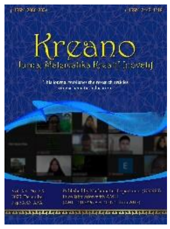
UNNES JOURNALS

Kreano, Jurnal Matematika Kreatif-Inovatif
Volume 17, number 1, 2026, pp. 1-27



Culture-Based AKM Contexts with Ethnomathematical Research Findings of the Gravestone Industry

Santi Wulan Cahyani[1], Eka Sulistyawati[1], and Dewi Hamidah [1]

[1]UIN Syekh Wasil Kediri, Indonesia

Correspondence should be addressed to Eka Sulistyawati: ekasulistyawati@uinkediri.ac.id

Abstract

Ethnomathematics research has primarily focused on exploring mathematical elements in culture and their application in learning. However, the use of local culture as context in the Minimum Competency Assessment (AKM) questions that measure students' numeracy literacy skills remain limited and need to be further developed. In fact, the AKM framework identifies the socio-cultural context as one of the contexts for question development. This study aims to identify mathematical elements within the *kijing* (gravestone) industry (including tradition, tools, materials, production, distribution, and installation) to serve as context for AKM questions development using the Research and Development (R&D) method with the 4D model (Define, Design, Develop, Disseminate). In the Define stage, an ethnographic exploration was conducted through interviews and observations using maximal variation sampling, involving business owners, employees, and the community. The research data were transcribed, coded, and analyzed using source and technique triangulation based on industrial sub-topics. The resulting interpretations were mathematically analyzed in reference to the 2023 AKM framework. A key strength of this research lies in the credibility of the mathematical interpretations, which were evaluated by three high school mathematics teachers acting as raters through inter-rater reliability testing to ensure objectivity and strong consensus regarding the identified mathematical elements. The results identified mathematical elements across four domains (numbers, geometry, algebra, and data and uncertainty) and 27 learning progressions within the AKM framework. The Design stage involved analyzing the intersections and interconnections between domains, sub-domains, and learning progressions across various cultural contexts, resulting in six stimulus sets. The Develop stage encompassed the creation of 17 numeracy literacy items, which were validated by two expert lecturers; the results were categorized as "highly valid" (6 items) and "valid" (11 items). This was followed by revisions based on the feedback provided until the items were declared fit for use. Finally, the Disseminate stage was conducted through publication in a simple scientific forum and the distribution of the instruments to educational practitioners. The results of this study are expected to inspire teachers in developing AKM items based on cultural contexts.

Keywords: Research and Development; 4D Model; ethnomathematics; the gravestone industry; numeracy literacy skills.

Information of Article	
Subject classification	*97C60 Sociological aspects of learning*
Submitted	*3 February 2026*
Review Start	*31 March 2026*
Round 1 Finish	*25 April 2026*
Round 2 Finish	*8 May 2026*
Accepted	*31 May 2026*
Scheduled online	*30 June 2026*
Similarity Check	*5%*

Abstrak

Penelitian etnomatematika selama ini berfokus pada eksplorasi unsur matematika dalam budaya dan penerapannya dalam pembelajaran. Namun, pemanfaatan budaya lokal sebagai konteks soal Asesmen Kompetensi Minimum (AKM) yang mengukur kemampuan literasi numerasi peserta didik masih terbatas, meskipun konteks sosial budaya tercantum dalam framework AKM. Penelitian ini bertujuan mengidentifikasi unsur matematika pada industri kijing (batu nisan), meliputi aspek tradisi pemasangan kijing, alat, bahan, produksi, distribusi, dan pemasangan kijing, untuk digunakan sebagai konteks dalam pembuatan soal AKM melalui metode Research and Development (R&D) dengan model 4D (Define, Design, Develop, Disseminate). Pada tahap Define, dilakukan eksplorasi etnografi melalui wawancara dan observasi menggunakan teknik maximal variation sampling kepada pemilik usaha, karyawan, dan masyarakat. Data hasil penelitian ditranskrip, dikodekan dan dianalisis menggunakan triangulasi sumber dan teknik berdasarkan sub-topik industri kijing. Hasil interpretasi dianalisis secara matematis mengacu pada framework AKM 2023. Keunggulan penelitian ini terletak pada kredibilitas hasil interpretasi yang dinilai oleh tiga guru matematika SMA sebagai rater melalui uji reliabilitas inter-rater untuk men-jamin objektivitas dan kesepakatan yang kuat terhadap temuan unsur matematika. Hasil penelitian mengidentifikasi unsur matematis pada empat domain matematika (bilangan, geometri, aljabar, serta data dan ketidakpastian) dan 27 learning progression dalam framework AKM. Tahap Design dilakukan analisis irisan dan keterkaitan antar domain, sub-domain, serta learning progression dalam berbagai konteks budaya yang menghasilkan enam stimulus soal. Tahap Develop mencakup pembuatan 17 butir soal literasi numerasi yang dival-idasi oleh dua dosen ahli dengan hasil sangat valid (6 soal) dan valid (11 soal), diikuti dengan revisi soal sesuai masukan yang diberikan, hingga dinyatakan layak digunakan. Terakhir, tahap Disseminate dilakukan melalui pub-likasi pada forum ilmiah sederhana serta distribusi instrumen kepada praktisi pendidikan. Hasil penelitian ini di-harapkan dapat menginspirasi guru dalam menyusun soal AKM berbasis konteks budaya.

