

Research Article

Ethnomathematical and Cultural Practices of Tribal Community in the Philippines from a Sociolinguistic Lens

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Abstract: Educational inclusivity and cultural sensitivity are essential elements that academic institutions across the globe must cultivate as accentuated commonly in each institution's vision and mission statement. This paper links ethnography and sociolinguistics fields by exploring the how ethnomathematical terms and native language play an essential role in their cultural practices and traditions. Leveraging ethnographic-developmental research design, several knowledge systems with lexical equivalents have surfaced. These have to do predominantly with their counting system, ciphering, measuring, ordering, classifying, inferring, and modelling practices. Findings, therefore, reveal that under-standing learners' background as starting point of educational delivery leads to the preservation of the tribe's identity and customs. In fact, the comprehensive footage of their scientific models and lexicon in both the native tongue and L2 guarantees that these ethnic practices are preserved for future applications to uphold their cultural inheritance. Authors recommend that an enhanced de-livery of educational services to the IP learners is essential. The implementation of L1 as a medium of instruction should not be for primary grades exclusively, but for all IP learners likewise to recognize and preserve their unique linguistic features. Ample resource allocation is necessary to bring fair and quality government service to the native people worldwide.

Keywords: educational inclusivity; ethnomathematics; indigenous people (IP); sociolinguistics

1. Introduction

Philippines has lately been troubled by the 2024 PISA outcome where Filipino learners lagged behind in Mathematics and Science subjects as likened to neighboring Asian countries with many drifting questions left unanswered (Bernardo et al., 2022; Garcia et al., 2024). This seemingly multifaceted concern may be linked to many recurring issues such as book inadequacies, teacher-learners ratio, professional trainings, meaningful exposures, budget allocations, buildings, and even teacher shortages (Zickafoose et al., 2024). As a proactive response, all-out efforts are being exerted to ensure that the Philippines' performance will at least be on par with other ASEAN countries like Singapore, Malaysia, among others. These efforts, as ordered by the umbrella department are pointed to mathematics education specifically. It was underscored that Mathematics concepts must have been taught and should be absorbed uniformly based on the standards and centralized-generated competencies. In the actual pedagogical practice, this directly implies that students should be trained homogenously without having at least to contextualize the concepts taking into consideration the localized materials (Giamellaro, 2017), cultural background (Gulzar et al., 2024), linguistic identity (Baliwas & Estremera, 2025; De Costa, 2025; Truong et al., 2025), and learning pace. This pedagogical practice has actually been prevalent countrywide with the aim of achieving learning uniformity among students. In some instances, the department likewise provides exclusive learning materials for (IP) students gearing towards pedagogical inclusivity anchored in the Department order no. 62, s. 2011 dubbed National Indigenous Peoples Education Policy Framework. The primary aim is the integration of IP learners into the mainstream system thereby preserving their cultural and linguistic backgrounds (Gulzar et al., 2024). In the process, this pedagogical inclusivity poses challenges and concerns to teachers such as the book inadequacies, localized and contextualized materials, and some noted linguistic barriers during actual teaching-learning process (Giamellaro, 2017). In fact, the books provided by the

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department still contains the standard competencies expected of the learners based on their grade levels. This mismatch between the order and actual teaching scenarios forced teachers to innovate some teaching materials that are suited to the level of the learners and are culturally and linguistically relevant (Baliwas & Estremera, 2025; De Costa, 2025; Truong et al., 2025). Teachers make modules and Strategic Intervention Materials (SIM) to address learning gaps and by considering the local learning systems which are proven relevant. And teaching mathematics is not only a matter of linguistic proficiency, but it also contains diverse cultural variables which play a substantial role in the teaching of mathematical models. Every individual's socio-cultural upbringing should be considered part of the education process. Considering the preceding scenarios, this ethnographic investigation aimed to develop some culturally-relevant instructional materials to the Agta-Tabangnon tribe of Lourdes, Polangui, Albay, Philippines through the project KABALAT delineated as (Katutubong Aralin Buhayin, Alagaan, Linangin at Tangkilikin), signifying racial inclusivity irrespective of skin color and race leaning towards cultural recognition and preservation while they are being taught formally with mathematical concepts leveraging their cultural practices.

1.1. Ethnomathematics Worldview

Ethnomathematical practices and knowledge systems among tribes pertain to the ethnically entrenched mathematical rehearses, models, and cognitive approaches that aboriginal communities cultivate and practice in their day-to-day lives (Cain & Johnson, 2021; Mokwana et al., 2024; Lim et al., 2023). These practices span from the exclusive ancient, societal, and ecological backgrounds of each ethnic group, mirroring their customs of calculating, computing, categorizing, and spatial thinking, often interconnected faithfully to their traditional practices and means of support. For instance, the Tharu civic group in Nepal adopts a base-20 calculating system due to the close association with indigenous counting traditions and employs body-referenced parts like the finger (Anguli) and hand (Haat) for quantifying, incorporating these norms into farming, interweaving, and ceremonies (Lim et al., 2023). Correspondingly, Native American people show varied mathematical schemes based on bodily groupings, with bases like 2, 5, 10, or 20, and exhibit symmetrical understanding via complex shapes in arts as well as crafts. Ethno-mathematical customs are transferred through intergenerational storytelling, internships, and public undertakings, helping both real-world and emblematic purposes. These aboriginal mathematical applications offer treasured understandings into substitute means of understanding and learning mathematics by connecting prescribed school theories into an ethnically accustomed information, thereby augmenting learning germaneness and reverence for ethnic identity. Most essentially, ethno-mathematical models highlight the wide-ranging variety of mathematical cognitive processes rooted in cultural milieus, accentuating the significance of knowing and incorporating home-grown knowledge schemes in arithmetic teaching (Cain & Johnson, 2021; Morrison et al., 2021).

