa kubus, balok, prisma, dan limas. Kubus dan balok banyak ditemukan dalam struktur bangunan, sedangkan prisma dan limas banyak ditemukan dalam atap bangunan. Kajian etnomatematika yang dihubungkan dengan konsep bangun ruang sisi datar memiliki dampak positif dalam pembelajaran matematika, yaitu meningkatkan motivasi dan pemahaman, sebagai sumber belajar, membentuk pemikiran kritis peserta didik, serta membuat pembelajaran lebih inovatif dan menyenangkan.

Kata kunci: Bangun ruang sisi datar, etnomatematika, pembelajaran matematika

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INTRODUCTION

Ethnomathematics is the integration of mathematics and culture (Manasikana et al., 2023). This can be seen from the combination of three words, namely “*ethno*” which means culture, “*mathema*” which means mathematics, and “*tics*” which means art (Assidiqi & Atiah, 2024). Ethnomathematics was first initiated by D'Ambrosio 1997 as a form of proof that mathematics is not just an abstract concept contained in the mind, but mathematics can also be connected to the surrounding environment

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(Sihombing, 2022). One example of the relationship between mathematics and the surrounding environment is the relationship between mathematics and culture, which is hereinafter referred to as ethnomathematics. Ethnomathematics proves that the relationship between mathematics and daily life or the surrounding environment is not only limited to the concept of mathematical calculation operations, such as addition, subtraction, multiplication, and division, however, the connection between mathematical concepts and daily life can be interpreted more broadly than this. In ethnomathematics, the scope of study or cultural objects studied can be related to various mathematical concepts, such as geometry, measurement, angles, social arithmetic, and etc (Serepinah et al., 2023). This demonstrates that the connection between mathematics and the surrounding environment is vast, leading to the conclusion that mathematics is always linked to the environment or culture.

There are many previous studies that discuss ethnomathematics, such as ethnomathematics in traditional houses (Kurino & Rahman, 2022; Nurhasanah & Puspitasari, 2022), ethnomathematics in traditional dance (Fatimah et al., 2024; Nurina & Indrawati, 2021), ethnomathematics in mosque buildings (Dewi et al., 2024), ethnomathematics in traditional food (Della et al., 2024; Minah & Izzati, 2021), ethnomathematics in musical instruments (Mu'asaroh & Noor, 2021; Novitasari et al., 2022), and etc. The many ethnomathematical studies have been able to produce studies that connect culture with mathematical concepts, such as flat building (Ibrahim & Napfiah, 2023), build an arch side space (Yudianto et al., 2021), transformation geometry (Krismonita et al., 2021), and etc. The results of the ethnomathematical studies indicate that research novelty is generally limited to the objects of study, while the analytical frameworks as well as the interpreted results and discussions tend to be similar and have not undergone significant development across studies. Consequently, most of these studies merely identify mathematical concepts embedded in cultural objects without incorporating theoretical development, comparative analysis, or methodological innovation, resulting in relatively limited scholarly contributions. In addition, this happens because the mathematical concepts that are connected to the cultural objects studied are the same, such as traditional food ethnomathematics in the concept of building space (Dalimunthe et al., 2022; Merliza et al., 2022), ethnomathematics of traditional houses in the concept of flat building (Kehi et al., 2022), ethnomathematics of mosque buildings in the concept of transformation geometry (Aulia Rahman et al., 2022), and etc.

The results of the above study show that many ethnomathematical studies have been carried out but are only limited to being connected with mathematical concepts, so that the resulting studies tend to be monotonous. This statement is evident in the results of bibliometric analysis which shows that ethnomathematical studies that connect cultural objects with mathematical concepts in the period 2000 to 2023 are the most widely studied topics in the field of ethnomathematics compared to other study topics that are still within the scope of ethnomathematics, such as the development and ability of mathematics (Sumarno & Suparman, 2024). This means that ethnomathematical studies that connect culture with mathematical concepts have been carried out a lot, but the results obtained between one study and another are the same, only different in the cultural objects studied, resulting in monotonous