INTRODUCTION

The Minimum Competency Assessment (Asesmen Kompetensi Minimum/AKM) is an evalua-tion of basic skills required by all students to develop their ability to play an active role in social life (Pusat Asesmen Pendidikan, 2022). AKM is designed to measure reasoning abilities in literacy and numeracy, particularly the ability to analyze information and then solve problems using logic (Sekretariat GTK, 2021). Numeracy literacy assessment in AKM can be viewed from three aspects, namely content (numbers, geometry, data and uncertainty, and algebra), cognitive levels (know-ing, applying, and reasoning), and context (personal, socio-cultural, and scientific). A number of studies related to AKM and numeracy literacy aim to describe numeracy literacy skills (Hastuti & Setyaningrum, 2023; Rachmawati et al., 2024; Setianingsih et al., 2022), develop products in the form of AKM items (Miftah & Setyaningsih, 2022; Mulyani et al., 2024; Salsabila et al., 2023), de-scribe the readiness of activities carried out in elementary schools to develop numeracy literacy in preparation for AKM (Rohmah et al., 2022), describe students' perceptions of the efforts required to improve numeracy literacy based on gender and school status (Rosnelli & Ristiana, 2023), and identify students' self-efficacy in mathematical literacy based on gender, school type, grade level, and parents' educational background (Ozgen & Bindaka, 2011). Several studies have not only been conducted on student subjects but also on pre-service teachers, such as the study by Setiyani et al. (2022) which describes the reflective thinking abilities of pre-service teacher students in solving numeracy problems based on mathematical disposition, as well as programs implemented for teachers in order to improve students' numeracy literacy (Worth et al., 2015). However, although cultural contexts have been incorporated into various types of assessment tasks, the process of integrating culture into the structure of numeracy items remains suboptimal. Thus far, cultural con-texts have been utilized in diverse formats, such as PISA-like mathematics tasks with

Islamic eth-nomathematics approaches, interactive tasks, and other mathematics test instruments. However, these developments rarely position cultural context as a foundational element in mathematics tasks designed to measure numeracy literacy within the framework of AKM (Afgani et al., 2021; Cervan-tes-Barraza & Araujo, 2023; Fitrah et al., 2024). This gap indicates that the potential of local culture has not been optimally utilized to make AKM tasks feel more authentic, logical, and relevant to students' lives. In fact, the use of familiar contexts can assist students in solving numeracy literacy problems more accurately and help overcome several educational barriers they encounter (Sianturi et al., 2025).

In response to this gap, in the context of AKM, culture is a relevant aspect because it plays a vital role in how individuals learn, understand, apply, and think critically when mathematics is im-plemented in real-world situations. Therefore, AKM items can be designed to assess students' abil-ity to apply mathematical knowledge in specific cultural situations (Kementerian Pendidikan dan Kebudayaan, 2021). Numeracy literacy items with cultural contexts can measure students' ability to formulate, apply, and interpret mathematical concepts by considering particular cultural or tradi-tional contexts. In addition, students can also understand and broaden their knowledge of local cultures in Indonesia. The application of cultural contexts in learning is proven effective in improv-ing the quality of learning by linking mathematical concepts to real-life situations, making students more motivated and feeling that the learning is closer, relevant, and meaningful (Bestari & Sari, 2025; Fauzi et al., 2025; Nihaya et al., 2022). Moreover, students who learn through culture-based learning are better able to interpret, apply, and evaluate mathematical concepts and experience improvements in numeracy literacy and critical thinking skills (Dinarti et al., 2023; Susanto et al., 2022). The numeracy literacy instrument was designed to integrate Indonesian socio-cultural con-texts. This aligns with previous research that has developed and utilized numeracy items integrat-ing the cultural values of Javanese primbon (Kurniawan et al., 2022), based on Javanese cultural contexts (Syaifuddin et al., 2022), and the culture of Sidoarjo (Safina & Budiarto, 2022).

According to Linton (1945), culture refers to patterns of behavior acquired through learning and is the result of actions whose components are shared and inherited by members of a particular society. Cultural heritage consists of tangible and intangible cultural heritage. Tangible cultural her-itage includes physical remains such as temples. Meanwhile, intangible cultural heritage includes elements that can be perceived by the senses, such as music, performing arts, oral language, dis-tinctive fragrances, and culinary tastes, as well as abstract elements that cannot be directly per-ceived by the senses, such as cultural values and concepts, including Tri Hita Karana, harmony, balance, aesthetics, language, and knowledge systems (Sedyawati, 1997). From 2013 to 2022, it has been established that there are 1,728 Intangible Cultural Heritage items (Warisan Budaya Tak Ben-da/WBTb) divided into five domains, namely oral traditions and expressions; performing arts; social customs, rituals, and festive events; knowledge and customary practices concerning nature and the universe; and skills and craftsmanship of traditional crafts. There are 491 cultural heritage items in the domain of customs, rituals, and celebrations; 440 cultural heritage items related to tradition-al crafts; 75 cultural heritage sites related to knowledge and customary practices concerning nature and the universe; 503 cultural heritage items in the performing arts domain; and 219 cultural herit-age items in oral traditions and expressions (Direktorat Pelindungan Kebudayaan, 2022).

