

Teachers' Perceptions in Nunukan Regency Regarding the Integration of Tidung Culture in Mathematics Learning

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Abstract—Mathematics and culture have a very close relationship and have been extensively studied since 2016. However, there is one culture that is rarely addressed in research regarding the implementation of culture in mathematics learning: the Tidung culture. This study aims to uncover teachers' perceptions and experiences of implementing Tidung culture in mathematics education in Nunukan Regency. This is a descriptive study involving 37 teachers in Nunukan Regency. Data were collected via a Google Forms questionnaire containing both closed-ended and open-ended questions. The findings indicate that the majority of teachers hold a positive attitude toward integrating Tidung culture and consider it important. However, there is a cognitive dissonance, as this positive attitude is not yet fully grounded in a solid understanding of the connection between mathematics and Tidung culture. There is also a significant gap between perception and practice in the field. Teachers' experience in integrating or creating Tidung culture-based teaching materials remains very limited. Nevertheless, teachers demonstrate initiative to pursue integration even without having attended any training. These findings indicate the need for teacher professional development programs that go beyond mere theoretical presentation to include practical application and evaluation.

Keywords—Tidung Culture; Teacher Perception; Teacher Experience; Mathematics Learning

Manuscript received August 22, 2026; revised September 25, 2026; accepted October 7, 2026

I. Introduction

Mathematics and culture have a very close relationship, as mathematical activities develop from the practices, needs, and ways of thinking of a society (D'Ambrosio, 1985). This subject is not merely a collection of culturally neutral knowledge, but is deeply rooted in culture and daily life practices (Marsigit et al., 2025; Rawat & Nagaraju, 2026). Frequently associated aspects include traditional games, crafts, artifacts, and tangible cultural activities (Amirah & Budiarto, 2022). The absence of cultural integration in the learning process will affect students' motivation and achievement in this subject (Batiibwe, 2024).

Globally, research linking mathematics and culture has grown into a well-established trend since 2018 (Rawat & Nagaraju, 2026), while in the Indonesian context this line of research emerged slightly earlier, around 2016 (Iffah et al., 2025). These two milestones reflect the earlier local uptake of ethnomathematics scholarship in Indonesia relative to the broader global research momentum. This indicates that since 2016, researchers in Indonesia have begun to view culture as an alternative approach to teaching mathematics that not only enriches mathematical understanding through cultural contexts but also improves students' motivation, creativity, and learning outcomes (Kusuma et al., 2024; Mania & Alam, 2021; Serepinah & Nurhasanah, 2023; Turmuzi et al., 2023; Wibawa et al., 2025).

However, research linking mathematics and culture does not yet fully reflect Indonesia's cultural diversity, even though the nation's culture and character should be continuously preserved and passed on to younger generations to prevent their erosion by the forces of globalization (Azis et al., 2020). Data from 2016 to 2024 indicate that research integrating culture and mathematics in Indonesia has remained heavily concentrated in Java and Sumatra, with no studies exploring the cultures of North Kalimantan (Iffah et al., 2025). One culture

that has not been explored in the implementation of culture-based mathematics learning is that of the Tidung tribe.

The Tidung tribe is one of the indigenous groups on the island of Kalimantan. Today, their regions are known to encompass Tarakan City, Bulungan Regency, Nunukan Regency, and Malinau Regency, extending as far as Labuk in Malaysia (Sani, 2018). Tidung culture is slowly being eroded by time. One of the causes is the lack of systematic efforts to introduce Tidung culture to the younger generation, particularly through formal education (Riyanti et al., 2025).

This condition necessitates a study that systematically investigates how the educational community in Nunukan Regency perceives and responds to the potential integration of Tidung culture into mathematics learning. This research aims to reveal mathematics teachers' perceptions regarding the integration of Tidung culture, identify the gaps between attitudes and actual classroom practices, and map the barriers that have hindered its implementation. The findings of this research are expected to serve as an empirical foundation for developing Tidung culture-based teaching materials and educational policies that are more inclusive of local wisdom in North Kalimantan.

II. Literature Review

A. Teachers' Perception

Perception is a basic psychological process that selects and organizes environmental stimuli and provides meaningful experience to the perceiver (Liu et al., 2025). In an educational context, this process enables teachers to make sense of an object or situation by drawing on the knowledge they have already acquired (Mardiyah et al., 2021), which means that a teacher's existing knowledge base becomes the interpretive lens through which new ideas, such as the possibility of integrating local culture into mathematics teaching, are understood and evaluated.