studies. This is very sad for the study of ethnomathematics in Indonesia. In fact, in the study of ethnomathematics, it is not only connected between culture and mathematical concepts, but can also be explored in the field of ethnomathematics based media development (Sumarno & Suparman, 2024), for example the development of ethnomathematics-based comic electronics that integrate the geometric shapes of triangles and squares with ornaments in the buildings of the Great Mosque of Central Java, the Semarang Old City Church, the Lawang Sewu Building, and the Sam Poo Kong Temple (Cahyono et al., 2023). However, in the results of previous studies, there are still very limited ethnomathematics studies that discuss the development of ethnomathematics based media. This statement is proven in a study conducted by Sumarno & Suparman (2024) which shows that the data visualization in ethnomathematics bibliometric trends on the topic of ethnomathematics based media development is still dark. This means that the topic is still rarely used to conduct studies.

Considering this background, researchers are motivated to carry out ethnomathematical studies, which have been widely examined, emphasizing the link between culture and mathematical concepts. The mathematical concept focused by the researcher in this study is the build of a flat sided space calculated in the last seven years. This is done by the researcher because based on the results of bibliometric analysis, the trend of ethnomathematical studies has increased rapidly over the last seven years, namely 2017-2024 (Sumarno & Suparman, 2024). The reason why researchers choose to build flat-sided spaces is because flat sided spaces are easy to find in ethnomathematical study objects, such as prisms in the roofs of traditional houses, blocks in mosque walls, and so on. The flat side space consists of cubes, blocks, prisms, and pyramids (Fakhrezi et al., 2023).

Based on the above explanation, this study seeks to identify various cultural studies connected to the concept of flat-sided geometric structures in mathematics education from 2017 to 2024.

METHODS

This research utilizes the Systematic Literature Review (SLR) method, which is a structured approach to analyzing existing studies on a particular phenomenon, subject, or topic. This method involves identifying, reviewing, assessing, and interpreting all relevant research to gain comprehensive insights into the existing knowledge (Khairunnisa et al., 2022). A search in the Google Scholar database found 100 journal articles published in the 2017-2024 period with a focus on the keywords “ethnomathematical exploration, building a flat sided space, mathematics learning”. The literature selection process refers to the exclusion criteria. This criterion is used to minimize ambiguity and reduce the possibility of bias in literature studies (Julia et al., 2024). These criteria can be shown in the following Table 1 (Muqoddaroh et al., 2024).

Table 1. Exclusion Criteria

No	Exclusion Criteria
1	Article cannot be opened
2	Articles include repositories

3	Non empirical article
4	Articles not appropriate for research topics

Data collection begins by documenting all selected research articles based on the keywords used. Based on the exclusion criteria used, as many as 14 articles were obtained that were considered relevant to the article filter process. This is as shown in Figure 1.