Indonesia has a wealth of tribes and diverse cultures and is influenced by the religious diversi-ty of its people, including Javanese traditions such as death commemorations (selametan) on the 3rd, 7th, 40th, 100th, and 1000th days after someone passes away (Karim, 2017). The thousandth-day commemoration is a very important tradition, as it serves as the closing ceremony of a series of selametan traditions (Mahyudi, 2014). One of the traditions performed is ngijing, which is the in-stallation of a gravestone (kijing) in the form of a cement wall shaped according to a design that reflects the social status and economic condition of the deceased (Huda, 2019). In terms of the thousand-day death tradition and the gravestone installation tradition, they fall into the category of intangible cultural heritage, while the gravestone itself is a form of material culture. Culture is closely related to societal habits and science, including mathematics, which is an inseparable part of culture that involves itself in every aspect of life (Bishop, 1994). Several studies show that teach-ers have positive perceptions of the ethnomathematics approach, which can motivate students and make learning more interesting and meaningful, and many teachers also agree that mathemat-ics can be found in various cultural elements and that cultural integration can increase students' learning motivation. Nevertheless, in terms of practical implementation, this approach has not been widely applied in classroom settings. In fact, based on students' views, cultural contexts in mathematics learning have not yet functioned optimally as learning contexts that support students in understanding real-life situations and in developing thinking skills beyond rote memorization (Mania & Alam, 2021; Mosimege & Egara, 2023; Nur et al., 2022).

The culture-based approach has great potential to help students understand mathematics in a contextual manner that is relevant to their experiences. However, the utilization of local culture in learning is still not optimal, even though many cultural practices contain mathematical concepts that can be used as meaningful learning resources. For example, Aflah and Andhany (2022) show that the culture of the Alas ethnic group reflects mathematical concepts such as geometry, alge-bra, and intervals in various cultural elements, including traditional clothing and houses, musical instruments, food, games, and traditional weapons. These findings indicate that mathematical concepts have long been embedded in people's daily lives before being formally introduced in schools. Ethnomathematics emerges as a framework to explain that the understanding and appli-cation of mathematics in everyday life are also influenced by the cultural context of society (Rosa & Orey, 2006). Ethnomathematics is an approach that connects mathematics by paying attention to cultural aspects in which mathematical concepts develop, through understanding the ways of thinking and the mathematical systems used by a particular culture (D'Ambrosio, 1985; D'Ambrósio & Knijnik, 2020; Rosa et al., 2016; Rosa & Orey, 2011)

Indonesia, with its rich cultural diversity, should integrate local cultural values into mathe-matics learning, as these contain relevant mathematical concepts (Prabawati, 2016). The use of cultural contexts in mathematics items, particularly those measuring numeracy literacy, has in-creasingly been implemented in recent years. This is evidenced by several studies focusing on in-strument development, such as mathematics literacy items using the floating market context, nu-meracy literacy items assisted by Quizizz with the socio-cultural context of Tebing Tinggi City, and numeracy literacy test instruments using the Minangkabau cultural context (Asyari et al., 2024; Jafirah et al., 2024; Sari et al., 2025). However, the application of cultural contexts remains limited and has not been conducted in depth, particularly in terms of analyzing the interrelationships be-tween mathematical concepts and the cultural contexts used in the items. Several studies have shown that culture-based learning, such as the use of AKM items, Dayak culture-based puzzle games, and Lampung culture-based student worksheets (LKPD), has proven effective in encourag-ing and improving students' numeracy literacy skills as well as their problem-solving and mathe-matical communication skills (Priyani, 2022; Rahmat, 2023; Wardhani & Oktiningrum, 2022). Never-theless, the development of culture-based numeracy items is frequently carried out without ade-quate support from in-depth ethnographic research to strengthen the relevance and alignment of mathematical concepts with the selected cultural contexts, even though ethnographic research in the field of ethnomathematics has been widely conducted. However, a gap remains in the devel-opment of culture-based numeracy problems, which are often not yet supported by in-depth eth-nographic research to strengthen the relevance and connection between mathematical concepts and the chosen cultural contexts (Utami et al., 2022). Furthermore, many ethnographic studies stop at the concept identification stage without further steps, such as instrument development (Marbun et al., 2026; Umbara et al., 2023, 2025). This condition is exacerbated by researcher subjec-tivity in linking culture and mathematics. Therefore, this study offers novelty by employing inter-rater reliability to ensure the objectivity of the developed products.

Various indicators have been used to measure numeracy literacy within the context of eth-nomathematics. One such indicator is the OECD framework, which assesses numeracy literacy based on mathematical processes (formulating, employing, and interpreting), mathematical con-tent, and mathematical contexts. Additionally, the Lane Quasar General Rubric is frequently uti-lized, categorizing student abilities into three levels: inability to answer or understand the problem, partial understanding of mathematical concepts and processes, and a solid understanding of mathematical concepts and processes (Munthahana et al., 2023).