Choy & Cheah (2009) explain that teacher perception is shaped by the teacher's prior experiences and needs, as well as by an active process of selecting information, which in turn forms the basis for how teachers respond in the classroom and ultimately shapes their teaching practices. This cyclical understanding of perception is essential for explaining how teachers' backgrounds and experiences may shape the way they view and respond to the idea of integrating local culture into mathematics learning.

B. Culture-Based Mathematics Learning

A culture-based approach allows abstract mathematical concepts to become concrete through cultural practices that are already familiar to students (Kholid & Husodo, 2025). Culture-based mathematics learning is considered an alternative that makes the learning atmosphere more engaging and less monotonous (Faqih et al., 2021). Integrating values and culture into the learning process generates new perspectives and ways of thinking without eliminating the core elements of education itself.

Solihin & Rahmawati (2024) reinforce that culture-based learning is an alternative that centers on the activities of students from diverse cultural backgrounds, creates a comfortable learning environment, and enables students to participate more enthusiastically. Together, these perspectives suggest that culture-based mathematics learning operates on three interconnected levels: it makes abstract concepts concrete, makes the learning experience more engaging, and creates an inclusive classroom atmosphere that accommodates students from diverse cultural backgrounds.

C. Tidung Culture

Local Tidung culture plays an important role in strengthening community identity in the Nunukan and Sebatik region, particularly because this border area faces the challenge of eroding national identity due to intensive social interaction between Indonesian and Malaysian residents (Zabadi et al., 2025). The traditional Tidung house and the Sina Beranti traditional clothing are two of the most recognizable cultural symbols of the Tidung community (Siteu et al., 2023). The structure of the traditional Tidung house displays strong geometric elements, such as the rectangular shape of the main room, a symmetrical arrangement of vertical pillars, and a proportionally triangular roof.

Nevertheless, cultural richness such as that of the Tidung people often receives insufficient attention within the formal education system (Selia et al., 2025). Riyanti et al. (2025) emphasize that introducing Tidung culture from an early age can foster pride, deepen students' understanding of their own identity, and strengthen their emotional connection to their cultural environment. Local Tidung culture, therefore, is not only an element of identity for the border community but also carries significant educational value, particularly through the geometric structures embedded in its architecture and clothing.

III. Methods

This descriptive study aims to examine teachers' perceptions and experiences of integrating Tidung culture into mathematics instruction. The study population comprised 37 elementary school mathematics teachers in Nunukan Regency who completed a questionnaire via Google Forms. The questionnaire contained both closed- and open-ended questions to explore respondents' perceptions, experiences, and opinions regarding the integration of Tidung culture into mathematics lessons. The demographic profile of the respondents is presented in Table 1. Participants were recruited using purposive sampling, with the criterion that respondents were currently active mathematics teachers in Nunukan Regency who agreed to participate voluntarily. All respondents had an education-related academic background, which was set as an inclusion criterion for participation.

Table 1. Demographic Profile of Respondents

Category	Number of Respondents	Percentage
Educational Background		
Education-related	37	100%
Non-education-related	0	0%
Teaching Experience		
Less than 5 years	8	21.6%
5–10 years	8	21.6%
More than 10 years	21	56.8%
Length of Residence in Nunukan		
Less than 5 years	1	2.7%
5–10 years	4	10.8%
More than 10 years	32	86.5%

IV. Results and Discussion

A. Results

This study involved 37 elementary school mathematics teachers in Nunukan Regency as respondents, consisting of 19 teachers who were not originally from the Tidung ethnic group and 18 teachers who are native to Nunukan. Data were collected through a questionnaire to explore teachers' perceptions and experiences in integrating Tidung culture into mathematics learning, covering four main aspects: (1) perceptions of the relationship between Tidung culture and mathematics, (2) perceptions of the ease of integration, (3) perceptions of the importance of integration, and (4) teachers' experience with training, actual integration practice, and the development of Tidung-culture-based learning media.

Teachers' Perceptions of the Integration of Tidung Culture into Mathematics Learning

The questionnaire results reveal a fairly interesting gap between teachers' views on the conceptual link between Tidung culture and mathematics and their willingness to integrate the two in classroom practice. Only 24.3% of teachers agreed that there is a relationship between Tidung culture and mathematics, while 37.8% disagreed and another 37.8% remained neutral. However, when asked whether Tidung culture could be integrated into mathematics learning, 70.3% of teachers agreed, while 5.4% disagreed, and 24.3% chose neutral (see Figure 1). This indicates that some teachers who do not perceive a direct relationship between mathematics and Tidung culture nevertheless remain open to integrating the two.

