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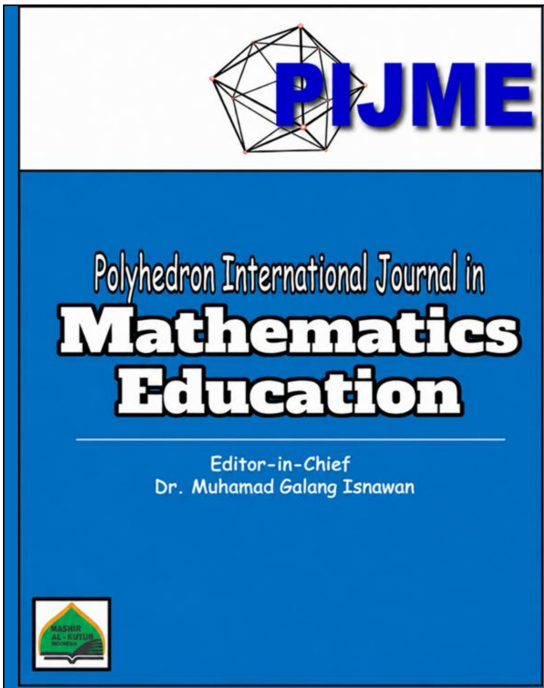

Developing and validating an ethnomathematics-based learning module from the traditional house and accessories of the Dayak Bumi Segandu Indramayu Tribe for junior high school students

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Developing and validating an ethnomathematics-based learning module from the traditional house and accessories of the Dayak Bumi Segandu Indramayu Tribe for junior high school students

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Abstract
Ethnomathematics research has documented mathematical concepts embedded in various Indonesian cultural artifacts; however, few studies have transformed these findings into validated instructional materials, and the traditional houses and accessories of the Dayak Bumi Segandu Indramayu community remain unexplored in mathematics education literature. This study addressed this gap by combining an ethnographic exploration with the ADDIE development model to design and validate an ethnomathematics-based learning module on three-dimensional geometry for seventh-grade junior high school students. The research was conducted at Padepokan Nyi Ratu Kembar Jaya, Krimun Village, Indramayu Regency. Data were collected through observations, interviews, and documentation involving four purposively selected participants representing the community leadership and members. Qualitative data were analyzed using coding, data reduction, data display, and conclusion drawing assisted by ATLAS.ti 8. The exploration identified mathematical concepts embedded in traditional houses and cultural accessories, including lines, angles, plane figures, and solid figures, which were integrated into the module. Validation by two mathematics education experts yielded an average score of 72.8% (Good), indicating satisfactory conceptual and pedagogical quality, although improvements were recommended for language clarity. Practicality evaluation by two mathematics teachers produced an average score of 95.5% (Strongly Agree), demonstrating high classroom usability. These findings indicate that the cultural heritage of the Dayak Bumi Segandu Indramayu community can be systematically transformed into a valid and practical mathematics learning resource while contributing to the preservation of local knowledge through school mathematics.

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1. Introduction

Mathematics is a fundamental discipline that plays an essential role in everyday life and serves as a compulsory subject across all levels of formal education. Learning mathematics enables students to develop logical, analytical, systematic, critical, creative, and collaborative thinking skills while strengthening their ability to solve problems encountered in academic and real-life contexts (Majeed & Jawad, 2021; Satria & Sopandi, 2019). Moreover, mathematics provides the conceptual foundation for scientific and technological advancement, making mathematical competence increasingly important in the era of rapid information and communication technology development. Consequently, mathematics instruction should not merely emphasize procedural fluency but should also foster deep conceptual understanding by connecting mathematical ideas with students' experiences and surrounding environments.

The quality of mathematics instruction plays a decisive role in shaping students' conceptual understanding and problem-solving abilities. Therefore, teachers are expected to continuously evaluate and improve instructional practices by designing meaningful learning experiences that encourage reasoning, communication, and critical thinking. One effective way to achieve this objective is by integrating mathematics with students' cultural backgrounds, allowing abstract mathematical concepts to become more contextual and meaningful. Such an approach not only enhances conceptual understanding but also helps students appreciate the cultural values embedded within their communities.The integration of mathematics and culture is widely known as ethnomathematics, an approach that examines mathematical ideas inherent in cultural practices, traditions, artifacts, and daily activities. Ethnomathematics recognizes that mathematical thinking is not confined to formal classroom settings but is deeply embedded in the ways communities solve practical problems and organize their lives. Indonesia, with its rich cultural diversity, offers abundant opportunities for ethnomathematics research through traditional architecture, handicrafts, performing arts, local measurement systems, ornaments, and customary practices. Previous studies have demonstrated that incorporating ethnomathematical contexts into mathematics instruction can improve students' engagement, conceptual understanding, and critical thinking while preserving local cultural heritage (Faqih et al., 2021; Imswatama & Lukman, 2018).

One cultural community that offers considerable ethnomathematical potential is the Dayak Bumi Segandu Indramayu community located in Krimun Village, Losarang District, Indramayu Regency, West Java, Indonesia. Although the community embraces unique cultural values rooted in Javanese traditions, it possesses distinctive architectural forms and cultural accessories that reflect various mathematical ideas. Their traditional houses, ornaments, and daily artifacts exhibit geometric characteristics that can be explored as authentic learning resources for school mathematics. In particular, concepts related to plane and solid geometry can be identified from the structural designs and decorative elements found in these cultural objects. Such cultural artifacts provide meaningful contexts through which students can relate abstract geometric concepts to tangible objects encountered in real life.

Previous ethnomathematics studies have investigated mathematical concepts embedded in various Indonesian cultural artifacts, including traditional houses, batik patterns, woven fabrics, dances, and local architectural designs. These studies have successfully documented numerous mathematical concepts and demonstrated the educational potential of local culture in mathematics learning. However, most existing research has focused primarily on identifying mathematical concepts without extending the findings into validated instructional materials that teachers can directly implement in classroom practice. Consequently, the practical contribution of many ethnomathematics studies to mathematics education remains limited.

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Furthermore, despite the cultural uniqueness of the Dayak Bumi Segandu Indramayu community, no previous study has comprehensively explored the ethnomathematical concepts embedded in its traditional houses and cultural accessories. This indicates an empirical gap, as the mathematical knowledge inherent in this community has not yet been systematically documented. At the same time, a developmental gap exists because no previous ethnomathematics research concerning this community has resulted in the development and validation of curriculum-aligned instructional materials that can be used by mathematics teachers. Addressing these two gaps is important not only for enriching the ethnomathematics literature but also for providing practical learning resources that integrate local wisdom into mathematics education.

Therefore, this study combines ethnographic exploration with the ADDIE instructional design model to bridge both the empirical and developmental gaps. The study first identifies mathematical concepts embedded in the traditional houses and cultural accessories of the Dayak Bumi Segandu Indramayu community and subsequently transforms these findings into an ethnomathematics-based mathematics learning module for junior high school students. The developed module focuses on three-dimensional geometry (solid figures with flat surfaces) and is designed to align with the Indonesian junior secondary mathematics curriculum while incorporating authentic cultural contexts.

Accordingly, this study addresses the following research questions:

1) What mathematical concepts are embedded in the traditional houses and cultural accessories of the Dayak Bumi Segandu Indramayu community?
2) How valid and practically usable, as evaluated by expert validators and practicing mathematics teachers, is an ethnomathematics-based learning module on three-dimensional geometry developed from these findings using the ADDIE model?

2. Method

2.1 Research Design

This study employed a sequential, two-phase research and development (R&D) design. The first phase was a qualitative ethnographic exploration aimed at identifying mathematical concepts embedded in the traditional houses and accessories of the Dayak Bumi Segandu Indramayu Tribe. The second phase used the ADDIE model, Analysis, Design, Development, Implementation, Evaluation, developed by Robert Maribe Branch, to translate these ethnographic findings into a validated ethnomathematics-based mathematics learning module. The two phases were not treated as independent procedures: the geometric concepts identified during the ethnographic exploration directly informed the Analysis stage of ADDIE by clarifying which cultural objects and mathematical topics were relevant to junior high school geometry; these findings were then mapped onto Basic Competencies and Competency Achievement Indicators during Design, realized as module content during Development, trialed with teachers during Implementation, and reviewed for strengths and shortcomings during Evaluation. This staged approach is consistent with other ADDIE-based mathematics module development studies (Asmianto et al., 2024; Patri & Heswari, 2021; Nuryadi et al., 2023). The diagram below summarizes the overall research design, showing how the ethnographic exploration phase feeds into each successive ADDIE stage and which participants were involved at each point.

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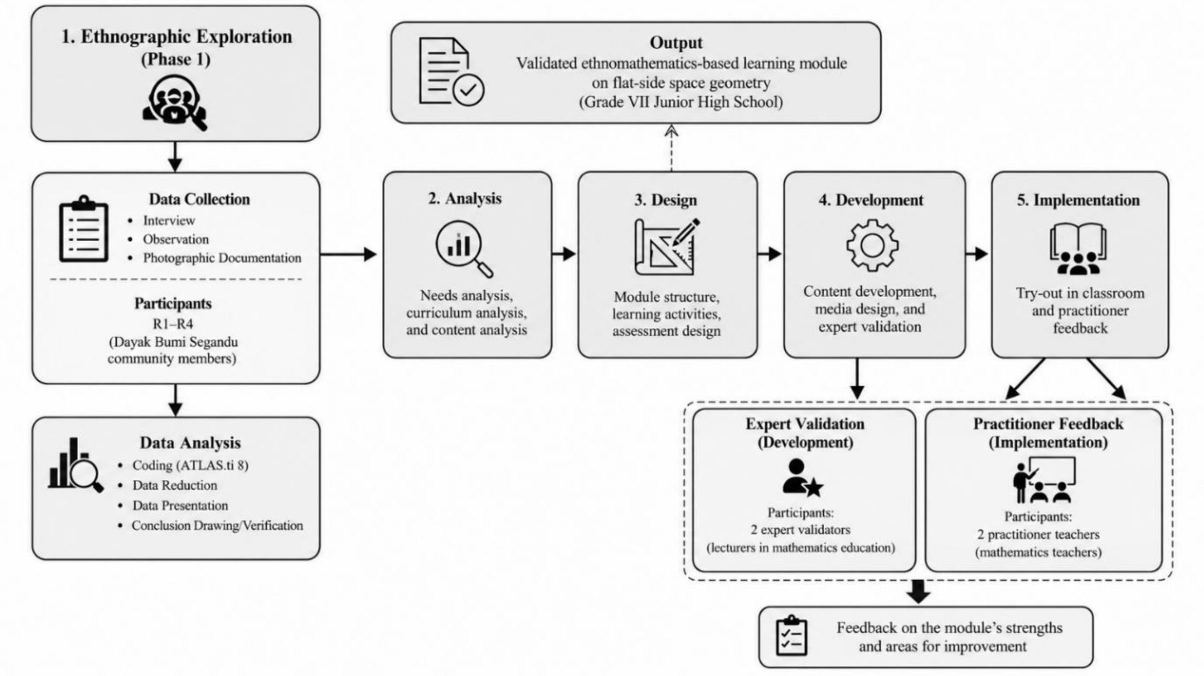
Figure 1
Research Flow from Ethnographic Exploration to ADDIE



2.2 Participants

Participants were purposively selected at each stage of the research to match the specific information needed at that point. During the ethnographic exploration phase, four members of the Dayak Bumi Segandu Indramayu community were purposively selected to represent distinct positions within the community structure: the tribal leader's spokesperson (R1), a general community member (R2), a uniform-bearer (R3), and community security personnel (R4), because each occupies a different vantage point, respectively custodial, everyday-use, ceremonial, and protective, on the community's traditional houses and accessories. This purposive, role-based selection followed common ethnographic practice, which prioritizes informational richness and diversity of perspective over sample size; data collection continued until the four accounts converged on a consistent set of mathematical concepts, indicating that thematic saturation had been reached for the scope of this study. During the Development stage, two lecturers in mathematics education served as expert validators of the module's content, language, and appearance. During the Implementation stage, two mathematics teachers at SMP Pesantren Al-Urwatul Wutsqo Indramayu, who had direct classroom teaching experience, served as practitioner respondents who trialed the module and judged its attractiveness and usability. In this way, the study's participants span the full arc of the research and development process, from the community members whose cultural knowledge grounded the module's content to the experts and practitioners who judged its validity and classroom readiness.