In terms of developing context-based assessment items, several studies have employed different development models. Puspadewi et al. (2025) developed numeracy items using the ADDIE model within the AKM framework, covering content, context, and cognitive levels. The item con-tent included numbers, geometry and measurement, as well as data and uncertainty. The context was drawn from Balinese culture relevant to students' lives, while cognitive levels were developed across understanding, application, and reasoning. However, the selection of this cultural context was not based on in-depth ethnographic analysis to link mathematical concepts with the selected cultural context. Another study used the Define, Design, Develop, and Disseminate (4D) stages, such as Amreta (2024), but it did not explain the item development framework and did not conduct an ethnographic analysis beforehand to ensure the alignment of mathematical concepts with the selected cultural context. Linuhung et al. (2025) also employed the 4D model and, during the define stage, conducted a literature study related to Lampung's local culture, such as the Lampung Tapis Cap (Peci Tapis Lampung), traditional house architecture, and the calculation systems of the Lam-pung people. These references were then linked to relevant numeracy concepts. Nevertheless, the connection between cultural forms and mathematical concepts was analyzed independently with-out a rater assessment process to validate the research analysis results. Additionally, Suryanti et al. (2023) conducted an analysis of students' numeracy literacy using culture-based items, specifically ethnomathematics-based HOTS items, to measure students' numeracy skills more comprehensive-ly.

Based on the studies, it is evident that culture is a relevant factor within AKM assessment items. Culture plays an important role in shaping how individuals learn and understand mathemat-ics in real-world situations. Therefore, AKM items can be developed to assess students' ability to apply mathematics in specific cultural situations (Kementerian Pendidikan dan Kebudayaan, 2021). However, a significant research gap exists in previous ethnomathematical studies; specifically, the mathematical analysis stage has generally not implemented research result coding or involved agreement from other parties (raters), so the results of the analysis tended to be subjective and de-pended solely on the researcher's interpretation. In fact, involving raters has the potential to in-crease the richness and accuracy of the analysis results. Raters are individuals with specific exper-tise who assess or assign scores to a research instrument, such as a questionnaire or other meas-urement tool. In practice, raters are typically used in research that requires psychological assess-ment or even instrument validation (Widhiarso, 2011).

The novelty of this study lies in the integration of expert validation through inter-rater reliabil-ity testing within the analysis of mathematical elements, as well as the exploration of a cultural ob-ject that has not been previously investigated. Furthermore, previous studies have frequently failed to integrate the formal AKM framework; consequently, the resulting instruments are not specifical-ly designed to prepare students for national assessment standards. This research focuses on utiliz-ing cultural contexts to develop numeracy literacy items within the AKM framework. Initial observa-tions indicate a wealth of mathematical elements within the gravestone industry; however, to date, no ethnomathematical studies have specifically explored the ngijing culture. Therefore, this study aims to deeply identify the mathematical elements contained within the traditions, production pro-cesses, and distribution of the gravestone industry. Furthermore, this research contributes to gen-erating ethnomathematics-based AKM stimuli and items that are valid for measuring students' nu-meracy literacy. Through this approach, it is expected that the connection between local cultural practices and formal assessments can be established more objectively and accurately, leading the researchers to consider it necessary to conduct an ethnomathematical study titled 'Culture-Based AKM Contexts with Ethnomathematical Research Findings of the Gravestone Industry'.

METHOD

Research Type and Design

This study employs a Research and Development (R&D) approach aimed at developing Minimum Competency Assessment (AKM) instruments embedded within cultural contexts to evaluate students' numeracy literacy skills. The development process follows the 4D model (Define, Design, Development, and Dissemination) (Thiagarajan & Others, 1974). In the **Define** stage, the researcher employs an approach that integrates ethnographic and mathematical elements, commonly referred to as ethnomathematics. Ethnomathematics is an approach to mathematics learning that can be identified in everyday activities and may not always be explicitly represented through formal real-life problems, as it is influenced by and rooted in the culture in which it develops within local culture-based communities, serving as a foundation for constructing concepts that are believed to help address encountered problems (Heryan, 2018). At this stage, the researcher mapped cultural findings through conceptual analysis to ensure systematic comprehension. This process commenced with data collection through interviews and observations with business owners, employees, and the community. The data were subsequently categorized into specific domains and cultural foci. To ensure objectivity, the mapping results were verified through source and technique triangulation and validated by three high school mathematics teachers as raters using inter-rater reliability testing. This process successfully identified mathematical elements relevant to the 2023 AKM framework, encompassing four main domains (numbers, geometry, algebra, and data and uncertainty) and 27 learning progressions, providing a robust foundation for product development in the subsequent stage. The **Design** stage focused on constructing criterion-referenced tests to bridge cultural findings with item development. This process was conducted through a nexus analysis of domains, subdomains, and learning progressions across various identified cultural con-texts. This analysis resulted in six AKM stimuli that systematically integrate ethnomathematical elements. The **Development** stage aims to refine the questions to become an effective final version. At this stage, 17 numeracy literacy items were developed, which then underwent an expert appraisal process by two expert lecturers. The validation results show that 6 items are categorized as very valid and 11 items are categorized as valid. Based on that feedback, revisions were made to improve the technical quality and accuracy of the questions until all instruments were deemed suitable for use. The **Dissemination** stage was conducted to socialize the developed instrument through publication in a scientific forum and distribution to educational practitioners. This step aimed to ensure that the instruments, which have been tested for consistency, can be adopted and utilized extensively.