1.2. Link between Ethnomathematics and Sociolinguistics

In the context of the current research, ethnomathematics as well as sociolinguistics are two interlinking fields which offer complete understanding of the arithmetic and social practices of the featured ethnic group in the country (Kabuye Batiibwe, 2024; Sunzuma & Umbara, 2025). Ethnomathematics highlights that scientific concepts and procedures are fundamentally rooted within local principles, mores, and day-to-day actions, often communicated and conserved through verbalized means and home-grown dialects. Conversely, sociolinguistics, in its societal background, offers the instrument to scrutinize how linguistic features shape, and is formed by, these mathematical processes (Maanu & Asare, 2025). In Philippine ethnic groups, arithmetic is not acquired in separation but is intertwined with native tongues and everyday practices, such as in aboriginal reckoning schemes, gauging practices, and emblematic illustrations distinct to each ethnolinguistic community. With these premises, language helps not solely as a channel of communication nonetheless as a transporter of social identity, and knowledge schemes, signaling how mathematical concepts are intellectualized and imparted within the tribal community (Ester et al., 2024). In effect, when mathematics is imparted through the mother language or vernacular, it links learning in acquainted social and dialectal frameworks, enhancing connection, self-confidence, and cultural belongingness among students. Exploring ethnomathematical processes from a sociolinguistic perspective discloses how scientific data is verified, processed, and modified across groups. This connection supports instruction that is all-encompassing and ethnically nourishing, exalting both native knowledge and

etymological multiplicity. Ethnomathematics by means of sociolinguistics therefore becomes more than just scientific learning journey – it could be also be a self-motivated course of cultural preservation, self-affirmation, and active engagement with facts entrenched in linguistics and practice (Bazinet et al., 2015; Fouze & Amit, 2023; Nugraha & Nugraha, 2025; Pratama & Yelken, 2024). Thus, the dearth of studies locally and internationally exploring ethnomathematics is the perceived gap that the present exploration hopes to fill. Besides, this study also envisions to communicate the importance of contextualization of competencies in the Philippines known for its one-size-fits-all educational set-up adopting a top-down and centralized educational policy. Meaning that books and reference materials are uniform all throughout the country. The study then proposes the following questions: (i) What are the ethnomathematical practices with lexical equivalents of Agta-Tabangnon tribe? and (ii) What culturally-relevant instructional materials may be accomplished to foster pedagogical inclusivity?

2. Materials and Methods

This study is under the purview of qualitative method specifically leveraging ethnographic-developmental research design to comprehensively provide philosophical answers to the research questions (Ahmed, 2025). This strategy paved the way for the exploration of the ethnomathematical practices with lexical equivalents of Agta-Tabangnon tribe in the locality (Nur et al., 2020; Umbara et al. 2021). The developmental component, on the other hand, concerns the instructional material developed by the implementers of the project taking into consideration the mathematical practices of the subject tribe incorporating likewise some mathematical concepts based on the standard competencies of the Department of Education (DepEd) Philippines as a national mandate (Olivero-Acuña et al., 2025).

2.1. Anthropological Background

The study location was in barangay Lourdes, one of the upland barangays of Polangui, Albay (figure 1). It is a forty-five (45) minute drive from Polangui proper via habal-habal (for rent motorcycle). The community is located near Iriga and Buhi of Camarines Sur, and Malinao, Tiwi, and Tabaco City of Albay. Agta-Tabangnons are an indigenous Filipino tribe primarily located in the Bicol Region, specifically in Albay, Sorsogon, Camarines Sur, and Catanduanes. They are descendants of Agta people who have intermarried with lowland Filipinos and have shifted from a primarily nomadic hunter-gatherer lifestyle to a more settled, agricultural one. The community in Lourdes, Polangui, primarily depends on farming as its source of living. There is an elementary school near the community, and the group lives at the farthest part of the barangay.