2.3 Data Collection

Data were collected using multiple complementary techniques appropriate to each phase of the study. In the ethnographic exploration phase, data collection consisted of semi-structured interviews with the four purposively selected respondents, direct field observation of the traditional houses and accessories, and photographic documentation, which together provided the primary evidentiary record retained for analysis (see Figures 1–4 for the resulting ATLAS.ti coding networks and Tables 1–2 for the observation and documentation record). In the Development and Implementation phases of the ADDIE model, data were collected through structured questionnaires: a module feasibility questionnaire completed by the two expert validators, and a module response questionnaire completed by the two practitioner teachers. Both questionnaires combined open and closed items covering the aspects of content, language, and appearance.

2.4 Data Analysis

Data from the ethnographic exploration phase were analyzed qualitatively using coding, data reduction, data display, and conclusion drawing/verification. Open coding was conducted in ATLAS.ti 8 by the first author to identify mathematical ideas embedded in the interview transcripts, field observations, and photographic documentation. Segments describing shapes, measurements, and spatial arrangements were assigned descriptive codes, which were subsequently grouped into three categories: lines and angles, plane figures, and solid figures. These categories were then synthesized into the overarching theme of ethnomathematical concepts embedded in traditional houses and cultural accessories. Data reduction focused the analysis on mathematical concepts relevant to the research objectives. The coding networks (Figures 1–4) and photographic documentation (Tables 1–2) were used to present the findings while maintaining analytical traceability from the raw data to the reported mathematical concepts, rather than relying solely on verbatim interview quotations.

To enhance the trustworthiness of the qualitative findings, the coding results were cross-checked against the photographic documentation and reviewed by the research advisory team before the final categories were established. Credibility was strengthened through triangulation of interview, observation, and documentation data, followed by member checking during follow-up visits with participants. Dependability and confirmability were ensured through peer debriefing with the advisory team, while transferability was supported by providing detailed descriptions of the research setting, participants, and cultural artifacts.

Data from the Development and Implementation phases were analyzed quantitatively by converting the validators' and teachers' questionnaire scores into percentages using the evaluation criteria adapted from Apsari and Rizki (2018). Percentage scores above 60% were interpreted as indicating acceptable validity and practicality. Finally, the qualitative findings from the ethnographic analysis and the quantitative evaluation results were integrated to draw conclusions regarding the mathematical concepts identified and the validity and practicality of the developed learning module.

3. Results and Discussion

3.1 Results

The subjects or sources of data in this study are the Earth Dayak Tribe Segandu Indramayu which includes tribal chiefs represented by their spokespersons as Respondent 1 (R1), general community members as Respondent 2 (R2), uniform-bearing officialsas Respondent 3 (R3), and security personnel as Respondent 4 (R4). This research is carried out periodically in different places, namely in the Padepokan of the Earth Dayak Tribe Segandu Indramayu in Krimun Village, Losarang District, and the houses of Dayak people outside Padepokan. The following is the result of the analysis of interviews with the four respondents.

3.1.1 Analysis

Following the ADDIE sequence described in the Methods section, this first stage presents the ethnographic exploration findings that constitute the Analysis stage of the research and development process: the results of the interviews with the four respondents, the mathematical concepts identified in the traditional houses, the traditional house observations, the mathematical concepts identified in the accessories, and the resulting rationale for the learning module. These findings directly informed the Design, Development, Implementation, and Evaluation stages reported in the following sub-sections.

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Results of Interview Analysis of Respondent 1

Interview data were coded and organized using ATLAS.ti 8 to identify the cultural elements associated with the traditional houses and accessories of the Dayak Bumi Segandu Indramayu community. Figure 1 presents the coding network generated from Respondent 1 (R1), illustrating the relationships among the identified themes that served as the foundation for subsequent ethnomathematical analysis.

Figure 2

Results of Interview Analysis of Respondent 1 (R1)

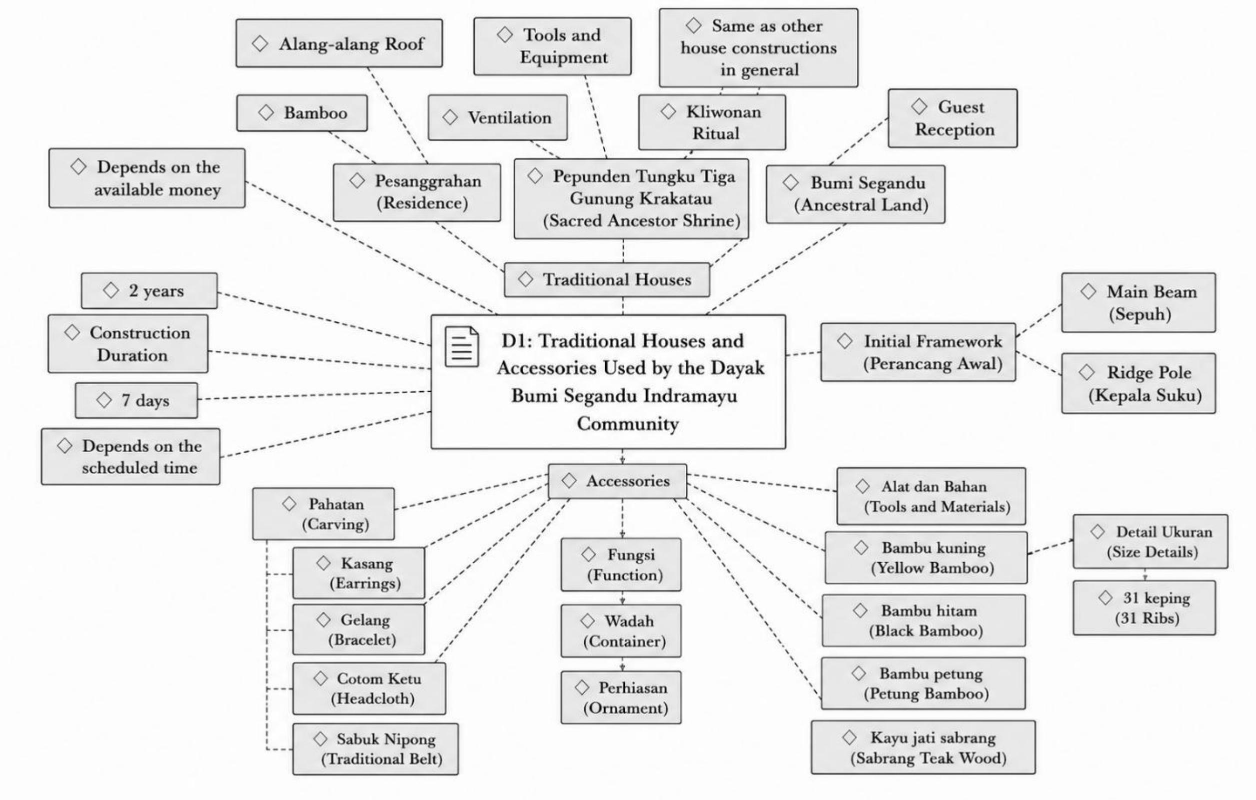

Figure 2 presents the coding network derived from the interview with Respondent 1 (R1), illustrating the main themes related to the traditional houses and cultural accessories of the Dayak Bumi Segandu Indramayu community. The analysis highlights information concerning the construction process, building components, construction duration, materials, cultural functions, and accessories, demonstrating the richness of knowledge embedded in the community's cultural heritage. These interconnected themes served as the foundation for identifying ethnomathematical concepts, particularly those associated with geometry, measurement, and spatial structures, which were subsequently incorporated into the development of the ethnomathematics-based learning module.

Results of Interview Analysis of Respondent 2

To enhance the credibility of the findings, interview data from additional respondents were analyzed using the same coding procedure in ATLAS.ti 8. Figure 2 presents the coding network generated from Respondent 2 (R2), illustrating the relationships among the identified themes and subthemes that support the identification of ethnomathematical concepts embedded in the traditional houses and cultural accessories of the Dayak Bumi Segandu Indramayu community.

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Figure 3
Results of Interview Analysis of Respondent 2 (R2)

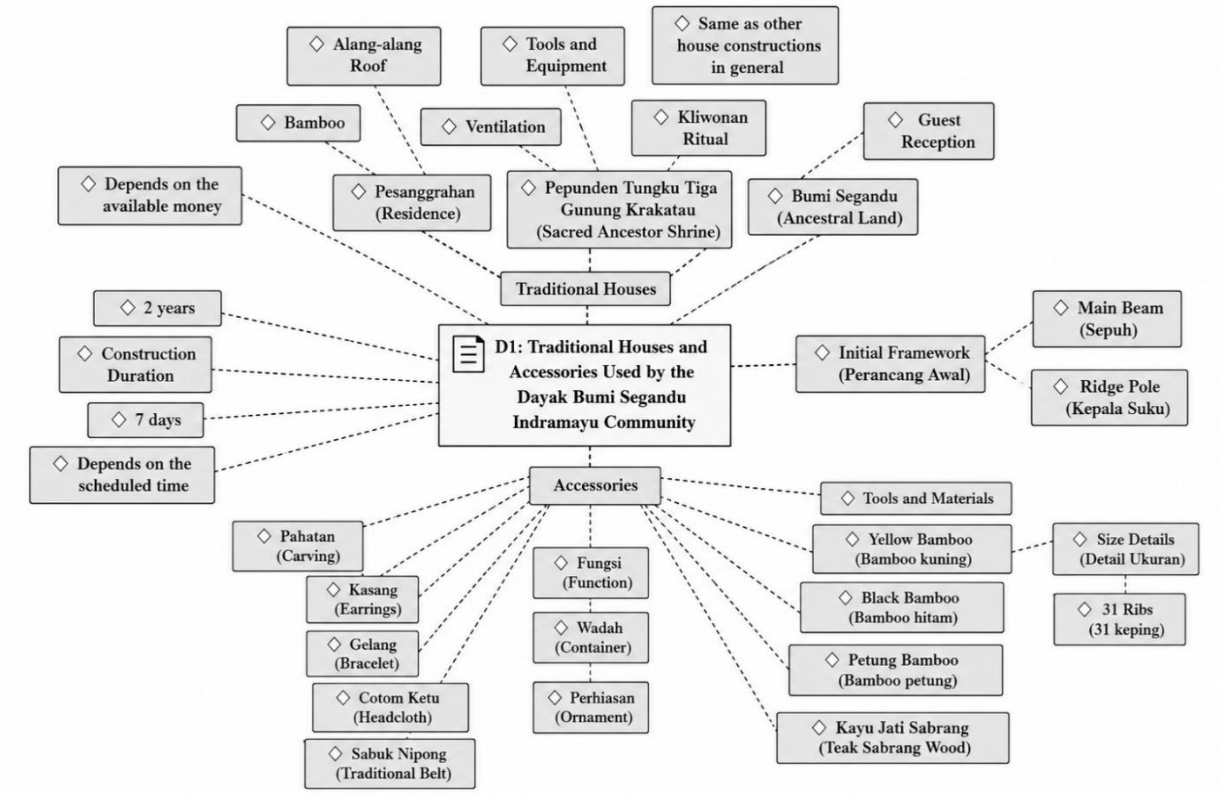

Figure 3 illustrates the coding network derived from the interview data of Respondent 1 (R1). The analysis reveals several interconnected themes describing the characteristics of traditional houses and cultural accessories, including their functions, construction materials, dimensions, and cultural significance. These findings provided the foundation for identifying mathematical concepts embedded in the cultural artifacts and informed the development of the ethnomathematics-based learning module.

Results of Interview Analysis of Respondent 3

Interview data from Respondent 3 (R3) were analyzed using the same coding framework to ensure consistency across participants. Figure 3 presents the coding network generated in ATLAS.ti 8, illustrating the relationships among the identified themes and subthemes that contributed to the identification of ethnomathematical concepts embedded in the traditional houses and cultural accessories of the Dayak Bumi Segandu Indramayu community.