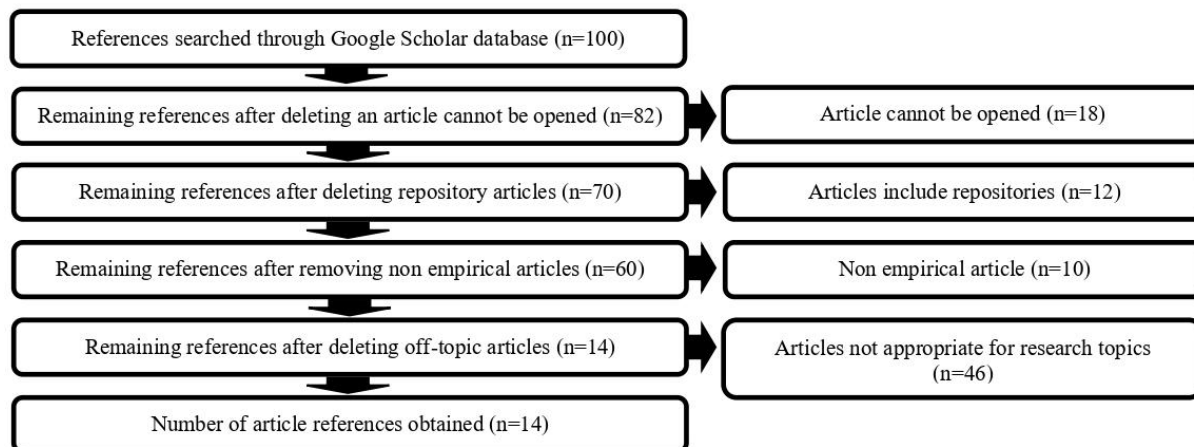


Figure 1. Article Filter Process Diagram

RESULTS AND DISCUSSION

Based on the selection process of articles with the above exclusion criteria, a total of 14 articles were obtained that were used to find out various ethnomathematical studies related to the concept of building flat sided spaces. The following are the results of the article filter by reviewing the exclusion criteria used by the researcher.

Table 2. Article Results of Literature Review

No	Title	Year	Researcher Name
1	“Eksplorasi Etnomatematika Uem Le’u Insana dalam Kaitannya dengan Konsep Geometri”	2019	Funan & Mamoh
2	“Etnomatematika: Makanan Tradisional Bugis Sebagai Sumber Belajar Matematika”	2019	Pathuddin & Raehana
3	“Eksplorasi Etnomatematika pada Masjid Al-Alam Marunda Ditinjau dari Segi Geometri”	2021	Faturrahman & Soro
4	“Eksplorasi Etnomatematika Ngadhu dan Bhaga dalam Kaitannya dengan Pembelajaran Matematika pada Masyarakat Desa Ubedolumolo Kabupaten Ngada”	2021	Djara, et al.
5	“Eksplorasi Etnomatematika pada Bangunan Masjid Agung Mataram Kotagede”	2021	Sanyoto, et al.
6	“Studi Etnomatematika: Masjid Sunan Bonang dalam Pembelajaran Geometri”	2021	Izah & Malasari
7	“Eksplorasi Etnomatematika di Museum Kereta Kraton Yogyakarta dan Pengintegrasian ke dalam Pembelajaran Matematika”	2021	Setiana, et al.
8	“Eksplorasi Etnomatematika pada Bangunan Tradisional Uma Lengge”	2021	Safitri, et al.

9	“Eksplorasi Etnomatematika terhadap Masjid Jami Cikini Al-Ma’mur sebagai Media dalam Penyampaian Konsep Geometri”	2023	Soebagyo & Haya
10	“Eksplorasi Etnomatematika pada Artefak Peninggalan Sejarah di Kota NTT”	2023	Litik & Argarini
11	“Eksplorasi Geometri Bangun Ruang Wisata Religi Mandala Giri di Gunung Srandil”	2024	Faozan & Kusno
12	“Eksplorasi Etnomatematika pada Wisata Pantai Papuma Jember”	2024	Nurazizah & Nuryani
13	“Eksplorasi Etnomatematika pada Busana Tari Pasombahan Kampar”	2024	Zulfah, et al.
14	“Etnomatematika: Eksplorasi Geometris pada Desain Bangunan Masjid Agung Surakarta”	2024	Wahyuni, et al.

Table 2 shows the articles from the literature review conducted by the researcher. In Table 2, it can be seen that there are as many as 14 articles that connect the study of ethnomathematics with the build of flat sided spaces. Based on the 14 articles obtained by the researcher in Table 2, the articles will be classified as explained as follows.

Ethnomathematical Study on Building Flat Side Spaces

Based on the articles from the literature review in Table 2 above, the researcher classifies various cultural studies that are related to the build of flat sided spaces that have been explored in previous studies. The following is a classification table of cultural studies that are related to the build of flat-sided spaces.