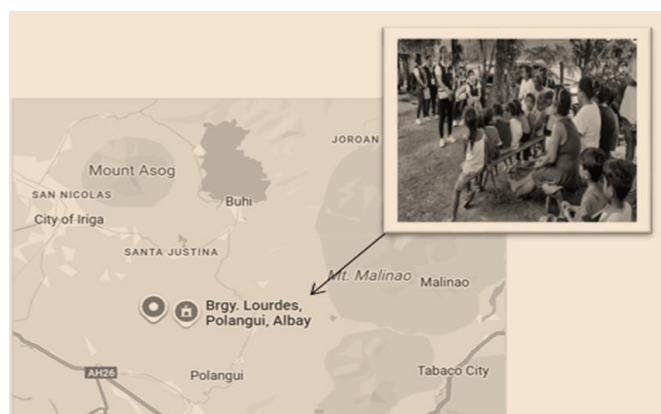


Figure 1. Locale of the study.

The forty (40) participants of the study were asked about their educational attainment (figure 2). The data gathered show that 2 or 5% of Agta-Tabangnon participants are high school graduates. five of them, or 12.5%, are still at their high school level, another five, or 12.5%, completed elementary, 20 or 50% are pursuing their elementary education, and eight or 20% were not able to attend any formal schooling.

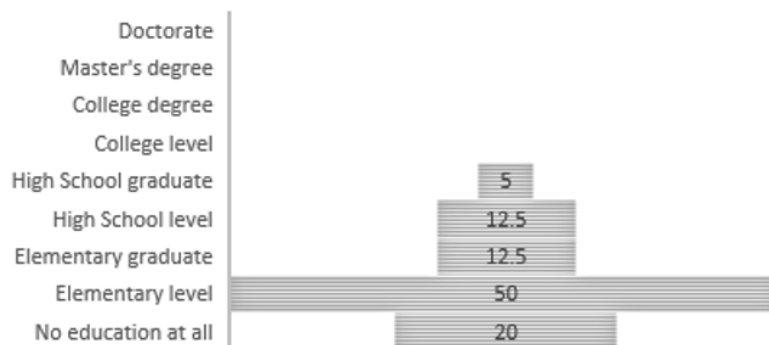


Figure 2. Distribution of the educational attainment of the participants.

These data indicate that all the participants have reached elementary high school levels of education, but none of them reached college level. The data likewise shows that none of them pursued higher education. The statistics also reveals that for education to maximize the human potential of Agta-Tabangnon is very slim since they struggle to attain tertiary level education. The majority of the people is only able to attain elementary education because the elementary school is situated near their community.

2.2. Sampling Method

The study utilized purposive sampling (Memon et al., 2025; Cash et al., 2022) involving fifteen (15) elders and twenty-five (25) school children. Records from the Polangui Service Center of the National Commission on Indigenous People (NCIP) served as a secondary source of data. The study was conducted in Lourdes, Polangui, Albay, one of the upland barangays in Polangui, and is situated beside the far-flung barangays of Tiwi and Tabaco in Albay and Buhi and Iriga in Camarines Sur.

2.3. Data Gathering and Protocols

Observation (Rossetti, 2023), teaching the community, and semi-structured interviews were utilized in this undertaking. The questions asked sought to identify the ethnomathematical practices of the featured tribe (Jayathilaka, 2021; Scott-Fordsmand, 2025; Trundle & Phillips, 2023).

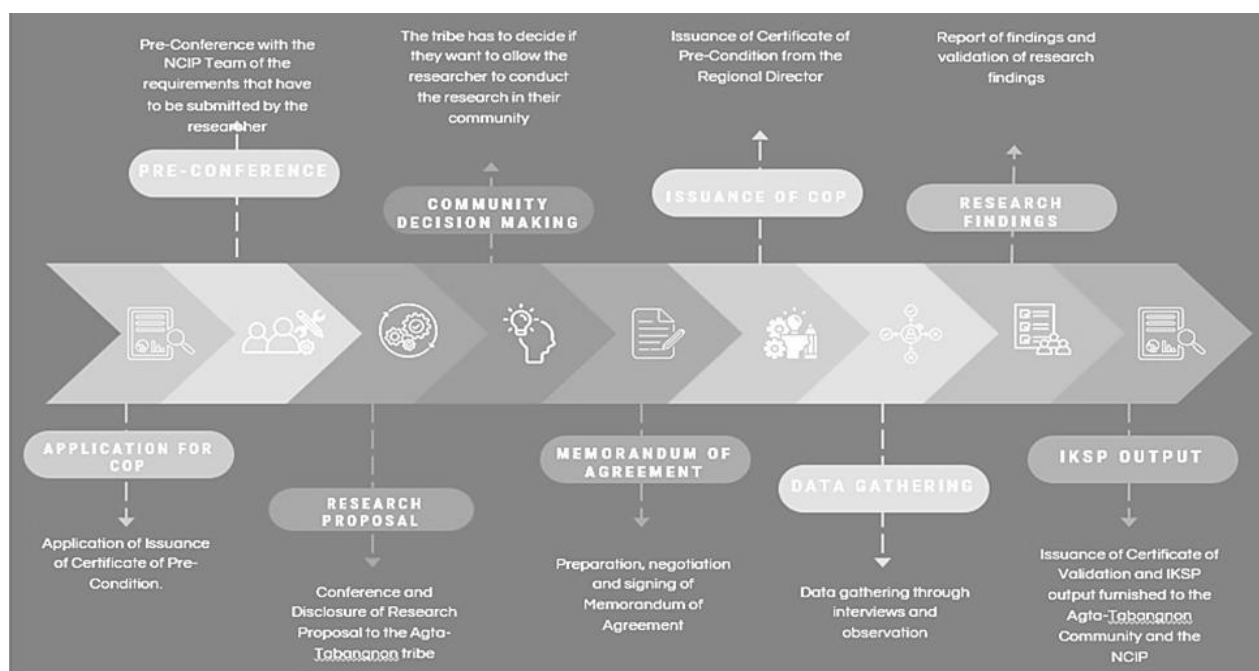


Figure 3. Prior and during informed consent procedure.