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Figure 4
Results of Interview Analysis of Respondent 3 (R3)

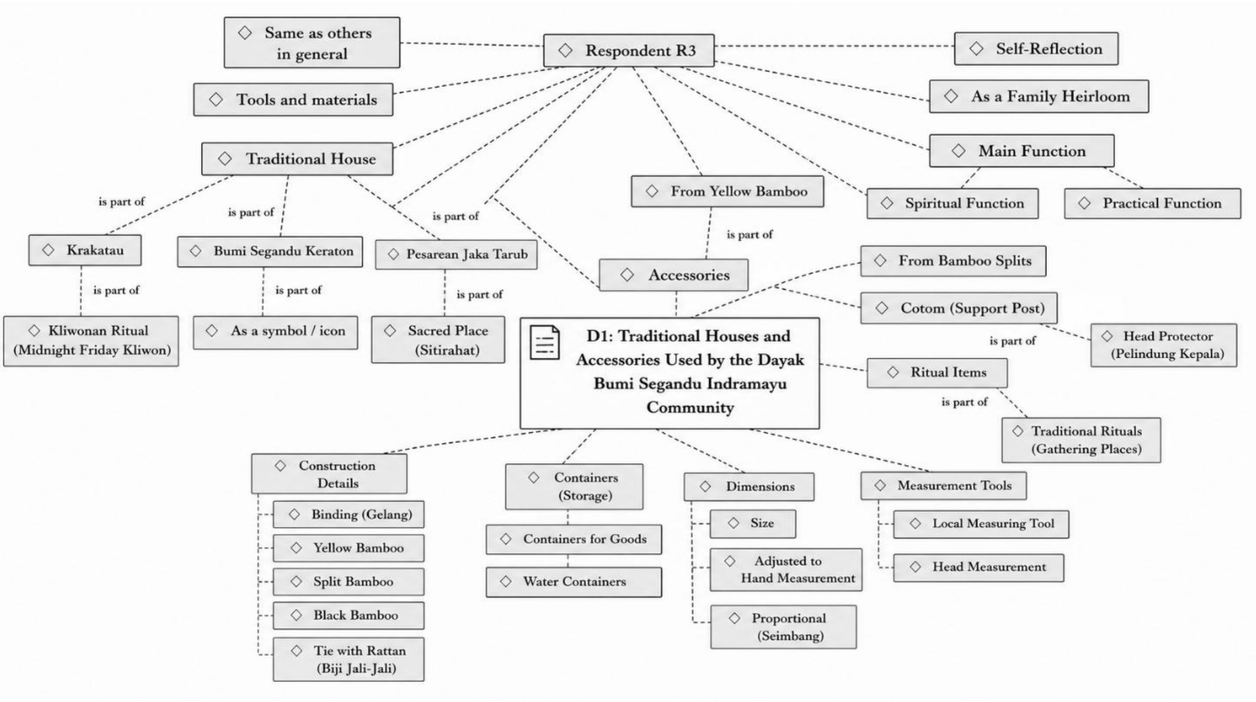

Figure 4 illustrates the coding network derived from the interview with Respondent 3 (R3), highlighting the interrelationships among themes related to the traditional houses and cultural accessories of the Dayak Bumi Segandu Indramayu community. The coding reveals that the respondent emphasized the functions, materials, symbolic meanings, dimensions, and construction characteristics of both the traditional houses and accessories, indicating that these cultural artifacts possess practical, cultural, and structural significance. These findings provide additional evidence that the community's cultural heritage embodies mathematical concepts, particularly those related to geometry, measurement, and spatial relationships, which were subsequently incorporated into the ethnomathematics-based learning module.

Results of Interview Analysis of Respondent 4

Finally, interview data from Respondent 4 (R4) were analyzed using the same coding framework to complete the cross-case comparison. Figure 4 presents the resulting coding network, which complements the findings from the previous respondents and contributes to a comprehensive identification of ethnomathematical concepts embedded in the traditional houses and cultural accessories of the Dayak Bumi Segandu Indramayu community.

Figure 5

Results of Interview Analysis of Respondent 4 (R4)

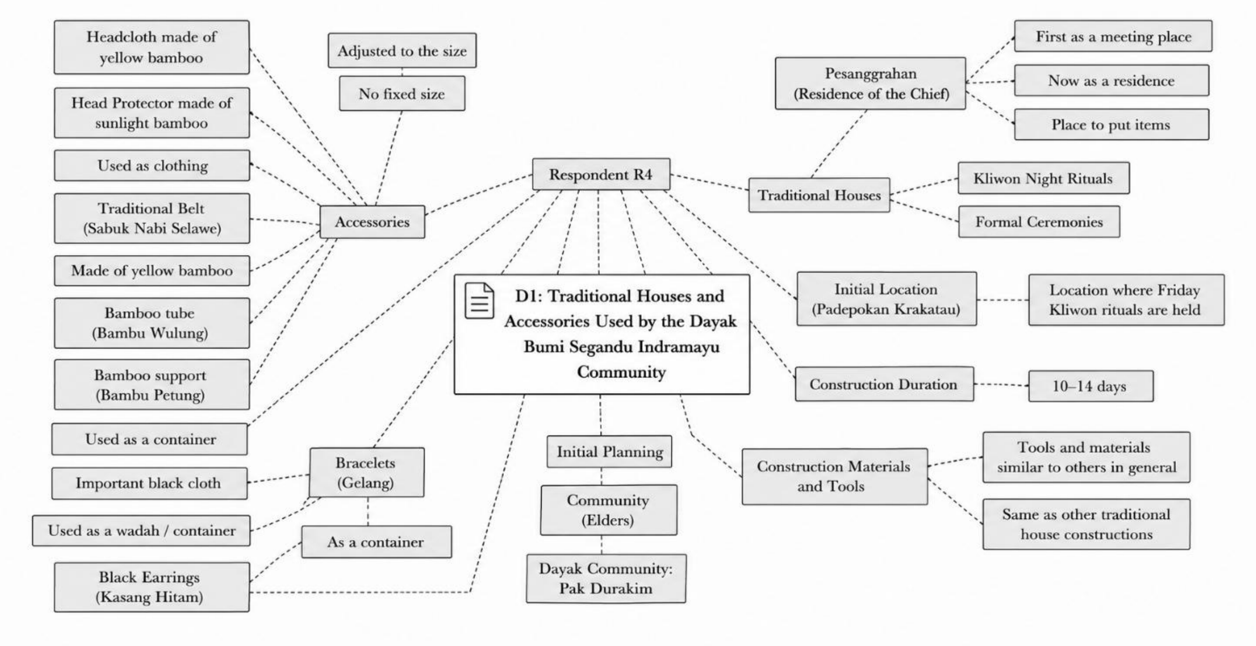

Figure 5 presents the coding network derived from the interview with Respondent 4 (R4), illustrating the relationships among themes associated with the traditional houses and cultural accessories of the Dayak Bumi Segandu Indramayu community. The coding highlights information regarding the functions of traditional houses, construction duration, building materials, cultural accessories, and the cultural practices associated with their use, reflecting the respondent's perspective on both the practical and symbolic aspects of the community's heritage. Together with the findings from the previous respondents, these results strengthen the identification of ethnomathematical concepts embedded in the community's cultural artifacts, particularly those related to geometry, measurement, and spatial organization, which formed the basis for developing the ethnomathematics-based learning module.

Traditional houses represent one of the most tangible cultural artifacts through which the Dayak Bumi Segandu Indramayu Tribe expresses its local knowledge, beliefs, and way of life. Beyond serving residential and ceremonial functions, these architectural structures embody various forms, proportions, and spatial arrangements that can be interpreted through the lens of formal mathematics. From an ethnomathematical perspective, examining traditional houses provides an opportunity to reveal how mathematical ideas are implicitly embedded in cultural practices and material objects. Therefore, the analysis begins with the traditional houses, as they offer rich visual and structural evidence of geometric concepts that can later be contextualized in mathematics learning. The following section presents the mathematical concepts identified in the traditional houses of the Dayak Bumi Segandu Indramayu Tribe based on field observations and ethnomathematical analysis.

Mathematical concepts found in traditional houses

Based on the ethnomathematics analysis, the researcher first identified the mathematical concepts embedded in the traditional houses of the Dayak Bumi Segandu Indramayu Tribe, encompassing lines and angles, plane geometry, and solid geometry. These findings are consistent with earlier ethnomathematics studies on Dayak traditional houses, which likewise identified mathematical concepts within everyday practices, spatial patterns, and geometric elements of traditionalhouse structures, namely plane figures, solid figures, and lines. The observations below are supported by field documentation collected during the research to address the research question

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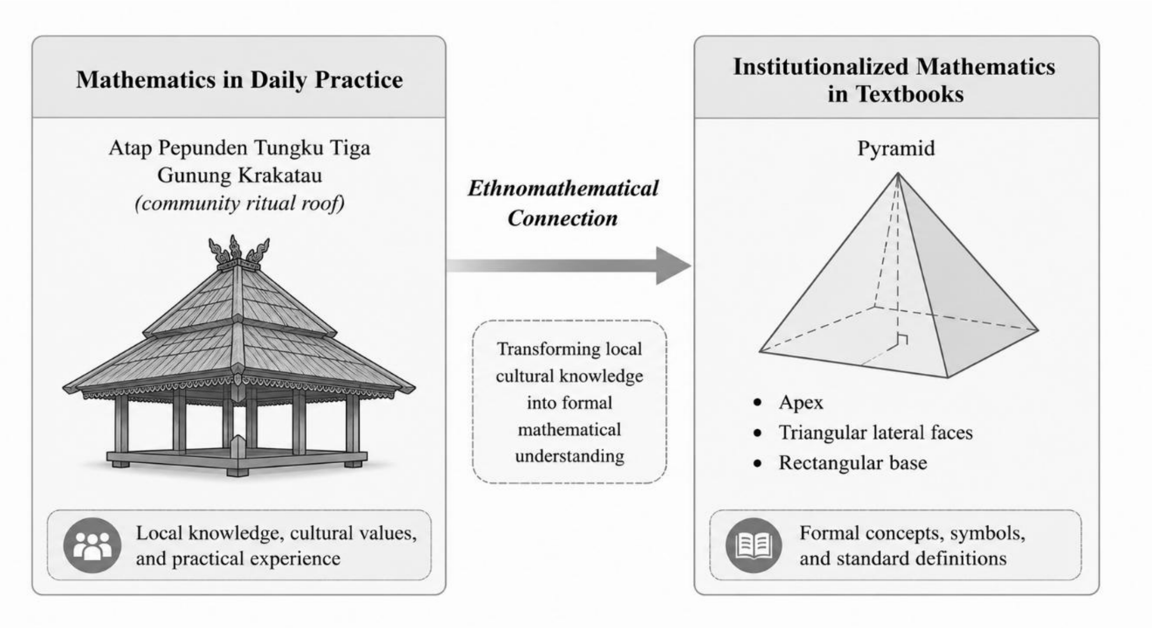
concerning the mathematical concepts found in the traditional houses of the Dayak Bumi Segandu Indramayu Tribe.

It is important to note that the geometric labels used in this section, such as trapezoid, cube, or cylinder, reflect the researchers' analytical interpretation using formal school-mathematics terminology applied to visual and structural patterns that the Dayak Bumi Segandu community does not necessarily name in these terms (cf. Pais, 2011); community members instead describe these forms through functional and ceremonial vocabulary rather than formal geometric language. Framed this way, the pedagogical value of these findings lies not in claiming that the community explicitly conceptualizes formal geometry, but in showing how familiar cultural forms can serve as a contextual bridge that helps students connect abstract geometric definitions to concrete, culturally meaningful objects they may already recognize from daily life in Indramayu.

Following this framing, the ethnomathematical connections identified in the traditional houses are presented below in the order in which they were documented in Table 1. The house as a whole is treated by the community as an integrated ceremonial structure; read against institutionalized mathematics, this constitutes the first ethnomathematical meaning connection, associated with spatial thinking, since the building's overall massing combines prismatic and pyramidal components. The pyramidal roof of the Pepunden Tungku Tiga Gunung Krakatau gives rise to the second connection, corresponding to a pyramid whose four sloping faces meet at a single apex above a rectangular base, while the rounded front floor yields the third connection, corresponding to a semicircular plane figure, and the gridded floor tiles and walls yield the fourth connection, corresponding to rectangles (see Figure 6).

Figure 6

Ethnomathematical connection between the Pepunden roof and the pyramid (Source: Authors' own elaboration)



Further along the same structure, the tapering foundation beneath the front poles gives rise to the fifth connection, corresponding to an isosceles trapezoid on each face; the front support poles and their small cube-shaped connector give rise to the sixth connection, corresponding to a rectangular beam and a cube, respectively; the entrance opening gives rise to the seventh connection, corresponding to a rectangle; and the woven cover placed over the pepunden, understood by the community as a protective shell for sacred objects, gives rise to the eighth connection, corresponding to a hemisphere.

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The second house, Boarding, contributes several further connections. Its woven bamboo wall panels give rise to the ninth connection, in which a single weaving technique simultaneously produces three plane figures — squares, rectangles, and rhombi — depending on the weaving direction; its beam-shaped body gives rise to the tenth connection, corresponding to a rectangular prism, while its roof gives rise to the eleventh connection, corresponding to a triangular prism; and its door, framed by vertical and horizontal lines meeting at right angles, gives rise to the twelfth connection, corresponding to a rectangle.