Table 3. Ethnomathematics Study on Building a Flat Side Space

Ethnomathematics Study	Researchers
Mosque	Faturrahman & Soro, Izah & Malasari, Sanyoto et al., Joko Soebagyo & Haya, and Wahyuni et al.
Historic Buildings	Djara et al., Faozan & Kusno, Safitri, and Setiana
Traditional House	Funan & Mamoh
Traditional Food	Pathuddin & Raehana
Tourist Attractions	Nurazizah & Nuryami
Traditional Clothing	Zulfah et al.
Artifacts	Litik & Argarini

Based on Table 3, it can be seen that cultural studies that can be related to the concept of building flat sided spaces are mosques, historical buildings, traditional houses, traditional foods, tourist attractions, traditional clothing, and artifacts. Based on Table 3 above, the following diagram is obtained.

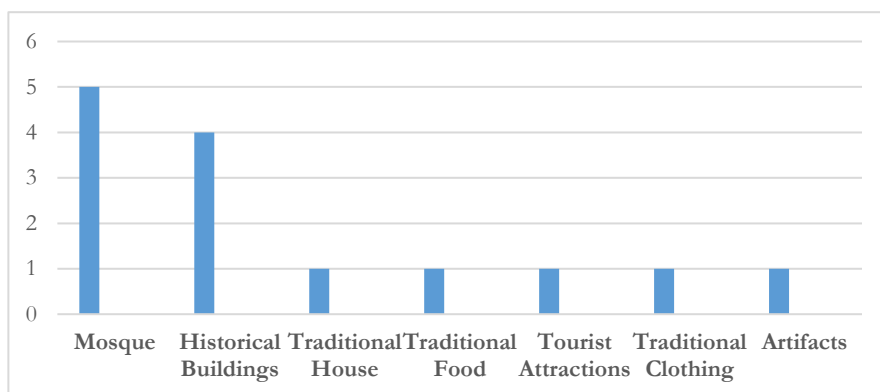


Figure 2. Diagram of Ethnomathematics Study on Building Flat Side Spaces

Figure 2 shows that the ethnomathematics study most closely associated with the build of flat sided spaces is ethnomathematics in mosque buildings, which is as many as 5 articles. After the mosque building, there is an ethnomathematical study on historical buildings, which is as many as 4 articles. Meanwhile, the ethnomathematical exploration of traditional foods, tourist attractions, traditional clothing, and artifacts is only 1 article each.

The number of ethnomathematical studies on mosque buildings that are connected with the build of flat sided spaces shows that the ornaments in each mosque have characteristics that have an attraction to be used as an ethnomathematical study (Muftiyah & Sudihartinih, 2024; Safwan et al., 2024). These ornaments have the shape of a flat-sided space, such as cubes, blocks, prisms, and pyramids (Faturrahman & Soro, 2021; Izah & Malasari, 2021; Sanyoto et al., 2021; J Soebagyo & A F Haya, 2023; Wahyuni et al., 2024). This is evident in the research conducted by Faturrahman & Soro (2021) who researched the Al-Alam Marunda mosque which uses the concept of pyramids on the roof of the mosque as well as the concept of blocks in the main room and ablution containers. Then it is also proven in the research conducted by Wahyuni et al. (2024) who researched the mosque of Surakarta which uses the concept of blocks on the pillars of the mosque, the concept of cubes on the mosque door, and the concept of prisms and pyramids on the roof of the mosque.

In addition to the findings from the literature review conducted by the researcher, the ethnomathematical study of mosque ornaments, which explored flat-sided geometric shapes, is consistent with the results of previous research by Saviraningrum & Wahidin (2023). Their study indicates that the mosque in Tasikmalaya City features an octagonal prism on the tower pillars and a rectangular prism on the dome's roof, both reflecting the concept of flat-sided geometric structures. The description above proves that each mosque has different ornaments, so the ethnomathematical exploration produced is also diverse.

The Concept of Building a Flat Side Space in Ethnomathematics

Referring to the articles from the literature review in Table 2 above, the researcher categorizes various studies on the concept of flat sided geometric structures explored in previous research. Below

is the classification table for the study of flat-sided geometric structures.