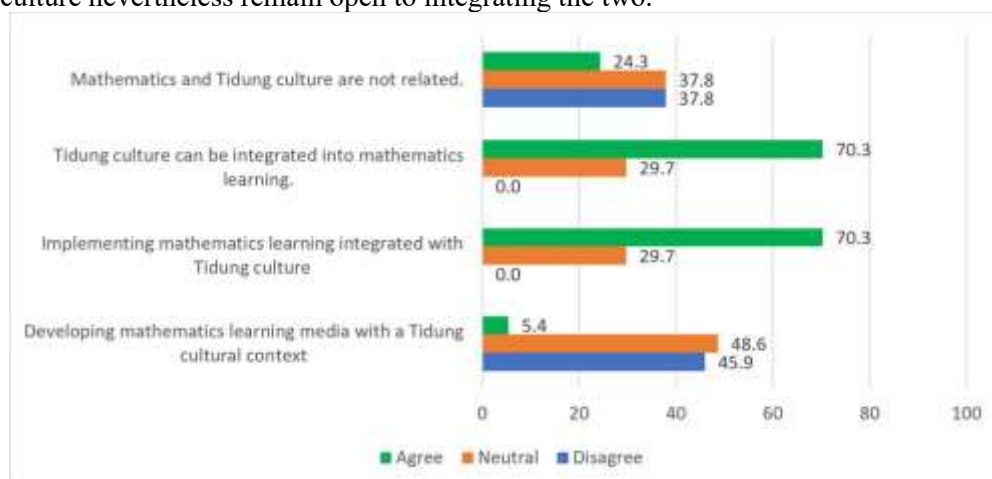


Figure 1. Teachers' Perceptions of the Integration of Tidung Culture in Mathematics Teaching

Examined by regional background, 16 of the 19 teachers who were not originally from Nunukan agreed that Tidung culture could be integrated with mathematics. In contrast, only 10 of the 18 native Nunukan teachers agreed. Among teachers who considered the integration process difficult, the obstacles most frequently mentioned were limited knowledge of Tidung culture, a lack of references linking Tidung cultural elements to mathematical concepts, language barriers, time constraints, and heterogeneous classroom conditions. A chi-square test of independence was conducted to examine whether regional background was related to teachers' acceptance of Tidung culture integration. The relationship between these two variables approached but did not reach statistical significance, $\chi^2(1, N = 37) = 3.64, p = .057$.

Regarding the perceived ease of implementation, 75.7% of respondents considered the integration of Tidung culture into mathematics learning to be easy or fairly easy, while 24.3% considered it not easy. A similar pattern emerged for the development of learning media, with 78.4% of teachers rating it easy or fairly easy and 21.6% rating it not easy (see Figure 2). This finding is notable because only 24.3% of respondents explicitly stated that mathematics and Tidung culture are interconnected, indicating that perceived ease of integration does not necessarily correspond to a strong belief in a conceptual relationship between the two.

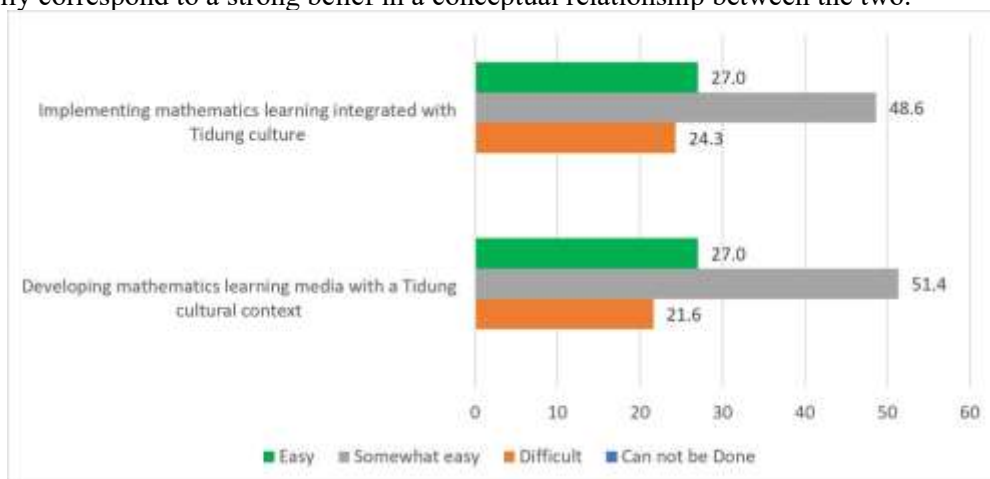


Figure 2. Teachers' Perceptions on the Ease of Integrating Tidung Culture into Mathematics Teaching