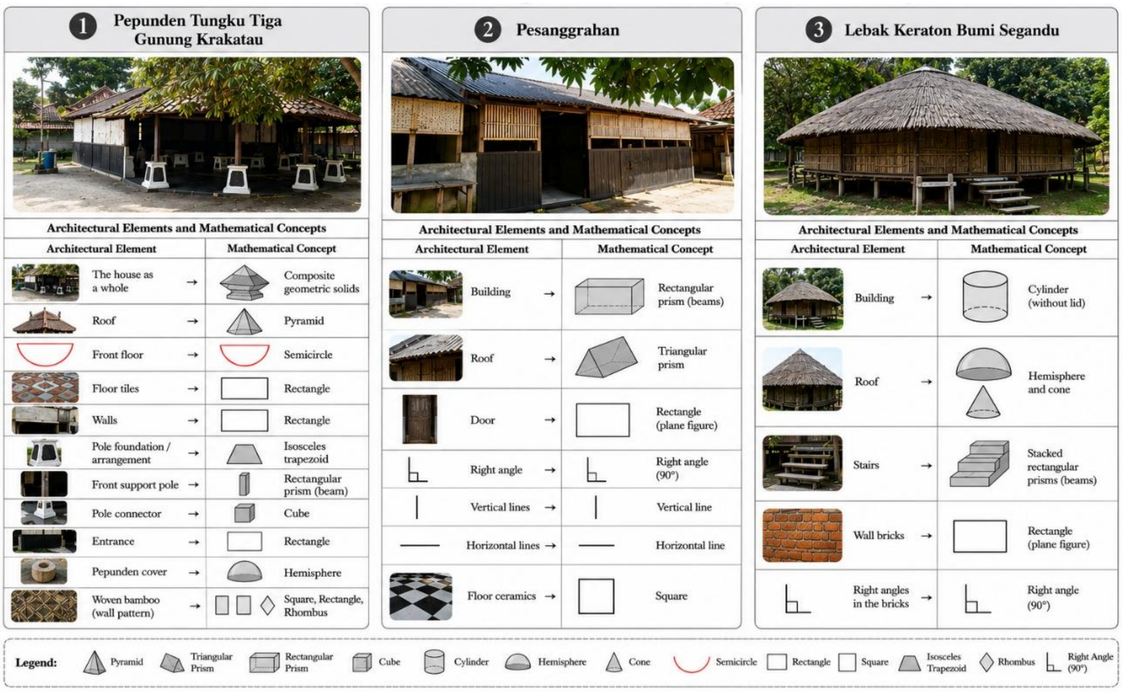
The third house, Lebak Keraton Bumi Segandu, completes this sequence. Its ceramic floor tiles give rise to the thirteenth connection, corresponding to squares; the tubular building itself, open at both ends, gives rise to the fourteenth connection, corresponding to a cylinder without a lid; its domed roof, combining a hemisphere and a cone at a shared circular base, gives rise to the fifteenth connection; its stacked entrance steps give rise to the sixteenth connection, corresponding to a sequence of rectangular beams of increasing height; and the brick pattern on its exterior wall, meeting at perpendicular edges, gives rise to the seventeenth and final connection identified in the traditional houses, corresponding to rectangles with right angles. Taken together, these seventeen connections show that spatial thinking dominates the ethnomathematical reading of the traditional houses, with the pyramid, prism, trapezoid, cylinder, hemisphere, and cone recurring as the community's structural vocabulary for shaping sacred and functional space.

Traditional House Observations

To provide a systematic overview of the ethnomathematical findings, Figure 7 summarizes the mathematical concepts identified across the three traditional houses of the Dayak Bumi Segandu Indramayu Tribe. Rather than presenting the findings as isolated geometric objects, the figure illustrates how specific architectural elements can be interpreted through formal mathematical concepts, thereby demonstrating the relationship between cultural artifacts and school mathematics. This visual synthesis serves as a foundation for the more detailed discussion of each ethnomathematical connection presented in the subsequent paragraphs.

Figure 7

Traditional House Observations



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As shown in Figure 7, the three traditional houses collectively exhibit a wide range of mathematical concepts, including lines and angles, plane figures, solid geometry, and composite geometric forms. Although each building possesses distinct architectural characteristics reflecting its cultural function, all of them contain structural features that can be interpreted mathematically through an ethnomathematical perspective. These findings indicate that mathematical ideas are implicitly embedded within the community's architectural traditions, providing authentic and culturally meaningful contexts for learning geometry. The following discussion explains each ethnomathematical connection in greater detail according to the sequence presented in Figure 6.

Mathematical concepts contained in accessories

Analysis of the accessories of the Dayak Bumi Segandu Indramayu Tribe likewise revealed mathematical concepts related to geometric materials, particularly plane and solid figures, consistent with earlier research identifying mathematical concepts in Dayak accessories in the form of geometric shapes, numerical concepts, angles, and geometric transformations. The observations below are supported by field documentation collected during the research to address the research question concerning the mathematical concepts contained in the accessories of the Dayak Bumi Segandu Indramayu Tribe.

The accessories of the Dayak Bumi Segandu Indramayu Tribe yield a further four connections, again presented in the order documented in Table 2. The bracelet, worn as a closed loop without a bottom or a lid, gives rise to the eighteenth connection, corresponding to an open cylindrical tube; the Kasang bag and its sling strap, both formed from flat rectangular panels, give rise to the nineteenth connection, corresponding to rectangles; the wooden segments of the Sabuk Nipong belt, each carved to hold Javanese script, give rise to the twentieth connection, corresponding to octagons; and the Cotom Ketu headwear, together with its woven bamboo matting, gives rise to the twenty-first and final connection of this study, corresponding to a cone and a rectangle, respectively. As with the traditional houses, these connections are predominantly spatial, reflecting how the community's accessory-making translates functional and protective needs, holding the head, carrying goods, fastening a belt, into recurring plane and solid figures.

Figure 8

Ethnomathematical connection between Cotom Ketu and the cone (Source: Authors' own elaboration)

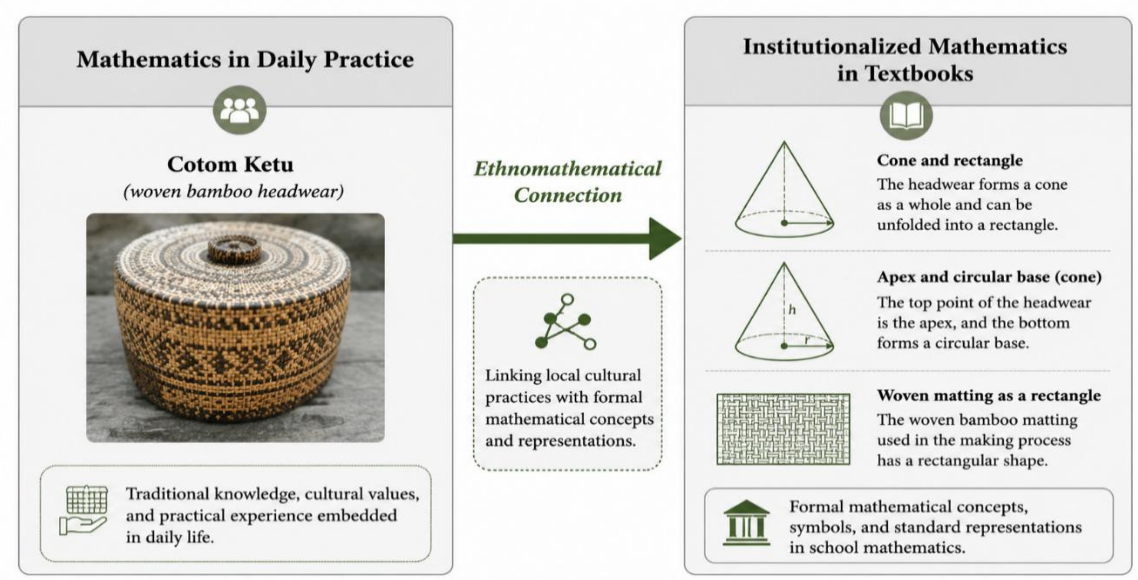

Figure 8 illustrates the ethnomathematical connection between the Cotom Ketu woven bamboo headwear, as a form of mathematics embedded in the daily cultural practices of the Dayak Bumi

Segandu Indramayu Tribe, and the formal mathematical concepts taught in school. The figure demonstrates that the cultural artifact can be interpreted using institutionalized mathematical concepts, including the geometric properties of a cone, its apex and circular base, as well as the rectangular pattern formed during the bamboo weaving process. This connection highlights how familiar cultural objects can serve as meaningful contextual learning resources that bridge students' everyday experiences with abstract mathematical concepts, thereby making geometry learning more relevant and culturally responsive.

Figure 9

Observation Results of Accessories

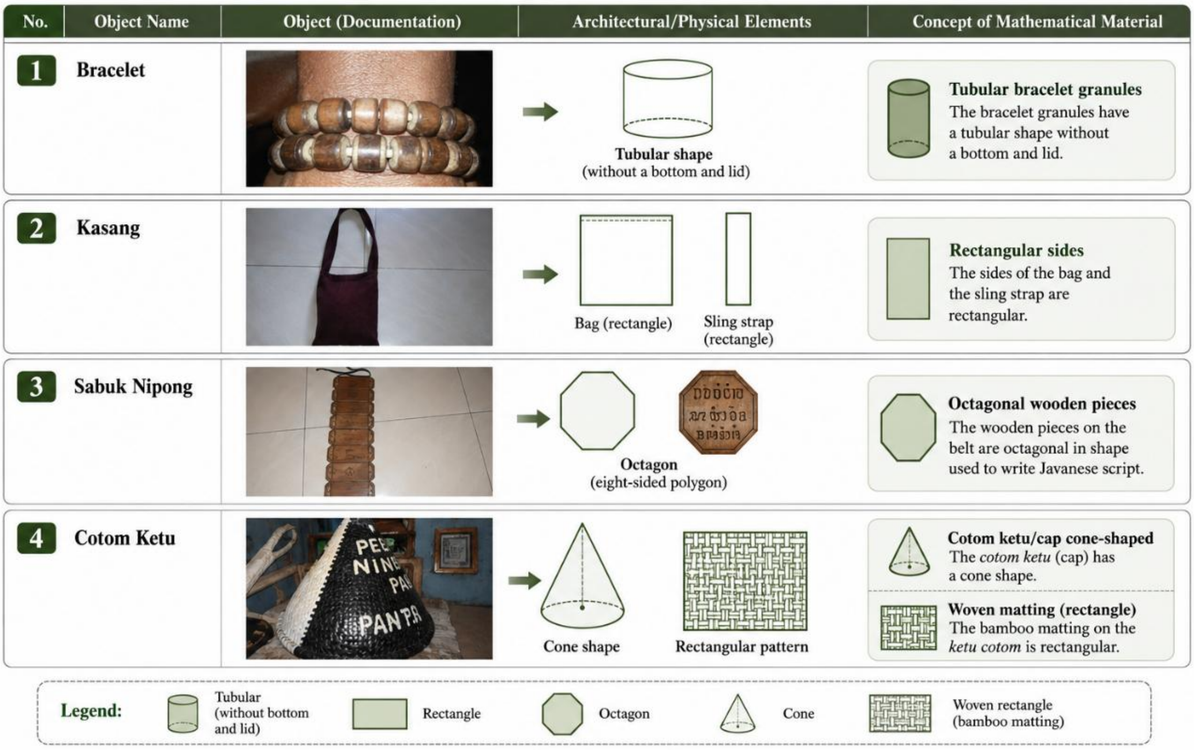

Figure 9 summarizes the ethnomathematical concepts identified in four cultural artifacts of the Dayak Bumi Segandu Indramayu Tribe, namely the bracelet**,** kasang**,** Sabuk Nipong, and Cotom Ketu**.** The analysis reveals that these objects embody a variety of mathematical concepts embedded in their physical forms and construction, including tubular shapes, rectangles, octagons, cones, and woven rectangular patterns. Although these artifacts are primarily created to fulfill cultural, practical, and ceremonial purposes rather than to represent formal mathematical ideas, their structural characteristics can be interpreted through the lens of institutionalized mathematics. These findings demonstrate that everyday cultural objects provide authentic contexts for connecting students' lived experiences with formal geometric concepts, thereby strengthening the role of ethnomathematics as a bridge between local cultural knowledge and school mathematics.

Mathematics Learning Module at Junior High School Level

The process of developing teaching materials such as mathematics learning modules requires a development model so that it can produce quality teaching materials. There are manymodels of teaching material development, some of which are ADDIE, ASSURE, Hannafin andPeck, Gagne and Brigs, and Dick and Carey. In this study using the ADDIE model developed by Robert Maribe Branch. The naming ADDIE stands for the steps of developing teaching materials carried out, namely Analysis, Design, Development, Implementation, Evaluation. Thefollowing is an explanation of these steps.