The study complied with Republic Act No. 8371, otherwise known as the Indigenous Peoples Rights Act (IPRA) of 1997 and NCIP Administrative Order No.01, s.2012, otherwise known as Indigenous Knowledge Systems and Practices (IKSPs) and Customary Laws

Research Documentation Guidelines of 2012, the researcher strictly followed the Free, Prior and Informed Consent (FPIC) process before actually conducting the data gathering. The process is a requirement before conducting any study about indigenous people to protect their rights and interests. Figure 3 shows the process from the issuance of the certificate of pre-condition down to the submission of IKSP output to the community and the NCIP.

2.4. Instrument Development and Validation

Taking into account the ethnographic-developmental feature of this exploration (Kjellsdotter & Erlandson, 2025), this study crafted a digital instructional material (slide deck) and modules incorporating the ethnomathematical knowledge systems & practices of Agta-Tabangnon tribe leveraging also the lexical equivalents of numbers in their native language. The developed teaching aid was used in the teaching of mathematical concepts taken from the standard DepEd competency for high school students. However, since most of the participants are elementary graduates and minority reached the high school level, some competencies were unpacked to suit to the cognition level of the recipients.

2.5. Data Processing

After instrument validation, researchers adopted a methodical qualitative data processing strategies anchored in ethnographic research techniques comprising data assembly and organization, transcription, coding and categorization, synthesis and triangulation, and most significantly theoretical integration particularly (figure 4).

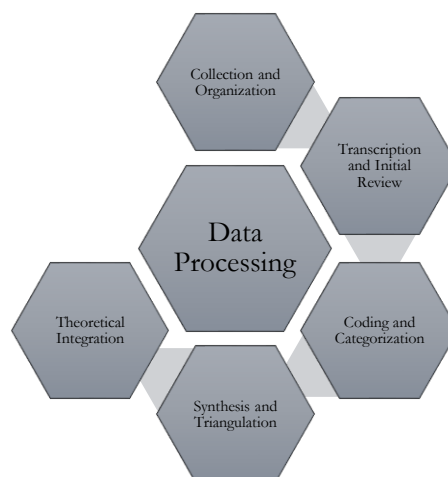


Figure 4. Data processing phases.

Firstly, data assembly and organization means that investigators conducted observations, in-depth consultations, and focused group discussions (FGD) with key participants from the Agta-Tabangnon community. Field records were methodically documented to obtain informal exchanges and ethnic events concerning mathematical models and practices (Gobo & Molle, 2017).

Secondly, transcription and preliminary assessment regards the fact that interview footages and observational records were transliterated in verbatim. These transcriptions were scrutinized to acquaint with the information and ascertain preliminary forms linked to ethnomathematical models rooted in ethnic practices (Copland & Creese, 2015).

Thirdly, data processing concerns coding and labelling. By means of thematic content examination, the records were coded by categorizing keywords and expressions that mirrored mathematical concepts such as calculating, quantity, spatial thinking, and design recognition within traditional circumstances. Codes had been clustered into categories demonstrating diverse features of the Agta-Tabangnon's ethnomathematical understanding (Sun, 2017).

Fourthly, synthesis and triangulation mean that information from numerous sources (opinions, discussions, consultations) had been triangulated to corroborate results and ensure dependability of data. This synthesis facilitated to create a wide-ranging depiction of how mathematical familiarity is ethnically conveyed and experienced within the subject tribe (Flick, 2007).

Fifthly, theoretical integration deals with the treated data that were examined taking into consideration the purview of ethnomathematics theory, associating mathematical models with ethnic values, etymology, and customs. This phase enabled the documentation of lexical

counterparts and their educational inferences for nurturing inclusive teaching (Mensah-Brown, 2025).