With respect to the perceived importance of integration, 54.1% of teachers considered integrating Tidung culture into mathematics learning to be important, while 45.9% considered it fairly important. For the availability of interactive Tidung-culture-based learning media, 56.8% of teachers rated it important and 43.2% rated it fairly important (see Figure 3). These findings suggest that although some teachers still exhibit cognitive hesitation regarding the conceptual link between mathematics and Tidung culture, they generally acknowledge the urgency of integrating this local culture into their teaching practice.

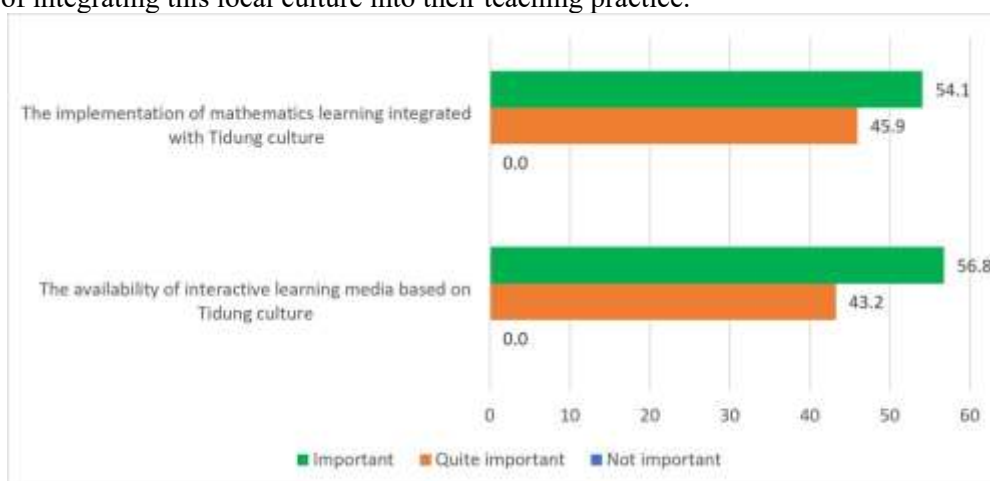


Figure 3. Teachers' Perceptions of the Importance of Integrating Tidung Culture into Mathematics Teaching

Teachers' Experiences in Integrating Tidung Culture into Mathematics Learning

In terms of experience, only 18.9% of respondents had ever participated in training on integrating local culture into learning, while 81.1% had never attended such training. Nevertheless, 21.6% of teachers reported having implemented the integration of Tidung culture in their mathematics teaching practice. This indicates that some teachers demonstrate initiative in integrating local culture into mathematics instruction even without formal training (see Figure 4).

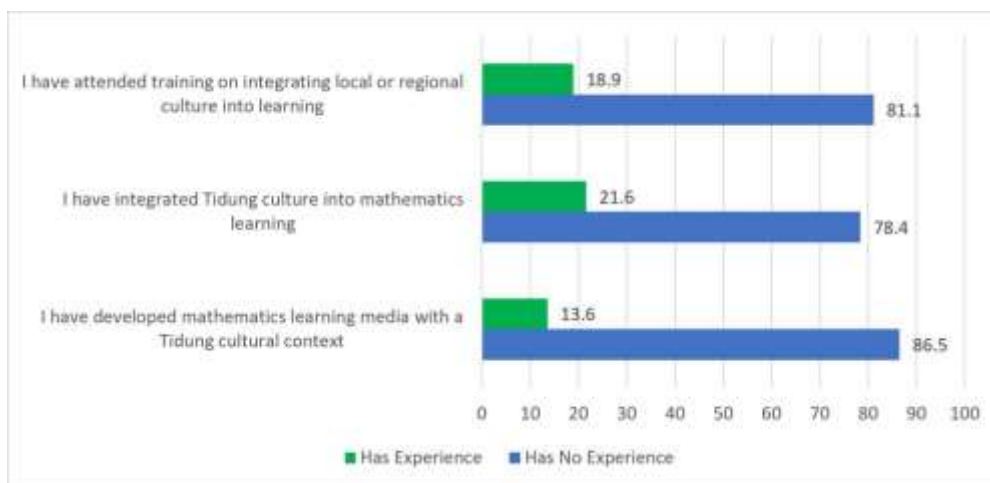


Figure 4. Teachers' Experiences of Integrating Tidung Culture into Mathematics Teaching