Table 4. The Concept of Building a Flat Side Space in Ethnomathematics

Concept of Building a Flat Side Space	Researchers
Cube	Sanyoto et al., Izah & Malasari, Setiana et al., Safitri et al., Litik & Argarini, Faozan & Kusno, Zulfah et al., dan Wahyuni et al.
Block	Faturrahman & Soro, Djara et al., Sanyoto et al., Izah & Malasari, Safitri et al., Soebagyo & Haya, Litik & Argarini, Faozan & Kusno, Nurazizah & Nuryami, Zulfah et al., dan Wahyuni et al.
Prism	Funan & Mamoh, Pathuddin & Raehana, Djara et al., Izah & Malasari, Safitri et al., Soebagyo & Haya, Faozan & Kusno, dan Nurazizah & Nuryami.
Pyramid	Funan & Mamoh, Pathuddin & Raehana, Faturrahman & Soro, Sanyoto et al., Izah & Malasari, Safitri et al., Soebagyo & Haya, Faozan & Kusno, dan Wahyuni et al.

Based on Table 4, it can be seen that the study of the concept of building a flat-sided space includes cubes, blocks, prisms, and pyramids. Based on Table 4 above, the following diagram is obtained.

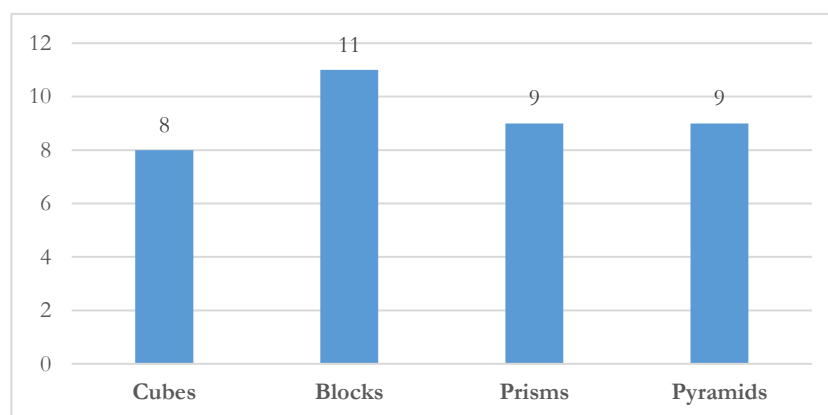


Figure 3. Study of the Concept of Building a Flat Side Space

Figure 3 demonstrates that the concept of flat-sided geometric structures, specifically the block concept, is covered in 11 articles. Next, the concept of flat-sided structures related to prisms and pyramids is explored in 9 articles. Meanwhile, the concept of cubes is 8 articles.

The many studies of the concept of building flat-sided spaces such as cubes, blocks, prisms, and pyramids show the relevance of the concept of geometry in the context of culture and architecture. The concept of cubes and blocks is widely found in building structures (Faturrahman & Soro, 2021; Izah & Malasari, 2021a; Safitri et al., 2021; Sanyoto et al., 2021). This is demonstrated in the study by Sipahutar & Reflina (2023) on ethnomathematics within museums, where the concept of cubes and blocks appears in several architectural elements, such as the asbestos in the museum buildings and their gates. Then the concept of prism and pyramids is widely found on the roofs of buildings (Faozan & Kusno, 2024; Soebagyo & Haya, 2023a; Wahyuni et al., 2024). This is proven in the research conducted by Zega (2023) on ethnomathematics in traditional houses that the concept of prism was found on the roof of

the omo hada south Nias, meanwhile the concept of pyramids is also found on the roof of the building, such as in the Joglo Sinom house (Susanto et al., 2022).

This description proves that each ethnomathematical study has a different concept of building a flat sided space, so that the study of concepts such as cubes, blocks, prisms, and pyramids also produces diverse results.

The Impact of Ethnomathematical Exploration of Building a Flat Side Space in Mathematics Learning

The following is the impact given by the exploration of ethnomathematics to build a flat sided space in mathematics learning according to the results of the literature review in Table 2.