Research Subject

The research was conducted at one of the largest gravestone production sites in Pagak District, Malang Regency, East Java. The research subjects included the business owner, employees, and community members involved in gravestone installation. These subjects were selected using a maximal variation sampling technique to explore the phenomenon from the various perspectives of individuals with different roles and experiences within the gravestone industry (Creswell, 2014). The location was selected based on regulatory policies that restrict gravestone installation in several areas of Malang Regency; Pagak District is one of the regions where such activities are still permitted, with four active gravestone industries currently operating there.

Research Instruments

The data sources in this study were obtained through interviews and observations conducted with the business owner, employees working as gravestone craftsmen, and community members involved in the gravestone installation process. The data were complemented by documentation in the form of interview audio recordings, photographs, and videos. The researcher served as the primary instrument in this study, while the supporting instruments included interview guidelines, ob-servation guidelines supported by documentation, as well as additional documents such as inter-rater assessment sheets, mathematical aspect categorization sheets, item sheets, and item valida-tion results.

The interview guidelines prepared for the business owner were intended to obtain infor-mation regarding the gravestone installation tradition, the types of gravestones produced, the tools and materials used, the production process, distribution, and the gravestone installation stage. In-terviews with employees focused on the gravestone-making process, including the tools used, as well as their involvement in the gravestone installation process. Meanwhile, interviews with com-munity members were directed to understand the gravestone installation tradition, the types of gravestones used, the transportation process, and the installation practices. The observation guide-lines were arranged in the form of a table of observed aspects and a description table, including the types of gravestones produced, the shape of each type of gravestone, the tools and materials for making gravestones, the gravestone-making process, and gravestone installation. Observations of the business owner focused on the types of gravestones produced and the preparation of tools and materials. Observations of employees focused on the production process, while observations of community members focused on the gravestone installation stage.

The developed instruments were then validated. The validity of an instrument can be meas-ured by examining how consistently the instrument produces results when it is used repeatedly to measure the same object (Mudhar, 2017). After the research instruments were validated, data col-lection was subsequently conducted.

Data Collection and Analysis

The process begins with obtaining permits, followed by interviews with informants, field observations, and photo or video documentation. Data obtained from interviews, observations, and documentation are then fully transcribed and coded. If the data obtained is incomplete, additional data collection is conducted to supplement aspects that have not been adequately covered. The codes resulting from interviews, documentation, and observations are subsequently analyzed using triangulation techniques in accordance with the focus or aspects of the research. One of the aspects studied is the tradition of installing gravestones, which is the focus of interviews with business owners, employees, and the community. Therefore, the interview data is analyzed using source triangulation, as information regarding the same aspect is obtained from three different sources. Meanwhile, the manufacturing process of each type of gravestone obtained through interviews, observations, and documentation is analyzed using technical triangulation, as the data collection techniques performed are different. Data validated by triangulation will provide the researcher with confidence in the authenticity of the data, allowing the researcher to draw conclusions regarding the research conducted without doubt (Bachri, 2010). The results of data triangulation are organized based on subtopics to produce interpretations of research findings. These interpretations are analyzed and identified to determine the activities occurring within the ngijing culture and the gravestone industry, as well as the mathematical concepts contained therein. Furthermore, the obtained mathematical aspects are analyzed according to the AKM framework covering the sub-topics of cultural context, domain, sub-domain, class, and Learning Progression (LP), and are then analyzed and assessed by experts.

To test the validity of the data, inter-rater reliability was employed, which is a method used to align or balance perceptions between raters in assessing data or instruments (Russell & Purcell, 2009). To test the reliability of the instrument by experts or raters, the gwets AC_1 coefficient formula was used, which is often considered more flexible in handling data with different numbers of categories to measure the level of agreement or consensus between raters. Gwets AC_1 has also been proven to produce more stable inter-rater reliability coefficients compared to Cohen's kappa. Furthermore, gwets AC_1 is proven to be more stable against differences in category frequencies and data distribution compared to Cohen's kappa; thus, it is more recommended for inter-rater reliability analysis (Wongpakaran et al., 2013). Based on the agreement scores provided by the three raters, an inter-rater reliability coefficient of 0.99 was obtained. The mathematical aspects approved by all raters were subsequently used as a reference for mapping in the development of mathematics problems consistent with the AKM framework, which involves content, context, and cognitive levels.