As explained earlier that the form of teaching is still unattractive so it looks so scary, difficult, and scary that it often fails to understand the basic concepts contained in mathematicssubjects, resulting in low student achievement. In this case, what needs to be improved is the teaching process through more contextual teaching materials that can be applied with culture- based learning. So that this problem can be pursued by developing interesting teaching materialssuch as learning modules which are then associated with one of the cultures in Indramayu Regency. Mathematics learning modules developed based on ethnomathematics from traditional houses and accessories of the Dayak Bumi Segandu Indramayu Tribe. The content of the material developed in this module is relevant to the applicable curriculum objectives andbased on reference sources related to geometry material at the junior high level.

Each learning activity in the module was designed to move students from concrete cultural referents to abstract geometric reasoning, following a concrete-representational-abstract progression: students first view photographs of the traditional house and accessory components, then identify the corresponding geometric shape and its properties using annotated diagrams, and finally solve formal problems, such as calculating surface area or volume, based on those shapes. This progression is intended to scaffold conceptual understanding by anchoring formal mathematical definitions in visually and culturally familiar objects before requiring students to reason about them symbolically.

To illustrate this progression concretely, the second ethnomathematical connection identified in the Results section, the pyramidal roof of the Pepunden Tungku Tiga Gunung Krakatau corresponding to a pyramid (see Figure 9), was carried directly into a module task, following a concrete-representational-abstract sequence consistent with instructional research on scaffolding mathematical reasoning for this kind of task (Witzel et al., 2008). Students are first shown the field photograph of the roof, then asked to trace its apex, lateral faces, and rectangular base on an annotated diagram, and finally asked to calculate the surface area of the roof given its slant height and base edge. In this way, each stage of module development is explicitly anchored to a specific ethnomathematical connection documented in the Results section, rather than to culture in a general sense, so that the connection between daily practice and institutionalized mathematics is preserved all the way into the classroom task.

3.1.2 Design of the Learning Module

The learning module was developed using Microsoft Word 2013 for the layout and content of the material, while the Canva application, accessed through a smartphone, was used to design the cover and add decorative elements that enhanced the visual appearance of the module. The design of each of these components is described below and illustrated in Figures 10 to 18. The module cover displays the title "Mathematics Learning Module: Build a Flat-Side Space" (Figure 10). The cover design refers to several comparable modules used as references so that the resulting design appears more attractive.

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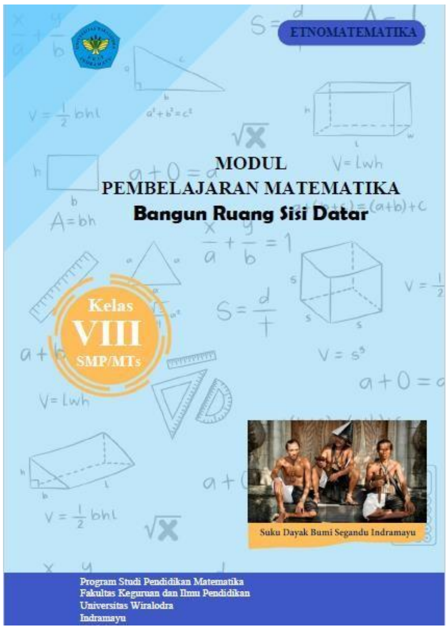
Figure 10
Module cover



The cover features an illustration of the Dayak Bumi Segandu Indramayu community, representing the ethnomathematical context that underlies the development of the module and situating students within a real cultural setting from the outset. Following the cover, the competencies and learning objectives that students are expected to master, covering knowledge, skills, and attitudes, are presented in the Basic Competencies (KD) and Competency Achievement Indicators (IPK) sub-sections (Figure 11).

Figure 11
Basic Competencies (KD) and Competency Achievement Indicators (IPK)

KOMPETENSI DASAR

3.9 Membedakan dan menentukan luas permukaan dan volume bangun ruang sisi datar (kubus, balok, prisma, dan limas).

4.9 Menyelesaikan masalah yang berkaitan dengan luas permukaan dan volume bangun ruang sisi datar (kubus, balok, prisma, dan limas).

INDIKATOR PENCAPAIAN KOMPETENSI

1. Memahami definisi kubus
2. Menentukan luas permukaan kubus
3. Menentukan volume kubus
4. Memahami definisi balok
5. Menentukan luas permukaan balok
6. Menentukan volume balok
7. Memahami definisi prisma
8. Menentukan luas permukaan prisma
9. Menentukan volume prisma
10. Memahami definisi limas
11. Menentukan luas permukaan limas
12. Menentukan volume limas

2

These competencies and indicators serve as a reference for sequencing the material and for assessing students' learning outcomes at the end of the module. The module then opens with an overview consisting of a preface, a table of contents, and a brief description of its content (Figure 12).

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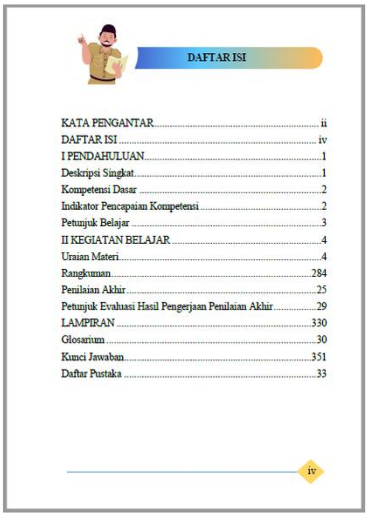
Figure 12
Preface, table of contents, and brief description of the module

KATA PENGANTAR

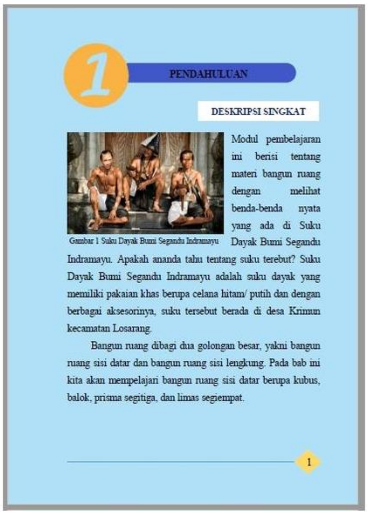
Dengan mengucapkan puji dan syukur kehadirat Allah Subhanallahu wa Ta'ala, hanya dengan limpahan rahmat dan hidayah-Nya, penulis dapat menyelesaikan Modul Pembelajaran Matematika untuk Siswa SMP/MTs Kelas VIII berbasis Suku Dayak Bumi Segandu Indramayu ini dengan baik. Modul pembelajaran ini dibuat bersamaan dengan penyusunan skripsi untuk memenuhi salah satu syarat menyelesaikan Program Sarjana Pendidikan Matematika pada Fakultas Keguruan dan Ilmu Pendidikan Universitas Wiralodra Indramayu. Modul pembelajaran ini diperuntukkan kepada siswa SMP/MTs kelas VIII. Penyajian kalimat dalam modul pembelajaran ini menggunakan bahasa yang sederhana sehingga bisa lebih mudah untuk dipahami dan dibuat dengan pemilihan warna yang mencolok sehingga menarik siswa untuk belajar. Tugas yang diberikan sesuai dengan kehidupan sehari-hari dan disertai gambar sehingga siswa mampu memvisualisasikan kalimat perintah pada tugas tersebut, serta mampu menghubungkan antara konsep dan penerapannya. Di akhir modul pembelajaran terdapat kunci jawaban dan pembahasan sehingga bisa

ii



DAFTAR ISI

iv



1 PENDAHULUAN

DESKRIPSI SINGKAT

Gambar 1 Suku Dayak Bumi Segandu Indramayu

Modul pembelajaran ini berisi tentang materi bangun ruang dengan melihat benda-benda nyata yang ada di Suku Dayak Bumi Segandu Indramayu. Apakah ananda tahu tentang suku terebut? Suku Dayak Bumi Segandu Indramayu adalah suku dayak yang memiliki pakaian khas berupa celana hitam/ putih dan dengan berbagai aksesorinya, suku tersebut berada di desa Krimun kecamatan Losarang.

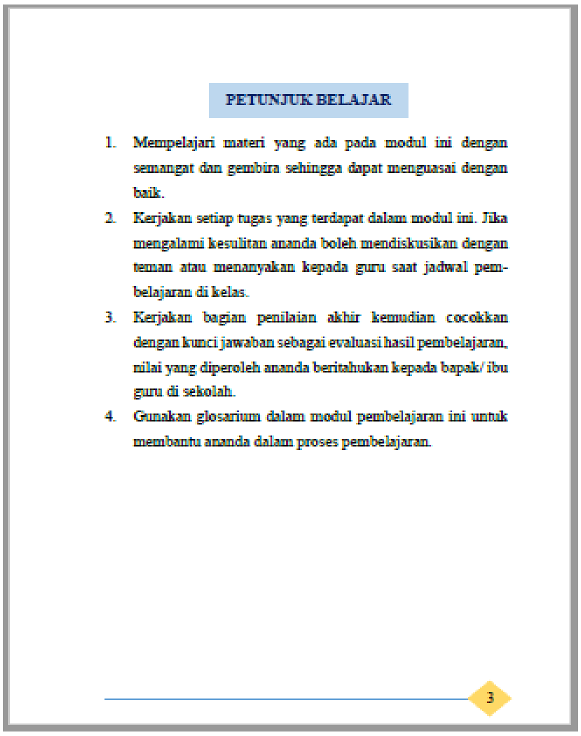
Bangun ruang dibagi dua golongan besar, yakni bangun ruang sisi datar dan bangun ruang sisi lengkung. Pada bab ini kita akan mempelajari bangun ruang sisi datar berupa kubus, balok, prisma segitiga, dan limas segiempat.

1

This overview orients students to the scope and structure of the module before they begin studying the material in depth.

Instructions for using the module, including guidance on how students should work through the material, are presented next (Figure 13).

Figure 13
Study instructions



PETUNJUK BELAJAR

1. Mempelajari materi yang ada pada modul ini dengan semangat dan gembira sehingga dapat menguasai dengan baik.
2. Kerjakan setiap tugas yang terdapat dalam modul ini. Jika mengalami kesulitan ananda boleh mendiskusikan dengan teman atau menanyakan kepada guru saat jadwal pembelajaran di kelas.
3. Kerjakan bagian penilaian akhir kemudian cocokkan dengan kunci jawaban sebagai evaluasi hasil pembelajaran, nilai yang diperoleh ananda beritahukan kepada bapak/ ibu guru di sekolah.
4. Gunakan glosarium dalam modul pembelajaran ini untuk membantu ananda dalam proses pembelajaran.

3

These instructions ensure that students understand how to use the module effectively and independently throughout the learning process. The core learning activities that students are required to complete are subsequently outlined (Figure 14).

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Figure 14
Learning activities

2 KEGIATAN BELAJAR
URAIAN MATERI
KUBUS

Suku Dayak Bumi Segandu Indramayu memiliki 3 rumah adat yang ada di dalam padepokannya, salah satunya yaitu Pepunden Tungku Tiga Gunung Krakatau. Rumah adat tersebut biasanya digunakan sebulan sekali di malam Jumat kliwon untuk ritual peribadatan. Di saat ritual peribadatan berlangsung, masyarakat Suku Dayak duduk melingkar menghadap kolam yang berisi air tawar. Setelah selesai melakukan ritual, masyarakat suku dayak meminum air tawar tersebut karena dipercaya dapat membawa keselamatan dan kelancaran rezeki.