2.6. Data Analyses Measures

To delineate the processed data, researchers employed varied analyses techniques to generate philosophical results (figure 5). These involve ethnographic observation strategy (Rossetti, 2023) in-depth interviews with the local tribes, narratives, documentation technique, and essentially cultural practices mapping paving the way for empirical evidences (Jayathilaka, 2021; Scott-Fordsmand, 2025; Trundle & Phillips, 2023). In effect, the participatory surveillance of day-to-day doings where mathematical models surface – calculating, computing, planning, swapping, or calendaring – permits investigators to pinpoint imbedded mathematical thinking and practices distinctive to the Agta-Tabangnon. This comprises field records, audio and video footages, and actual events to highlight background and detail (Kjellsdotter & Erlandson, 2025). Organized and semi-planned consultations with community seniors, consultants, and information holders elucidate how mathematical models are practiced, imparted, and applied. FGDs also disclose collective cultural tales and shared memory linked to mathematical understanding. Vocabulary focus, conversely has probed on the aboriginal expressions, symbols, and tales used to define mathematical models (e.g., calculating systems, measurement components, geometric designs). These lexical equivalents come in both the native tongue and English (or Filipino) with notable semantic hints. Moreover, collecting and analyzing the tribal stories, ceremonies, and oral customs embedded in mathematical practices supplemented further data.

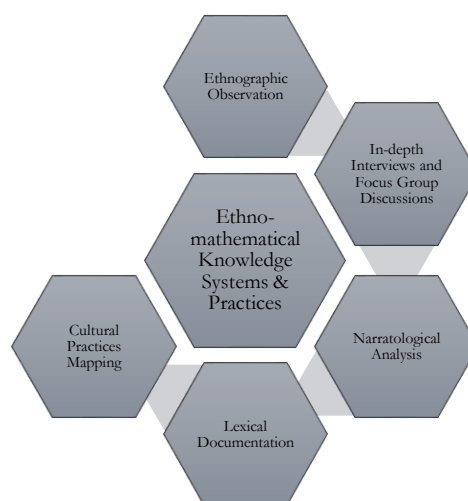


Figure 5. Analyses systems.

Researchers likewise systematically listed and defined all ethnic lexes associated to mathematical models (sums, operations, figures, forms, dimensions). This redounded to creation of a mini-bilingual wordlist with lexical equivalents in English and Filipino with notable phonetic transcriptions, usage and contextual applications. The links to specific mathematical rehearses as well as cultural traditions involving weaving designs, hunting tactics, and seasonal calendars reflective of how math is entrenched in day-to-day life are also captured and analyzed closely.

2.7. Ethical Reflections

The study on the Agta-Tabangnon tribe strictly adhered to ethical guidelines for research involving Indigenous Peoples (IPs) as mandated by the Philippine Health Research Ethics Board (PHREB) and the NCIP. Key ethical considerations included obtaining FPIC through an iterative and documented community consultation process, ensuring that participants fully understood the research aims and methods, preferably in their native language (Sugiman et al., 2025). The research respected the tribe's cultural knowledge and practices, recognizing their intellectual property rights (Aquidado et al., 2025). Data privacy was maintained in compliance with the Data Privacy Act of 2012. The study also ensured benefit-sharing and cultural sensitivity, fostering trust and collaboration with the community while protecting their dignity and autonomy throughout the research process.

3. Results

Generating data from the community immersion experienced among Agta-Tabangnon tribe, several knowledge systems with lexical equivalents have surfaced (table 1). These have to do predominantly with their counting system, ciphering, measuring, ordering, classifying, inferring, and modelling delineated each by each hereunder. The first column is the internationally known counting symbols in Mathematics class. Additionally, the second and third highlight the unique phonological feature of the tribe's counting system that is likewise linked with the formal counting system confirming the tribe's prior knowledge in the target language. Lexically, it sounded closely with its Filipino equivalent. Researchers deem it relevant to provide the IPA transcription for lexical comparison and etymological feature.

Table 1. Mathematical symbols, equivalents and transcriptions.

Symbols Used in Formal Mathematics	Counting in Native Tongue	Agta-Tabangnon Symbol	Filipino Equivalent (L1)	English Equivalent (L2)	IPA Phonetic Transcription
1	usad/saro'	1	Isa	One	wan
2	Duwa	2	dalawa	Two	tu:
3	Tulo	3	Tatlo	Three	θri:
4	upat/apat	4	Apat	Four	fɔ:
5	Lima	5	Lima	Five	farv
6	unom/anom	6	Anim	Six	siks
7	Pito	7	Pito	Seven	'sevⁿ
8	Walo	8	Walo	Eight	eɪt
9	Syam	9	Siyam	Nine	naɪn
10	Sampulo'	10	sampo	Ten	tɛn
11	Onse	11	labing-isa	Eleven	ɪ'levⁿ
12	Dose	12	labing-dalawa	Twelve	twɛlv
13	Trece	13	labing-apat	Thirteen	θɜ: 'ti:n
14	Katorse	14	labing-lima	Fourteen	fɔ: 'ti:n
15	Kinse	15	labing-anim	Fifteen	fɪf' ti:n

3.1. Counting

Construing from the community immersion and table above, counting is one of the most important systems in a tribal community. It is used in their daily transactions with peers to trade, record, and observe time. This involves the use of fingers, toes, dots and even bars to counter numbers manually and traditionally. With this system, the subject tribe is able to link numerals to body parts to aid them in counting cognitively. It was likewise empirically noted that many of the tribe members were deprived of the Mathematics education formally. However, if likened to formal schools, their manner of writing mathematical symbols is the same as that of formal Mathematics teaching. They, in effect, use Hindu-Arabic numerals in their native tongue as well. For instance, it can be noted that for some numbers like one (1), four (4), and six (6), they are phonetically pronounced in their own dialect due to peripheral linguistic influence. This implies that neighboring tribal group does have influence in their mathematical etymology. The first district of Albay, having saro for one (1), apat for four (4), and anom (6). Furthermore, the usad for 1, upat for 4, and unom for 6 are the lexical items used in the third district of Albay. This counting system divulges a culturally- entrenched scientific concepts, elevating formal mathematics teaching by linking it to native practices, conserving cultural uniqueness, and nurturing significant learning processes embedded in customs and community traditions (Kabuye Batiibwe, 2024; Pratama & Yelken, 2024).