The next stage involves the analysis of intersections and unions. Based on the analysis of the interrelationships between domains, sub-domains, LP, and cultural contexts above, it can be identified that one cultural context can be linked to several domains, sub-domains, and LPs. These findings can be implemented as AKM question stimuli covering elements of numbers, geometry, and algebra, as well as data and uncertainty. Thus, a formed stimulus can encompass findings to be used as a complex question stimulus, and the stimulus can be used to create AKM questions appropriate for grade levels ranging from elementary to secondary school. From various cultural contexts, six stimuli were identified. For each stimulus, questions were developed in accordance with the domain, subdomain, class, LP, and cognitive level. The developed questions consisted of 17 items in the form of essays, multiple-choice, and multiple-choice multiple answer; therefore, in the validation stage, the aspects or indicators assessed were adjusted to the question format. Multiple choice questions were validated using 16 assessment aspects covering the suitability of the question domain, subdomain, learning progression, distractor function, homogeneity of answer choice, etc. Multiple-choice multiple answer questions were validated using 14 assessment aspects covering the suitability of the question domain, subdomain, learning progression, suitability of answer choices to grade level, etc. Meanwhile, essay questions were validated using 12 assessment aspect covering the suitability of the question domain, subdomain, learning progression, questions require students to answer with detail answer, etc. The validation scores from the rater's assessment were then calculated using Aiken's V formula. The rationale for employing Aiken's V is that this validity index is specifically designed for items evaluated using scales with more than two categories (Saifuddin, 2020). In this study, the researcher used a 1-4 scale, namely very appropriate (4), appropriate (3), less appropriate (2), and inappropriate (1). This study utilizes Aiken's V formula to test the quality of the items, with Aiken's coefficient values ranging from 0 to 1. An average score of 4.00 from the raters represents a perfect score, which, when calculated using Aiken's V formula, results in a value of 1.00 (Very Valid). However, if the raters provide a score below 4, the Aiken's V calculation for that aspect will automatically fall below the 1.00–0.80 range. If the calculated result is below 0.8, the aspect is categorized as 'fairly valid' (0.8–0.4) or 'invalid' (0.4–0) and must be revised immediately to maintain the quality of the instrument (Retnawati, 2016).

To ensure the research proceeded smoothly, the researcher established a sequence of research stages as in figure 1.

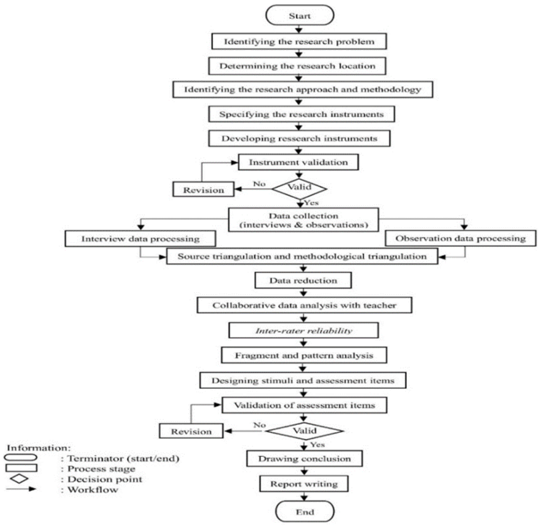


Figure 1. Research Procedure

RESULT AND DISCUSSION

Results

The identified mathematical concepts were analyzed based on the AKM framework document (Tim Substansi Asesmen Akademik, 2023) and were approved by the raters, resulting in the findings presented in Table 1. More detailed, rater assessment results can be found in the appendix.

The mathematical elements from the research results agreed upon by the raters cover four domains with nine subdomains, five grade levels, and 27 learning progressions. These mathematical elements focus on content for elementary school students in Grades 2, 4, and 6; junior high school students in Grade 8; and senior high school students in Grade 10. This allows for deeper exploration by presenting various types of items across several educational levels.

Table 1. Inter-rater Reliability Calculation

Category			**pe Calculation**			**pa Calculation**		
	Agree	Disagree		Sigma Agree	Sigma Disagree		Sigma Agree	Sigma Disagree
$\bar{x}$	2.89	0.1087	Total	44	2	Total	43	0
n'	46		Sigma pe	-1922		Sigma pa	43	
			Pe	-961		pa	0.927536232	
			Gwet AC1 Koefisien	0.999925				

Table 2 Identification of Mathematical Concepts in the Gravestone Industry

Cultural Context	Domain	Sub domain	Learning progression
***Ngijing* culture**	Numbers	Representation	Understanding whole numbers
		Measurement	Calculating time conversion and duration
	Geometry and measurement	Geometric shapes	Recognizing rectangular prisms, cubes, and prisms, as well as distinguishing various three-dimensional shapes based on their characteristics and nets
			Using the concepts of similarity and congruence
Tools and materials	Number	Representation	Understanding whole numbers
			Recognizing equivalent fractions and expressing fractional numbers in decimal form
		Ordering properties	Ordering numbers, including integers
	Geometry and measurement	Geometric shapes	Recognizing rectangular prisms, cubes, and cylinders
			Distinguishing three-dimensional shapes based on their characteristics and nets
			Using the concept of the Pythagorean theorem
		Measurement	Measuring the length and weight of objects using non-standard units
			Determining the length and weight of objects using standard units
			Calculating conversions of standard units of weight
			Calculating and estimating the volume and surface area of cylinders
	Algebra	Ratio and proportion	Solving daily life problems related to ratios
Gravestone production	Number	Representation	Understanding whole numbers
			Understanding simple unit fractions
			Expressing fractional numbers in the form of percentages or vice versa
		Operation	Using arithmetic operations of two whole numbers
	Geometry and measurement	Geometric shapes	Recognizing rectangular prisms and cubes
		Measurement	Measuring the length and weight of objects using non-standard units
			Using standard units
			Calculating and estimating the volume and surface area of cylinders
		Spatial reasoning	Recognizing the relative position of an object (front-back, left-right, top-bottom).
	Algebra	Ratio and proportion	Solving daily life problems related to ratios
Marketing and distribution	Number	Representation	Understanding whole numbers
		Operation	Using arithmetic operations of whole numbers, fractions, or decimal numbers
	Data and uncertainty	Data and representation	Presenting, analyzing, and interpreting data in the form of bar charts or tables
			Determining and using the mean, median, and mode
Delivery	Number	Representation	Understanding whole numbers
Installation	Number	Representation	Understanding whole numbers
		Operation	Using arithmetic operations of whole numbers, fractions, or decimal numbers
	Geometry and measurement	Measurement	Calculating and estimating the perimeter and area of plane figures and their combinations
	Algebra	Relations and functions	Presenting, analyzing, and solving problems using relations, functions, and linear equations along with their graphs