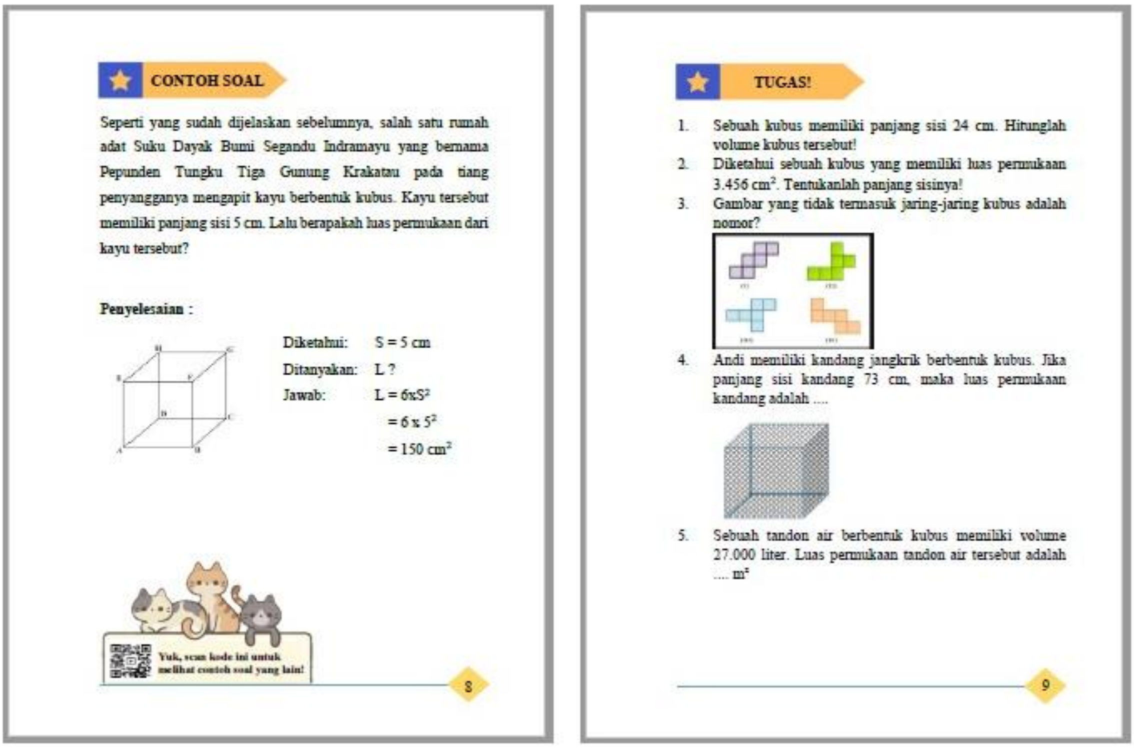
Gambar 2 Tempat Peribadatan

Gambar 3 Penghubung Tiang Penyangga

4

Through these activities, students are guided to construct their understanding of the material within an ethnomathematical context. To reinforce students' understanding, sample practice questions and independent assignments are then provided (Figure 15).

Figure 15
Sample practice questions and assignments



CONTOH SOAL

Seperti yang sudah dijelaskan sebelumnya, salah satu rumah adat Suku Dayak Bumi Segandu Indramayu yang bernama Pepunden Tungku Tiga Gunung Krakatau pada tiang penyangganya mengapit kayu berbentuk kubus. Kayu tersebut memiliki panjang sisi 5 cm. Lalu berapakah luas permukaan dari kayu tersebut?

Penyelesaian :

Diketahui: S = 5 cm
Ditanyakan: L ?
Jawab: $L = 6 x S^2$
$= 6 x 5^2$
$= 150 \text{ cm}^2$

Yuk, scan kode ini untuk melihat contoh soal yang lain!

8

TUGAS!

1. Sebuah kubus memiliki panjang sisi 24 cm. Hitunglah volume kubus tersebut!
2. Diketahui sebuah kubus yang memiliki luas permukaan 3.456 cm^2. Tentukanlah panjang sisinya!
3. Gambar yang tidak termasuk jaring-jaring kubus adalah nomor?
4. Andi memiliki kandang jangkrik berbentuk kubus. Jika panjang sisi kandang 73 cm, maka luas permukaan kandang adalah ....
5. Sebuah tandon air berbentuk kubus memiliki volume 27.000 liter. Luas permukaan tandon air tersebut adalah .... m^2

9

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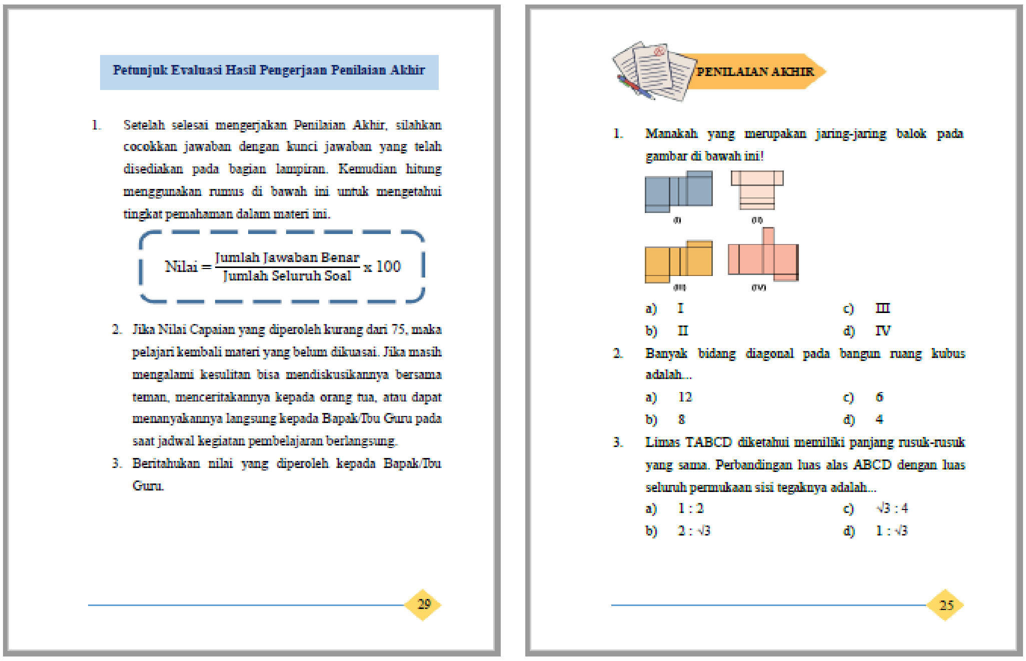
These exercises strengthen students' conceptual understanding before they proceed to the final assessment. A final assessment, accompanied by evaluation instructions, is included to measure students' mastery of the material presented in the module (Figure 16).

Figure 16

Final assessment



Petunjuk Evaluasi Hasil Pengerjaan Penilaian Akhir

1. Setelah selesai mengerjakan Penilaian Akhir, silahkan cocokkan jawaban dengan kunci jawaban yang telah disediakan pada bagian lampiran. Kemudian hitung menggunakan rumus di bawah ini untuk mengetahui tingkat pemahaman dalam materi ini.

$$\text{Nilai} = \frac{\text{Jumlah Jawaban Benar}}{\text{Jumlah Seluruh Soal}} \times 100$$

2. Jika Nilai Capaian yang diperoleh kurang dari 75, maka pelajari kembali materi yang belum dikuasai. Jika masih mengalami kesulitan bisa mendiskusikannya bersama teman, menceritakannya kepada orang tua, atau dapat menanyakannya langsung kepada Bapak/Ibu Guru pada saat jadwal kegiatan pembelajaran berlangsung.
3. Beritahukan nilai yang diperoleh kepada Bapak/Ibu Guru.

29

PENILAIAN AKHIR

1. Manakah yang merupakan jaring-jaring balok pada gambar di bawah ini!

(I) (II) (III) (IV)

a) I c) III
b) II d) IV

2. Banyak bidang diagonal pada bangun ruang kubus adalah...

a) 12 c) 6
b) 8 d) 4

3. Limas TABCD diketahui memiliki panjang rusuk-rusuk yang sama. Perbandingan luas alas ABCD dengan luas seluruh permukaan sisi tegaknya adalah...

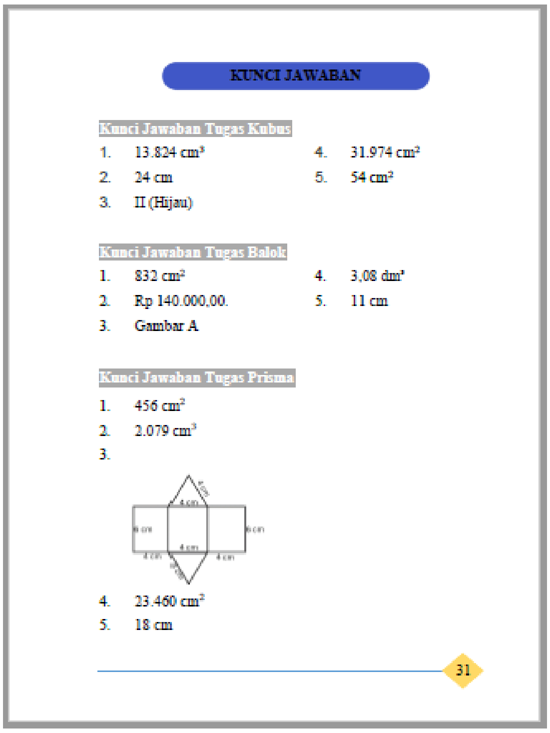
a) 1 : 2 c) √3 : 4
b) 2 : √3 d) 1 : √3

25

The final assessment allows both students and teachers to evaluate the extent to which the learning objectives have been achieved. The answer key for both the assignments and the final assessment is provided at the end of the module (Figure 17).

Figure 17

Answer key



KUNCI JAWABAN

Kunci Jawaban Tugas Kubus

1. 13.824 cm³
2. 24 cm
3. II (Hijau)
4. 31.974 cm²
5. 54 cm²

Kunci Jawaban Tugas Balok

1. 832 cm²
2. Rp 140.000,00.
3. Gambar A
4. 3,08 dm³
5. 11 cm

Kunci Jawaban Tugas Prisma

1. 456 cm²
2. 2.079 cm³
3.
4. 23.460 cm²
5. 18 cm

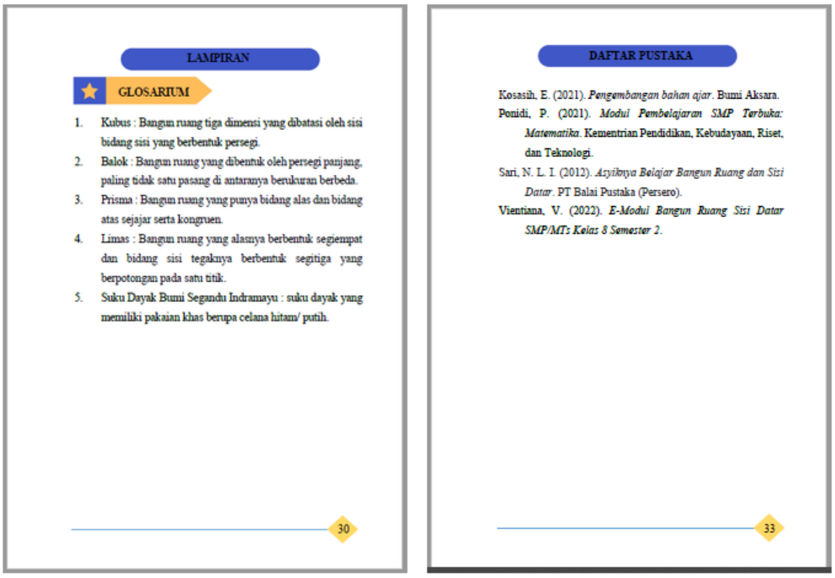
31

The answer key enables students to check their own work and reflect independently on their learning progress.

Finally, a glossary containing definitions of key terms used throughout the module is included, together with the reference sources used in its preparation (Figure 18).

Figure 18

Glossary and reference sources



LAMPIRAN

GLOSARIUM

1. Kubus : Bangun ruang tiga dimensi yang dibatasi oleh sisi bidang sisi yang berbentuk persegi.
2. Balok : Bangun ruang yang dibentuk oleh persegi panjang, paling tidak satu pasang di antaranya berukuran berbeda.
3. Prisma : Bangun ruang yang punya bidang alas dan bidang atas sejajar serta kongruen.
4. Limas : Bangun ruang yang alasnya berbentuk segiempat dan bidang sisi tegaknya berbentuk segitiga yang berpotongan pada satu titik.
5. Suku Dayak Bumi Segandu Indramayu : suku dayak yang memiliki pakaian khas berupa celana hitam/ putih.

30

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33

Together, the glossary and reference list support students' comprehension of key terms and provide traceability to the sources underlying the module's content.

3.1.3 Development

The next stage of product development involved expert validation, revision, and production of the learning module. Validation was carried out by two validators — lecturers in mathematics education at Wiralodra University, with expertise respectively in mathematics content/pedagogy and in instructional media design — using an instrument adapted from Apsari & Rizki (2018) that covers content, language, and appearance across 20 items combining open and closed-response formats (Table 1). As only two validators were involved, the resulting scores are treated in this study as an initial expert judgment rather than a definitive validity claim, a limitation discussed further in the Limitations section.

Table 1

Learning Module Validation Questionnaire Grid

Aspect	Indicators	Item No.
Content	Compatibility with KD; clarity of achievement indicators; clarity of module-use instructions; material suitability & clarity; ease of understanding; everyday-life examples; task/final-assessment quality; summary and glossary compatibility	1–10
Language	Easy-to-understand language; EYD-compliant sentences; communicative language; suitability for junior-high students' thinking level	11–14
Appearance	Color unity; writing layout; typeface suitability/text readability; interesting images and animations; accuracy of symbols and illustrations	15–20

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The validation questionnaire was scored as the percentage of the total score awarded by the validators relative to the maximum possible score (Apsari & Rizki, 2018): Percentage = (Total score awarded / Maximum possible score) × 100%.