3.2. Ciphering

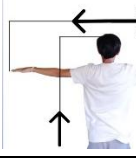
In the context investigation, ciphering denotes a written code in which the letters of a text are replaced with others according to a system. The activity involves signs, symbols, and human gestures, which are other ways of conveying the message to their fellow Agta-Tabangnon inhabitants. The ethnomathematical practice of the tribe insofar as ciphering is concerned, was evident during local rituals and gathering. For instance, shouting can be deciphered as a signal to assemble themselves for an impending congregation. Hence, in Mathematics education, ethnic ciphering indicates the practice of ethnically specific ciphers,

codes, and signals to express a message within the learning context. It divulges how ethnic groups cultivate distinctive communication schemes incorporated with scientific calculation processes, maintaining ethnic individuality and elevating home-grown scientific understanding through emblematic depiction and actual practice in everyday routines (Age, 2025; Wulandari et al., 2024).

3.3. Measuring

The tribe's practices in measuring disclose an inspiring connection in the field of ethnomathematics. As captured, elders would usually be guided by the environmental cues such as sun ray, object shadows, and even the extent and magnitude of daylight to determine the time of the day. Interestingly, Agta-Tabangnon associates the sound produced by a hornbill bird as a time signal and gauge apart from the customary sound echoed and crowed by roosters early in the morning cueing for another ethnic day. As documented, another measuring practice among the tribal community is the use of finger (usually middle) in calculating the water volume prior to cooking their rice. This practice, in effect, has been handed-down from generation to generation already as an effective way of measuring water level. Another captured measurement technique in measuring the rice field is by the approximate number of sacks of rice that can be harvested instead of using square meters (*sq. m.*) or hectares (*ha*). The lexical item *topones* is the term used to measure the land area of a rice field. Two hundred twenty-five *topones* is equivalent to one hectare (*1 ha*). They likewise use the body parts to measure the distance between one object to another. For this claim, table 2 presents the ethnomathematical terms they used in measuring distances. As noted, ethnic measuring in reflects how the tribe improve real-world, ethnically rooted dimension systems leveraging body portions like fingers and limbs or any ordinary items around. These manner of measuring are deeply linked to their day-to-day errands such as in farming, handicraft making, and sales, maintaining their cultural distinctiveness and elevating mathematical acumen through context-inspired processes and practical apparatuses. Such methods enable ethnic knowledge communication that are potentially adoptable in formal mathematics teaching anchored on inclusive education principles (Kyeremeh et al., 2025; Sunzuma & Umbara, 2025).

Table 2. Native tongue equivalents in measuring distances among Agta-Tabangnons.

Measurement lexical items	Description	Diagram	Native tongue equivalents
hand span	The distance between the tip of the thumb and the tip of the little finger on an outstretched hand		Dangaw
foot span	The distance between the tip of the toe and the foot's heel		Lakbang
pace movement	Two natural steps are equal to a pace		Lakbang
span/wingspan	The physical measurement of the length from one end of an individual's arms (measured at the fingertips) to the other when elevated parallel to the ground at shoulder height		dupa/dipa

3.4. Ordering

Some of the notable local practices of the tribe linked to ordering is ethnically known as pagnganga, (a traditional chewing of combined medicinal herbs and seed common to elderlies in rural areas) and a usual practice in planting crops within in their tenured lot. One of the activities of the tribe, which is considered part of their customs in agriculture is pagnganga equivalent to putting lime, betel leaf, a quarter of sweetened tobacco, and 1/8 of betel nut

chewed altogether coupled with a wish for abundance during harvest season. Connecting this knowledge system to ethnomathematics, such practice may be contextualized by incorporating concepts relative to their customs to ensure that learners will be able to link their schema to the formal Mathematics concepts, by degrees. Some of the observed ordering activities manifested by the ethnic group are as follows: (i) making bamboo sticks to guard the plant, (ii) putting available fertilizer around the roots, (iii) harvesting the crops and vegetables according to size category, (iv) weighing of crops and vegetables, (v) selling the harvested crop in the local market, and (vi) earning money in return. It worth noting that each activity involves ethnomathematics which guides them in doing their tribal practices. Thus, ordering among the ethnic group involves the ethnically accepted ways of arranging or sequencing items, events, and time that are based on resident rules and requirements. It mirrors real-world organization in day-to-day life – in agriculture or sales – that develops their mathematical concepts by associating nonconcrete models of order and arrangement to lived practices and knowledge systems. This nurtures significant mathematics acquisition that is culturally imbedded in nature (Fouze & Amit, 2023; Radzi & Mahmud, 2025).