Table 5. The Concept of Building a Flat Side Space in Ethnomathematics

Researchers	Impact on Mathematics Learning
Funan & Mamoh	Introduction to geometry concepts in schools, especially building flat sided spaces.
Pathuddin & Raehana	Increase motivation to learn mathematics and facilitate students' understanding of the concept of building flat sided spaces through ethnomathematics.
Faturrahman & Soro	Concrete learning resources in learning surface area, volume, and flat side space building nets.
Djara et al.	As a learning resource to build a flat sided space.
Safitri et al.	Unexplained.
Izah & Malasari	Shape students' mathematical thinking through their surroundings and introduce students that mathematics learning can be applied in everyday life.
Sanyoto et al.	Mathematics learning at school becomes fun, improves students' mathematical skills, and instills the value of cultural preservation in students.
Setiana et al.	As a source of learning mathematics, character instillation, and instilling cultural values to students.
Litik & Argarini	Unexplained.
Soebagyo & Haya	Mathematics learning becomes innovative by introducing the concept of building a flat sided space to students through ethnomathematics of mosque ornaments.
Faozan & Kusno	Materials for learning geometry concepts, especially building flat sided spaces.
Nurazizah & Nuyami	Enriching mathematics learning materials and making it easier for students to understand the building of flat sided spaces because they are relevant to daily life.
Zulfah et al.	As a suggestion for further research.
Wahyuni et al.	As a source of concrete learning materials, build flat sided spaces and create innovative, creative, and fun mathematics learning.

Based on Table 5 above, it can be seen that ethnomathematical exploration in flat sided space buildings has various positive impacts on mathematics learning, especially on the understanding of flat sided space buildings.

Several studies have shown that this approach not only introduces the concept of geometry, but also increases students' motivation and understanding of the material being taught. As Pathuddin & Raehana's research shows, the ethnomathematical approach not only increases students' motivation to learn, but also makes it easier to understand geometric concepts (Pathuddin & Raehana, 2019). It is evident that cultural context can make learning more relevant and interesting for students (Lubis et al., 2024; Soebagyo et al., 2021). Then there is also research that emphasizes the importance of concrete learning resources in understanding various concepts (Djara et al., 2021; Faturrahman & Soro, 2021; Wahyuni et al., 2024). This shows that the use of concrete objects from local culture can help students associate theory with practice (Nurniyati et al., 2024; Turmuzy, 2022).

Furthermore, ethnomathematics can also shape students' mathematical thinking by associating learning with their daily lives (Izah & Malasari, 2021b), So that it can create a more interactive and applicable learning atmosphere (Krisdiana et al., 2024). Another study showed that the ethnomathematical approach can enhance the innovation and enjoyment of mathematics learning, as well as promote the integration of cultural values among students (Sanyoto et al., 2021; Soebagyo & Haya, 2023a). This is important to maintain cultural identity while improving students' academic abilities (Saparuddin et al., 2019). The description indicates that ethnomathematics in teaching flat-sided geometric structures has significant potential to enhance the quality of mathematics education by incorporating local cultural values into the curriculum.

CONCLUSION

Based on the results and discussion above, it can be concluded that there are several ethnomathematical studies on flat sided space buildings such as mosques, historical buildings, traditional houses, traditional foods, tourist attractions, traditional clothing, and artifacts. The study contains mathematical concepts of building flat sided spaces such as cubes, blocks, prisms, and pyramids. The cubes and blocks are mostly found on building structures while prisms and pyramids are found on the roofs of buildings. The ethnomathematics study has a beneficial effect on mathematics learning, including enhancing motivation and comprehension, serving as a learning resource, developing students' critical thinking, and making the learning process more innovative and enjoyable.

Thus, the researcher provides suggestions for further research to increase references in analyzing or studying mathematical concepts in other cultural studies. In addition, it is also necessary to develop interactive ethnomathematics learning modules, collaborate with educational practitioners, and utilize educational technology such as e-modules or online applications to increase students' understanding and awareness of local cultural values.

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