Table 2

Judging Criteria

Score	Criterion	Rating (%)
5	Excellent	$80 < N \leq 100$
4	Good	$60 < N \leq 80$
3	Not Good	$40 < N \leq 60$
2	Bad	$20 < N \leq 40$
1	Very Not Good	$0 < N \leq 20$

A validation results above 60% meets the "Good" criterion, indicating that the product is declared valid. Table 3 presents the results of the learning module validation questionnaire completed by the two validators.

Table 3

Learning Module Validation Results

Aspect	Validator 1	Validator 2	Average	Criterion
Content (10 items)	39 (78%)	41 (82%)	80%	Good
Language (4 items)	13 (65%)	13 (65%)	65%	Good
Appearance (6 items)	21 (70%)	23 (77%)	73.5%	Good
Overall Average			72.8%	Good

Based on the two validators' assessments, the learning module scored 80% (Good) on the content aspect, 65% (Good) on the language aspect, and 73.5% (Good) on the appearance aspect, for an overall average of 72.8% (Good). The module is therefore declared valid and suitable for use, with the following comments and suggestions for improvement provided by the validators.

Table 4

Comments and Suggestions for Improvement

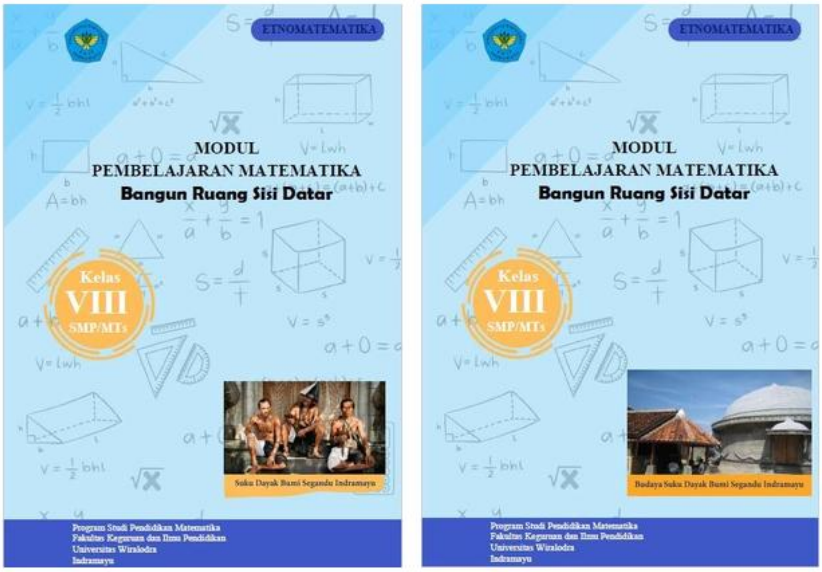
Validator	Comment	Suggestion	Improvement Made
1	Module already good	(1) Vary the practice questions asked; (2) match cover images to the module's material.	(1) Added more varied practice questions; (2) replaced the cover with traditional-house photos matching the material.
2	Already good	(1) Add more practice questions to strengthen concept understanding; (2) include answer keys for all assignments.	(1) Increased practice questions from 1 to 5; (2) added answer keys for the task and final assessment.

Learning Module Improvements

The comments and suggestions above were used to revise the learning module, as shown before and after revision in Figures 19–23.

Original Article

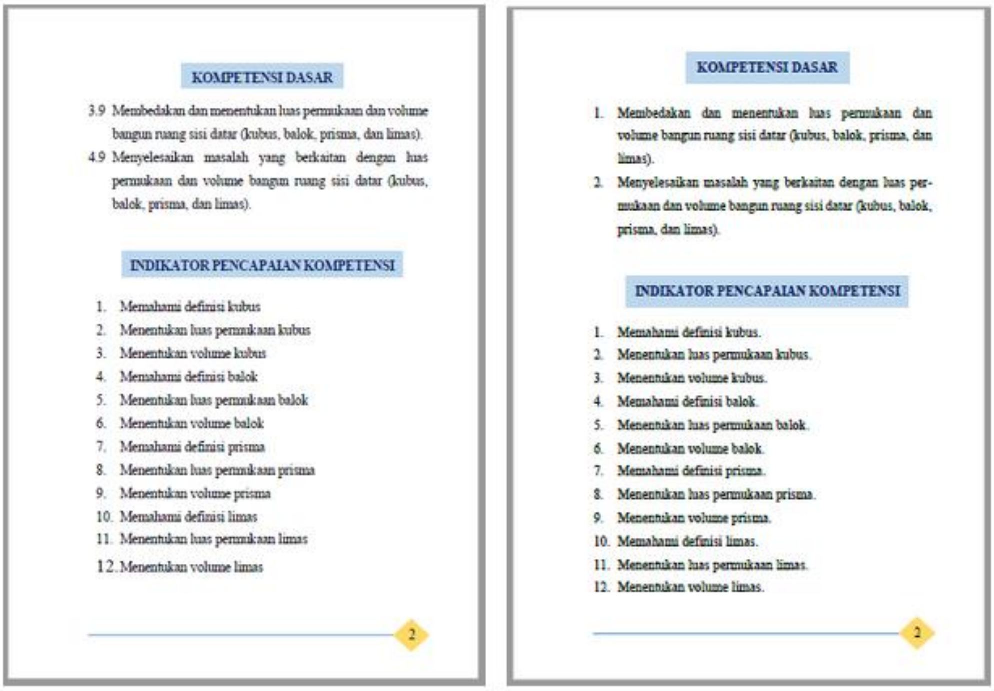
Figure 19
Cover



Before *After*

The cover was revised because the original image did not reflect the culture being explored. The author selected traditional house photographs to match the module's material on flat-side spaces.

Figure 20
Basic Competencies (KD) and Achievement Indicators (IPK)



KOMPETENSI DASAR

3.9 Membedakan dan menentukan luas permukaan dan volume bangun ruang sisi datar (kubus, balok, prisma, dan limas).
4.9 Menyelesaikan masalah yang berkaitan dengan luas permukaan dan volume bangun ruang sisi datar (kubus, balok, prisma, dan limas).

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3. Menentukan volume kubus
4. Memahami definisi balok
5. Menentukan luas permukaan balok
6. Menentukan volume balok
7. Memahami definisi prisma
8. Menentukan luas permukaan prisma
9. Menentukan volume prisma
10. Memahami definisi limas
11. Menentukan luas permukaan limas
12. Menentukan volume limas

2

KOMPETENSI DASAR

1. Membedakan dan menentukan luas permukaan dan volume bangun ruang sisi datar (kubus, balok, prisma, dan limas).
2. Menyelesaikan masalah yang berkaitan dengan luas permukaan dan volume bangun ruang sisi datar (kubus, balok, prisma, dan limas).

INDIKATOR PENCAPAIAN KOMPETENSI

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2. Menentukan luas permukaan kubus.
3. Menentukan volume kubus.
4. Memahami definisi balok.
5. Menentukan luas permukaan balok.
6. Menentukan volume balok.
7. Memahami definisi prisma.
8. Menentukan luas permukaan prisma.
9. Menentukan volume prisma.
10. Memahami definisi limas.
11. Menentukan luas permukaan limas.
12. Menentukan volume limas.

2

Before *After*

The numbering format in the Basic Competency and Competency Achievement Indicator sections was changed from letters to ordinary numbers.

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Original Article

Figure 21
Preface

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ii

KATA PENGANTAR

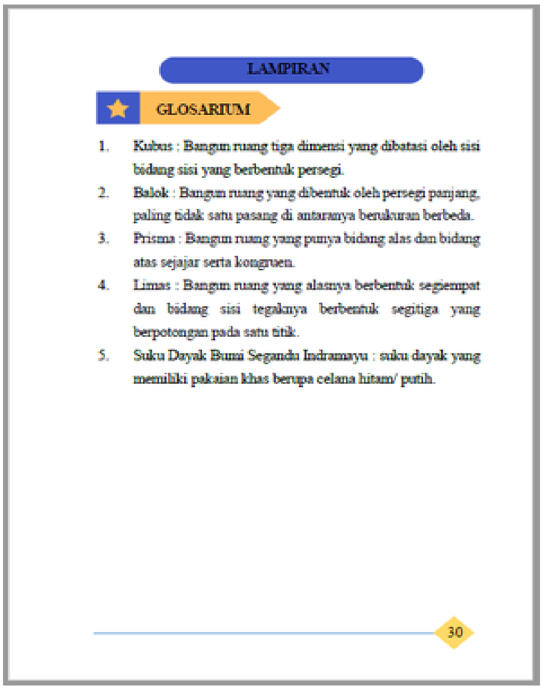
Dengan mengucapkan puji dan syukur kehadirat Allah Subhanallahu wa Ta'ala, hanya dengan limpahan rahmat dan hidayah-Nya, penulis dapat menyelesaikan Modul Pembelajaran Matematika untuk Siswa SMP/MTs Kelas VIII berbasis Suku Dayak Bumi Segandu Indramayu ini dengan baik. Modul pembelajaran ini dibuat bersamaan dengan penyusunan skripsi untuk memenuhi salah satu syarat menyelesaikan Program Sarjana Pendidikan Matematika pada Fakultas Keguruan dan Ilmu Pendidikan Universitas Wiralodra Indramayu. Modul pembelajaran ini diperuntukkan kepada siswa SMP/MTs kelas VIII. Penyajian kalimat dalam modul pembelajaran ini menggunakan bahasa yang sederhana sehingga bisa lebih mudah untuk dipahami dan dibuat dengan pemilihan warna yang mencolok sehingga menarik siswa untuk belajar. Tugas yang diberikan sesuai dengan kehidupan sehari-hari dan disertai gambar sehingga siswa mampu memvisualisasikan kalimat pada soal tersebut, serta mampu menghubungkan antara konsep dan penerapannya. Di akhir modul pembelajaran terdapat kunci jawaban dan pembahasan sehingga bisa digunakan siswa untuk mencocokkan jawaban yang telah didapatkan dalam mengerjakan penilaian akhir yang ada pada modul pembelajaran ini. Dalam penyusunan modul ini penulis

i

Before *After*

Decorative elements in each sub-chapter were removed, as they appeared too crowded and interfered with the readability of the module's contents.

Figure 22
Glossary

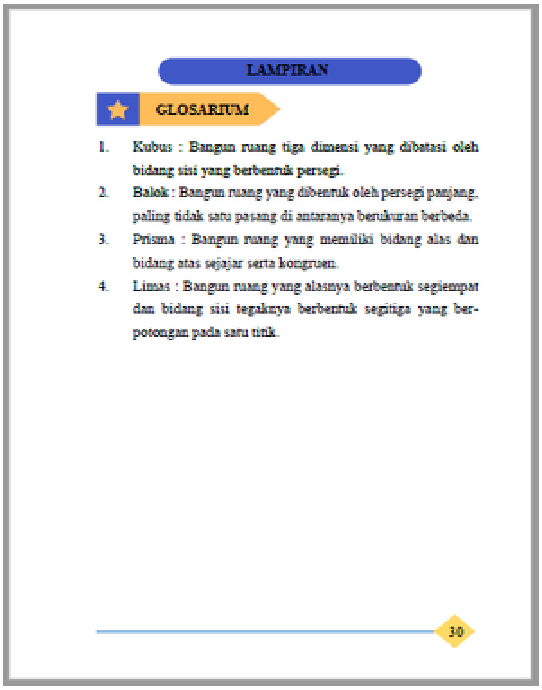


LAMPIRAN

GLOSARIUM

1. Kubus : Bangun ruang tiga dimensi yang dibatasi oleh sisi bidang sisi yang berbentuk persegi.
2. Balok : Bangun ruang yang dibentuk oleh persegi panjang, paling tidak satu pasang di antaranya berukuran berbeda.
3. Prisma : Bangun ruang yang punya bidang alas dan bidang atas sejajar serta kongruen.
4. Limas : Bangun ruang yang alasnya berbentuk segiempat dan bidang sisi tegaknya berbentuk segitiga yang berpotongan pada satu titik.
5. Suku Dayak Bumi Segandu Indramayu : suku dayak yang memiliki pakaian khas berupa celana hitam/ putih.

30



LAMPIRAN

GLOSARIUM

1. Kubus : Bangun ruang tiga dimensi yang dibatasi oleh bidang sisi yang berbentuk persegi.
2. Balok : Bangun ruang yang dibentuk oleh persegi panjang, paling tidak satu pasang di antaranya berukuran berbeda.
3. Prisma : Bangun ruang yang memiliki bidang alas dan bidang atas sejajar serta kongruen.
4. Limas : Bangun ruang yang alasnya berbentuk segiempat dan bidang sisi tegaknya berbentuk segitiga yang ber-potongan pada satu titik.