3.5. *Classifying*

Organizing objects or things based on their common characteristics is the documented knowledge system and practice linked to classifying things by the featured tribe. It usually communicates a model for organizing things in the real-world divulging their logical thinking skills. As claimed during close interview, classifying objects is important to some of the tribe's customary rituals and survival. This can be observed around the community through their way of arranging things together in constructing their nipa huts, farming, growing plants, and selling home-grown products revealing arithmetic concepts. Table 3 highlights the ethnic system's way of classifying the kind of harvested rice plant as their primary source of living. As captured, classifying in the field of ethnomathematics nurtures the different ethnic mathematical knowledge systems, upholding inclusivity in teaching students. It links formal mathematics with learners' traditional experiences, increasing engagement, enthusiasm, self-confidence, and impetus, thereby ensuring academic feat and ethnic individuality among varied students (Ajani, 2025; Nur et al., 2020; Nurhanan & Santoso, 2025).

Table 3. Ethnomathematical terms used in classifying *palay*.

Native tongue categorizing terms	Description
Presko	newly threshed
Alusamug	fresh rice harvest with slightly higher moisture content
medya ga-ngo	rice harvest from dried to a moisture content of slightly higher than 14%
ga-ngo	rice harvest from dried to 14% moisture or less
Maluyang liyempesa	freshly threshed rice harvest with unripe seeds (matured rice harvest but not yet greenish in hull color)

3.6. *Inferring*

As verified, inferring was used in the context of deriving meanings from the observed patterns in the environment. In the case of Agta-Tabangnon, inferring is evident when predicting weather through cloud formations and moon shapes signifying for an impending good or bad weather helping them when to conduct rituals, congregations, likewise cueing them when to cultivate their farm lots. This tribe also made use of the sound produced by dogs to signal for a bad omen or luck is about to happen assisting them to analyze and predict future events. These knowledge systems, if linked to the lessons in Mathematics may be applied as a way to connect with the ethnic group and stimulate their active participation. Teachers may leverage this predicting technique as preliminary activity or a motivational technique to arouse the interest of the students. As a matter of fact, one key finding verified by this qualitative immersion is the fact that inferring supports learners in developing significant mathematical understanding anchored on their cultural backgrounds, upholding rational thinking and profounder understanding of the concepts being explored. It also links mathematical models to realistic cultural understandings, increasing relevance, enthusiasm, and problem-solving abilities, thereby nurturing equitable and efficient education for varied students. This method boosts learners to make and construe mathematics according to their socio-cultural upbringings, enhancing commitment and academic achievement (Günay &

Takunyacı, 2023).

3.7. Modelling

The designs documented by this study are typically produced by nature and of the tribe themselves revealing practical Mathematical applications specifically geometrical figures. Such patterns are evident weaving, handicraft, rice planting. In the straight method of planting patterns, geometric concepts are observed. The mathematical concepts palpable in this pattern are the undefined terms – points, lines, and planes. The planted rice represents points forming a line. The rectangular figure formed by the planted rice spacing also applies the plane concept. The lines created by the planted rice also form parallel lines (figure 4). Operationally, modelling empowers students to generate scientific illustrations imbedded in their traditional perspectives, improving understanding and germaneness in Mathematics by promoting a comprehensive and conducive learning atmosphere (Bulut & Borromeo Ferri, 2025; Saparbayeva et al. 2025; Uba et al., 2023).

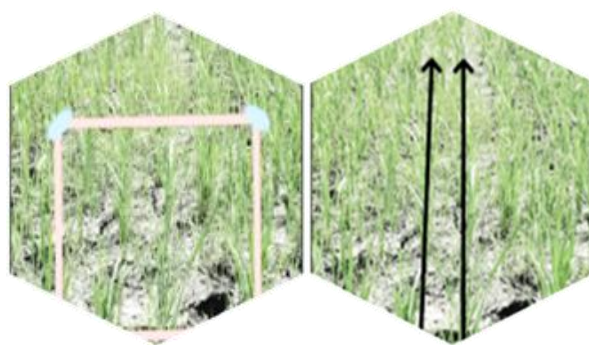


Figure 6. Illustration of how rice is planted in parallel line and rectangular form.

Geometric concepts are also evident in the designs of the *lanub* or walls of some of their houses. The sidewalls are made of woven bolo (bamboo) ethnically known as sawali. The woven bamboo follows a pattern in such a way that it will look neat and will not be easily deformed. The patterns formed in the weaving of sawali illustrate geometric concepts such as congruency and geometric transformations: translation, reflection, and rotation. Inferring from these patterns, these can be a good source of localized instructional materials that are relevant and practical to be used as concrete samples adoptable to almost all fields like geometry, arithmetic, statistics, and algebra making Mathematics more stimulating and meaningful to study on the part of the students underpinning accordingly inclusive education. Thus, the incorporation of these indigenous geometric patterns into mathematics instruction not only bridges cultural knowledge and formal mathematical concepts but also enhances students' engagement by contextualizing learning within their lived experiences.