When analyzed by teaching experience, none of the teachers with less than 5 years of experience had ever integrated Tidung culture into mathematics instruction, whereas 37.5% of teachers with 5–10 years of experience and 23.8% of teachers with more than 10 years of experience had done so. Regarding the development of learning media, only 13.5% of respondents reported having created Tidung-culture-based media. Notably, among teachers who had attended training, only 28.6% had actually developed such media. This 28.6% figure should be interpreted with caution because it is derived from a very small subgroup ($n = 7$ trained teachers), meaning that the reported percentage represents only two teachers.

B. Discussion

The findings of this study confirm a cognitive contradiction among teachers in Nunukan Regency: while the majority hold positive attitudes toward integrating Tidung culture into mathematics learning, this positive attitude is not yet fully grounded in a conceptual understanding of how mathematics and Tidung culture are interrelated. This pattern aligns with the theoretical framework proposed by Liu et al. (2025), who argue that perception is shaped by environmental stimuli, and Choy & Cheah (2009), who emphasize that teacher perception is filtered through prior experience and active information selection.

The gap between perception and practice is particularly evident in teachers' experiences with training and actual classroom integration. This finding reinforces the culture-based mathematics learning framework articulated by Kholid & Husodo (2025) and Solihin & Rahmawati (2024), who argue that effective cultural integration requires not only positive attitudes but also concrete knowledge and pedagogical tools. The data clearly suggest that positive perception alone is insufficient to drive systematic classroom implementation.

The low rate of training participation (18.9%) and classroom integration (21.6%) underscores the structural barriers identified in the literature. Faqih et al. (2021) and Selia et al. (2025) emphasize that without targeted professional development programs, the potential for integrating Tidung culture into mathematics learning cannot be realized. These findings reinforce the urgency of developing a targeted teacher professional development program so that the potential for integrating Tidung culture into mathematics learning in Nunukan can be realized more systematically and sustainably.

From a pedagogical standpoint, the geometric structures embedded in Tidung cultural artifacts — such as the rectangular shape of traditional houses, the symmetrical arrangement of vertical pillars, and the regular patterns of Sina Beranti clothing provide concrete and contextually relevant representations for mathematics learning. Muhiddin et al. (2025) and Marsigit et al. (2025) confirm that such cultural artifacts can serve as effective mathematical learning media when teachers are provided with appropriate guidance and references.

This study has several limitations. First, the relatively small number of respondents (37 teachers) and the limited geographic scope of Nunukan Regency restrict the generalizability of the findings. Second, the data were collected through a self-report questionnaire, which may be subject to social desirability bias. Third, this study did not examine in depth the quality or effectiveness of the integration practices reported by teachers. Future research should employ in-depth qualitative methods, such as interviews or classroom observations, to further explore these dimensions.

V. Conclusion

This study presents two major findings on mathematics learning within the context of Tidung local culture. First, the majority of teachers held positive views toward integrating Tidung culture into mathematics instruction and considered it important. However, a crucial cognitive contradiction was identified: some

teachers who perceived the integration process as easy did not fully believe that mathematics and Tidung culture are actually interconnected. This indicates that the existing positive attitudes are not yet fully supported by a strong conceptual understanding.

Regarding teachers' experiences, there is a considerable gap between perception and practice. Fewer than 20% of teachers had attended training on cultural integration, and fewer than 25% had ever integrated Tidung culture into mathematics instruction. The situation is even more limited in the development of learning media, with fewer than 15% having developed mathematics learning media based on Tidung culture. Nevertheless, an encouraging finding is that teachers still demonstrated the initiative to integrate local culture despite having never participated in formal training.

These findings indicate the need for teacher professional development programs that go beyond theoretical exposure and address practical implementation and evaluation. The availability of clear guidelines and examples of Tidung culture-based learning media also becomes an urgent necessity to bridge the gap between teachers' awareness and its actual implementation in classroom practice.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

S.A.S. conceptualized the study and contributed to the literature review; I.A. supervised the research design and provided critical feedback on the manuscript; S.F.S. conducted data collection, analyzed the data, and wrote the original draft; S. contributed to the discussion section and reviewed the manuscript. All authors read and approved the final version.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Acknowledgment

The authors wish to thank all 37 mathematics teachers in Nunukan Regency for their participation and willingness to share their perceptions and experiences in this study.

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