30

Before *After*

The phrase "Dayak Bumi Segandu Indramayu tribe" was omitted from the glossary, as it had already been explained in the brief description section.

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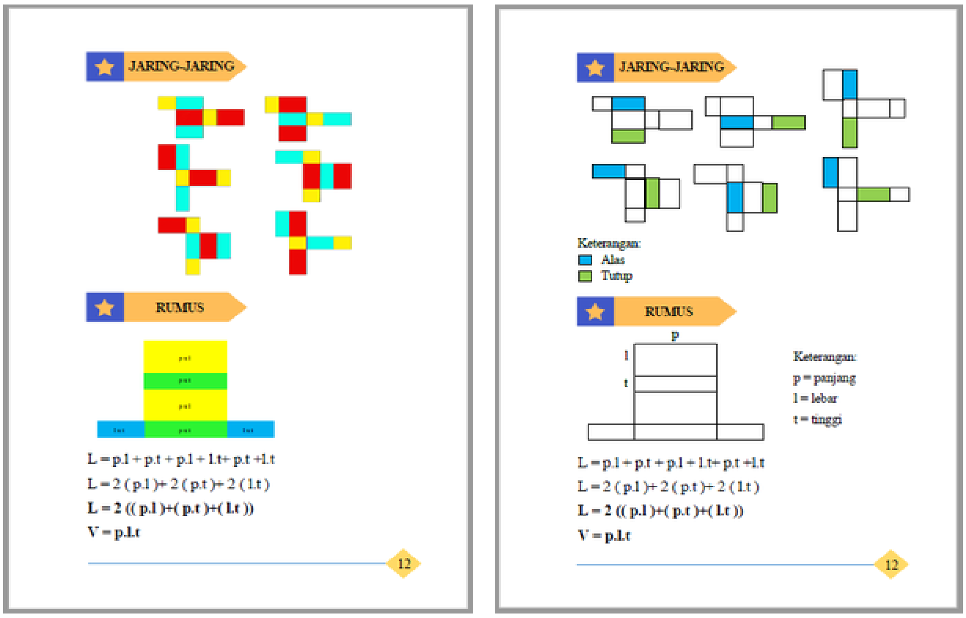
Figure 23

Symbols and Formulas



Before *After*

Colors and symbols/letters were added to the nets, formulas, and other notations to prevent miscommunication among students. Once the material and design of the learning module were finalized, the next stage was to produce the design as an actual product: an ethnomathematics-based mathematics learning module on flat-side spaces for seventh-grade junior high school students.

3.1.4 Implementation

After developing the learning module, the next stage was implementation through product responses from teachers as practitioners experienced in teaching mathematics at the junior high school level. This stage aimed to determine the module's attractiveness. The respondents were two mathematics teachers from SMP Pesantren Al-Urwatul Wutsqo, Indramayu, Indonesia, who completed a teacher-response questionnaire on the module's attractiveness. The questionnaire grid and its assessment criteria are presented in Table 5 and 6.

Table 5

Teacher Response Questionnaire Grid

Aspect	Indicators	Item
Content	Compatibility with KD; clarity of achievement indicators; clarity of module-use instructions; material suitability; clarity of the material presented; ease of understanding; everyday-life examples; task/final-assessment quality; summary and glossary compatibility	1–10
Language	Easy-to-understand language; EYD-compliant sentences; communicative language; suitability for junior-high students' thinking level	11–14
Display	Color unity; writing layout; typeface suitability/text readability; interesting images and animations; accuracy of symbols and illustrations	15–20

Table 6
Assessment Criteria for the Teacher Response Questionnaire

Score	Criterion	Rating (%)
5	Totally Agree	$80 < N \leq 100$
4	Agree	$60 < N \leq 80$
3	Disagree Less	$40 < N \leq 60$
2	Disagree	$20 < N \leq 40$
1	Strongly Disagree	$0 < N \leq 20$

The results of the teacher-response questionnaire on the ethnomathematics-based mathematics learning module on flat-side spaces for seventh-grade junior high school students are presented in Table 7.

Table 7
Results of the Teacher Response Questionnaire

Aspect	Respondent 1	Respondent 2	Average	Criterion
Content (10 items)	45 (90%)	49 (98%)	94%	Totally Agree
Language (4 items)	19 (95%)	20 (100%)	97.5%	Totally Agree
Display (6 items)	27 (90%)	30 (100%)	95%	Totally Agree
Overall Average			95.5%	Totally Agree

Across the two respondents, the module obtained an average score of 94% (Totally Agree) on the content aspect, 97.5% (Totally Agree) on the language aspect, and 95% (Totally Agree) on the display aspect, for an overall average of 95.5% (Totally Agree). This indicates that the ethnomathematics-based mathematics learning module on flat-side spaces for seventh-grade junior high school students was very well developed and suitable for use in student learning activities, both at school and independently. The advantages and disadvantages identified by the respondents through the questionnaire are presented in Table 8.

Table 8
Advantages and Disadvantages of the Learning Module

Respondent	Advantage	Lack
1	(1) The module is easy to understand and interesting; (2) content is aligned with the Basic Competencies (KD).	Add a pooling of GPA (Achievement Indicators) for two or more flat-side spaces.
2	The material presented is clear and easy to understand.	(1) The practice questions could be further varied; (2) the “Task” answer key could include the steps of the solution.

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3.1.5 Evaluation

The process carried out at the evaluation stage is to assess the feedback provided by respondents. The steps for developing teaching material products that have been carried out previously can be assessed that the mathematics learning module of ethnomathematics-based flat side room building materials for junior high school grade VII students developed by researchers is very valid and very good/ feasible to be used in the process of student learning activities both at school and independently with several advantages, namely in accordance with Basic Competencies (KD), The material presented is clear, easy to understand, and also interesting. However, apart from these advantages, there are also some disadvantages that are owned, namely the practice questions are less varied, the answer key has not been equipped with a way of working, and has not included the Competence Achievement Indicator (GPA) about combining two or more flat side spaces.

3.2 Discussion

These findings extend previous ethnomathematics research on indigenous Indonesian houses, such as the study of the Betang Ensaid Panjang house in West Kalimantan, and comparable studies of traditional houses and cultural patterns elsewhere in Indonesia, including the Madura tanean-lanjang house (Sari et al., 2022), the Banyuwangi Using house (Hariastuti et al., 2019), and batik-based ethnomathematics explorations in Yogyakarta and West Java (Prahmana & D'Ambrosio, 2020; Prahmana et al., 2023; Abdullah, 2016; Muhtadi et al., 2017), by showing that comparable geometric richness, namely lines, angles, plane figures, and solid figures, can also be documented in a smaller and previously undocumented community such as the Dayak Bumi Segandu Indramayu Tribe. Unlike prior studies that largely stop at documenting these concepts, the present study contributes by carrying the exploration through to a validated instructional product, addressing the persistent gap between ethnomathematics documentation and classroom-ready material development discussed in the Introduction.

At the same time, the module's language-aspect score (65%) was noticeably lower than its content (80%) and appearance (73.5%) scores, suggesting that translating cultural and mathematical content into clear, grade-appropriate language remains the most challenging aspect of ethnomathematics-based material development and warrants particular attention in future module design. Regarding practical implications, the strongly positive teacher responses (95.5%) should be interpreted as preliminary practitioner feedback from a small, single-school sample rather than evidence of broad classroom effectiveness; for classroom integration, teachers could use the module as a supplementary contextual unit introducing flat-side space geometry, using the traditional house and accessory images as an opening hook before proceeding to the module's formal practice questions, rather than as a stand-alone replacement for the standard textbook sequence.

Beyond its immediate empirical contribution, this study also connects to several broader currents in international mathematics education scholarship. Bibliometric reviews of ethnomathematics research (Turmuzi et al., 2023; Deda et al., 2024) have noted that studies documenting cultural artifacts as sources of mathematical concepts continue to expand rapidly, yet relatively few translate that documentation into validated instructional products, a gap this study directly addresses. The reflexive stance adopted toward the geometric labels used in the Results section is consistent with long-standing epistemological critiques of ethnomathematics research, which caution against over-attributing formal mathematical intent to community practices (Pais, 2011). At the level of learning design, the concrete-representational-abstract progression embedded in the module draws on instructional research showing its effectiveness for scaffolding mathematical reasoning (Witzel et al., 2008), while the emphasis on identifying specific solids and plane figures within cultural artifacts resonates with the broader literature on geometric thinking development (Burger & Shaughnessy, 1986; Abdullah & Zakaria, 2013; Alex & Mammen, 2018). More broadly, this study's attempt to trace mathematical concepts from an everyday cultural practice through to a formal instructional artifact echoes the aims of the extended theory of mathematical connections, which similarly seeks to make explicit the relationship between mathematics as practiced and mathematics as institutionalized (Dolores-Flores et al., 2019; García-García & Dolores-Flores, 2018, 2019, 2020; Rodríguez-Nieto et al., 2020, 2021; Hatisaru, 2023), and aligns with STEAM and ethnomodeling perspectives that similarly view cultural practices as legitimate sites of mathematical activity (Rodríguez-Nieto & Alsina, 2022; Orey & Rosa, 2021; Sudirman et al., 2024; Sugiarto et al., 2025). Similar ethnomathematics-based module development efforts elsewhere in Indonesia (Purniati et al., 2022; Pathuddin & Mariani, 2023; Utami et al., 2019; Umbara et al., 2021, 2023) further situate the present findings within a wider, internationally visible research program rather than as an isolated local case.

Limitations

This study has several limitations. First, the ethnographic exploration relied on four respondents from a single community; while adequate for the purposive, role-based sampling strategy adopted, this limits the extent to which findings can be generalized beyond the Dayak Bumi Segandu Indramayu community. Second, module validation involved only two expert validators and two practitioner respondents; these numbers reflect common practice in small-scale research and development studies but constrain the statistical generalizability of the validity and feasibility scores reported. Third, the module was not trialed with students in an actual classroom setting, so its effect on student learning outcomes, as distinct from its validity and teacher-perceived attractiveness, remains untested. These limitations should be considered when interpreting the conclusions of this study.

4. Conclusion

Based on the results of exploration of traditional houses and accessories of the Segandu Indramayu Earth Dayak Tribe, it was obtained that the traditional houses and accessories usedby the Segandu Indramayu Earth Dayak Tribe community contain geometric mathematical concepts in the form of lines, angles, flat wakes, and building space. The mathematics learningmodule for building a flat side room based on ethnomathematics for junior high school grade VII students that was developed was considered valid and suitable for use as teaching materialwith an average score from both validators of 72.8% with Good criteria. The average score of 95.5% from both respondents with the criteria Strongly Agree that the learning module can beused because it has advantages in the form of material presented is clear, easy to understand, and also interesting even though it still has shortcomings in the form of less varied question exercises, answer keys have not been equipped with workmanship, and have not included Competency Achievement Indicators (GPAs) about combining two or more flat side spaces. Feasibility The mathematics learning module for building ethnomathematics-based flat side rooms for junior high school grade VII students that are developed can be recommended to beused as an alternative teaching material at school or at home independently so that students canlearn mathematics as well as culture in their learning. For the next researcher who will exploreethnomathematics in the Traditional House and Accessories of the Dayak Bumi Segandu Indramayu Tribe and developed into teaching materials, it may be possible to conduct further research on the application of accessories in the teaching materials to be developed because researchers only include aspects of traditional houses in the learning modules developed).

Future research is also recommended to trial the module directly in classroom settings to evaluate its effect on students' conceptual understanding of flat-side space geometry and their mathematical reasoning, and to involve a larger and more diverse pool of validators and practitioners to strengthen the reliability of feasibility claims.

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Authors' contributions
Nandang Nandang: Conceptualization, Methodology, Investigation, Writing – Original Draft, Project Administration.
Mochammad Taufan: Formal Analysis, Data Curation, Writing – Review & Editing.
Mellawaty Mellawaty: Validation, Resources, Writing – Review & Editing.
Runisah Runisah: Supervision, Validation.
Ratna Sri Rahayu: Investigation, Data Curation. Ronaldo
Rafael Olivero-Acuña: Review & Editing, Validation.
Jenisus O. Dejarlo: Review & Editing, Validation.

Data availability
The data supporting the findings of this study, including interview transcripts, field observation notes, and photographic documentation, are available from the corresponding author upon reasonable request. Some data are not publicly available due to privacy and cultural-sensitivity considerations concerning the community participants.

Use of Artificial Intelligence
During the preparation of this work, the author(s) used [nama alat, mis. Grammarly/ChatGPT/Claude] to improve the language, clarity, and readability of the manuscript. After using this tool, the author(s) reviewed and edited the content as needed and take full responsibility for the content of the publication.

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