4. Discussion

Taking into account the data, it presupposes that incorporating ethnomathematics mixed with sociolinguistics feature in teaching boosts ethnically relevant mathematics education that regards students' dialectal upbringings and cultural characteristics, redounding in enhanced engagement, advanced learning process, and better self-image, particularly among aboriginal and marginal students (Kabuye Batiibwe, 2024; Sunzuma & Umbara, 2025). This tactic nurtures comprehensive, evocative learning journey for varied teaching spaces (Maanu & Asare, 2025). This exploration has likewise verified the importance of understanding learners' background as starting point of educational delivery. These considerations will lead to the preservation of the tribe's identity and customs (Age, 2025; Wulandari et al., 2024). In fact, the comprehensive footage of their scientific models and lexicon in both the native tongue and L2 guarantees that these ethnic practices are preserved for future applications to uphold their cultural inheritance (Kyeremeh et al., 2025; Sunzuma & Umbara, 2025). Moreover, reconnoitering the knowledge systems in L1 with highlighted L2 equivalents provides awareness for crafting ethnically-inspired mathematics programs that will fortify inclusive teaching by linking prescribed mathematics with the community's lived familiarities and socio-cultural authenticities (Fouze & Amit, 2023; Radzi & Mahmud, 2025). As to lexical equivalence and linguistic preservation, the key points of this immersion will aid Mathematics educators in crafting relevant bilingual instructional materials that regard both language and

theoretical integrity transcending linguistic blockades in teaching (Ajani, 2025; Nur et al., 2020; Nurhanan & Santoso, 2025). In the same vein, the comprehensive ethno-mathematical information contained in this study may apprise local and countrywide education officials to craft and issue policies designed to incorporate indigenous rich heritage in the school syllabi. This will contribute to a more evenhanded educational structures and support ethnic privileges in education, anchored with UNESCO and other intercontinental pronouncements on native peoples' traditional and scholastic civil rights (Günay & Takunyacı, 2023). Most essentially, it offers some comparative findings with other ethnomathematics inquiry to expand under-standing of the multiplicity and intricacy of ethnic mathematical knowledge systems and practices across the world. From these premises, it can be inferred that the participant tribe do have their own calculating systems which can be applied and be incorporated by Mathematics teachers in their lesson preparation and extension activities. The tribe is responsive to the lesson if their language is used initially before introducing mathematical lexicon. Cultural practices and rituals such as their weaving, farming, and counting models may be used as a springboard to make sure that the content is contextualized and made relevant to the learners.

Cultural significance is essential to the study of ethnomathematical and social practices of tribal groups in the Philippines, particularly when regarded through a sociolinguistic lens (Gbormittah et al., 2025; Olivero-Acuña et al., 2025). Ethnomathematics distinguishes that mathematical knowledge is profoundly rooted in cultural mores, dialects, and day-to-day practices, such as counting schemes, measurement, and pattern-making in indigenous artstries and ceremonies. For tribal societies, these practices are not only practical but also mirror unique worldviews and dialectal expressions that shape mathematical understanding. Incorporating these practices into teaching nurtures cultural-rootedness, letting students see mathematics as a living, developing part of their heritage rather than an intangible, foreign discipline. This method upholds the worth of local knowledge and supports the inclusion of diverse cultural viewpoints in mainstream programs, encouraging equity and identity affirmation for indigenous students.

5. Conclusions

Inferring from the key findings, researchers concluded that an enhanced the delivery of educational services to Agta-Tabangnon in particular and to the IP learners at large is essential. Thus, implementation of L1 as a medium of instruction should not be for primary grades exclusively, but for all IP learners as well to recognize and preserve their unique language features. Correspondingly, integration of IKSPs that are unique to the tribe is also recommended to make the lesson more relevant and meaningful. Teacher training as to the culture, beliefs, and practices of the community will help educators to be aware of the learners' background and identity. Community-based tourism and livelihood programs has also been recommended to augment the economic status of IP and of the learners in the process. Ample resource allocation is necessary to bring fair and quality government service to the native people worldwide. Thus, researchers recommend that in order to improve cultural relevance in the study of ethnomathematical and cultural practices of ethnic communities in the Philippines from a sociolinguistic view, it is indispensable to center indigenous dialects and spoken traditions in research and curriculum development. Academics and teachers should join forces with ethnic elders and community members to document and authenticate local mathematical concepts, guaranteeing that linguistic expressions and cultural distinctions are truthfully epitomized. Educator training agendas must include ethnomathematics and sociolinguistics to prepare educators with the skills to contextualize lessons and link cultural gaps. Materials should be developed in local languages and reflect everyday practices, such as traditional measurement, enumeration, and pattern-making, to affirm schoolchildren's identities and encourage deeper engagement. This style fosters inclusivity, empowers indigenous students, and enhances the national curriculum with diverse cultural viewpoint.

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