Based on Table 2, the cultural context of the *ngijing* tradition shows a strong correlation with various mathematical domains in the Minimum

Competency Assessment (AKM) instrument. The identified mathematical elements are primarily dominated by the number domain, specifically the representation of whole numbers and fractions, along with the geometry and measurement do-main. These elements appear consistently throughout all stages, ranging from tools to the physical form of the gravestone as shown in Figure 2. In addition to those domains, this study also identifies the algebra domain within the ratio and proportion subdomains of production and marketing, while the data and uncertainty domain emerge from statistical data interpretation in distribution activities. These findings indicate that ethnographic activities in the gravestone industry involve comprehensive mathematical reasoning. The integration of these various domains, including the concepts of the Pythagorean theorem, similarity, and functional relations, demonstrates that the cultural practice of ngijing provides a rich and valid contextual foundation for developing numeracy literacy instruments in this Research and Development (R&D) study.

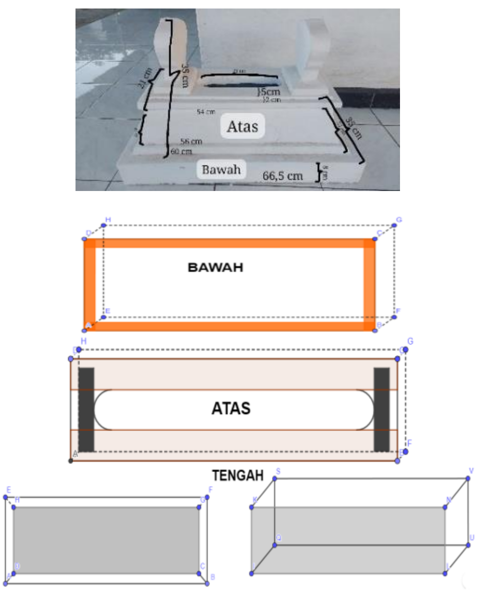


Figure 2. Sketch on GeoGebra

The results of the above study are in accordance with the theory that there are two forms of culture, namely tangible cultural heritage and intangible cultural heritage (Sedyawati, 1997). In tan-gible cultural heritage, mathematical elements of numbers were found with the representation subdomain in the LP of "understanding whole numbers" for Grade 4 elementary school and the measurement subdomain in the learning progression of "calculating time conversion and duration" in the context of calculating the time of installing gravestones on the thousandth day after death for Grade 6 elementary school. Meanwhile, in intangible cultural heritage, mathematical elements of geometry and measurement were found with the geometric shapes subdomain in the learning progression of "recognizing rectangular prisms, cubes, and prisms, and distinguishing various three-dimensional shapes based on their characteristics and nets" in the forms of gravestones, namely small and large white gravestones, tall gravestones, and hero gravestones in the materials for Grades 2, 4, and 6 elementary school, as well as "using the concepts of similarity and congru-ence" in the forms of tall and hero gravestones made of ceramic and granite for Grade 10 senior high school. More detailed cultural elements, along with the elaboration of mathematical concepts arranged according to the same domains and grade levels, are presented in Appendix.

Based on the analysis of the interrelationships among domains, subdomains, LP, and cultural contexts, it was found that one cultural context can be related to several domains, subdomains, and LP. These findings can be implemented in AKM item stimuli covering four domains. The con-structed stimuli can serve as complex item stimuli and can be used for developing AKM items that are appropriate to grade levels and arranged according to the AKM item development guidelines. Furthermore, an analysis of cognitive levels appropriate to the cultural context was conducted as a guideline for AKM item development by analyzing the learning progression agreed upon by the raters. The items successfully developed amounted to 17 AKM items with cognitive levels of know-ing, applying, and reasoning (Figure 3). The following is one example of the developed item.

The developed items were then assessed for quality by two validators based on the aspects or indicators used for evaluating culturally based AKM items. The scores obtained from both validators were then used to calculate the inter-rater agreement index using Aiken's V. The validation scores of the test items are presented in Table 3.

Soal 4

Pada tanggal 30 September karyawan toko "Alpha" akan menerima gaji bulanan. Gaji setiap karyawan berbeda, Andi selama satu bulan selalu hadir, dia juga selalu mengambil konsumsi, tetapi setiap 7 hari sekali dia hanya masuk setengah hari. Bayu pernah 3 hari izin tidak hadir dan meminjam uang sebesar $Rp350.000$, di tempat kerja dia selalu mengambil konsumsi. Candra pernah izin 4 hari, lalu izin lagi 2 hari, di tempat kerja dia tidak pernah mengambil konsumsi, dia dua kali meminjam uang sebesar $Rp100.000$, dan meminjam $Rp50.000$ sekali. Dodik hanya masuk kerja selama 18 hari, 5 harinya dia masuk setengah hari, dan dia hanya mengambil konsumsi saat bekerja satu hari penuh.
Dari pernyataan di atas dapat diketahui bahwa Andi merupakan karyawan yang mendapatkan gaji paling banyak. Benarkah pernyataan tersebut? Berikan alasanmu!

Question 4

On September 30, employees of "Alpha" Shop will receive their monthly salaries. Each employee receives a different salary. Andi was always present for the entire month, always took the meal allowance, but every 7 days he only worked half a day. Bayu was absent for 3 days and borrowed Rp350,000. At work, he always took the meal allowance. Candra was absent for 4 days and then absent again for 2 days. At work, he never took the meal allowance. He borrowed Rp100,000 twice and Rp50,000 once. Dodik only worked for 18 days; for 5 of those days, he worked half days, and he only took the meal allowance on full working days.
From the statements above, it is claimed that Andi is the employee who receives the highest salary. Is this statement true? Provide your reasoning.

Kunci Jawaban Soal

Diket:
Gaji harian $= 75.000$ + konsumsi
Gaji harian $= 100.000$ (tanpa konsumsi)
September memiliki 30 hari
Andi: selalu hadir, selalu mengambil konsumsi, setiap 7 hari sekali masuk setengah hari.
Bayu: hadir 27 hari, selalu mengambil konsumsi, memiliki hutang $Rp350.000$.
Candra: hadir 24 hari, tidak pernah mengambil konsumsi, memiliki hutang $2(Rp100.000) + Rp50.000$
Dodik: hadir 18 hari, 5 hari masuk setengah hari, hanya mengambil konsumsi saat bekerja satu hari penuh.
Ditanya: membuktikan bahwa pernyataan bahwa Andi mendapatkan gaji paling tinggi
Jawab:
Andi: $30:7 = 4\ sisa\ 2 \rightarrow 4\ hari$
$30 - 4 = 26\ hari$
$26 \times 75.000 = 1.950.000$
$4 \times (75.000:2) = 150.000$
Total gaji $= 1.950.000 + 150.000 = \mathbf{2.100.000}$
Bayu: $27 \times 75.000 = 2.025.000$
$2.025.000 - 350.000 = \mathbf{1.675.000}$
Candra: $24 \times 100.000 = 2.400.000$
$2(100.000) + 50.000 = 250.000$
$2.400.000 - 250.000 = \mathbf{2.150.000}$
Dodik: $18 - 5 = 13$
$13 \times 75.000 = 975.000$
$5 \times 50.000 = 250.000$
Total gaji $= 975.000 + 250.000 = \mathbf{1.225.000}$
Jadi pernyataan tersebut salah, karena karyawan yang mendapatkan gaji tertinggi adalah Candra dengan selisih $Rp50.000$ lebih banyak dari Andi.

Answer Key

Given:
Daily wage = Rp75,000 (with meals)
Daily wage = Rp100,000 (without meals)
September has 30 days.
Andi: Always present, always takes meals, works half days every 7 days.
Bayu: Present for 27 days, always takes meals, has a debt of Rp350,000.
Candra: Present for 24 days, never takes meals, has debts of 2 × Rp100,000 + Rp50,000.
Dodik: Present for 18 days, works half days for 5 days, only takes meals on full working days.
Question: Prove whether the statement that Andi receives the highest salary is correct.
Solution:
Andi: $30:7 = 4\ remainder\ 2 \rightarrow 4\ half\ days$
$30 - 4 = 26\ full\ days$
$26 \times 75.000 = 1.950.000$
$4 \times (75.000:2) = 150.000$
Total salary $= 1.950.000 + 150.000 = \mathbf{2.100.000}$
Bayu: $27 \times 75.000 = 2.025.000$
$2.025.000 - 350.000 = \mathbf{1.675.000}$
Candra: $24 \times 100.000 = 2.400.000$
$2(100.000) + 50.000 = 250.000$
$2.400.000 - 250.000 = \mathbf{2.150.000}$
Dodik: $18 - 5 = 13$
$13 \times 75.000 = 975.000$
$5 \times 50.000 = 250.000$
Total gaji $= 975.000 + 250.000 = \mathbf{1.225.000}$
Conclusion:
The statement is **false**, because the employee who receives the highest salary is **Candra**, who earns Rp50,000 more than Andi.

Figure 3. Reasoning-level Questions

Table 3. Calculation of Rater Agreement Index Using Aiken's V Index

Number of Question Indicators	Questions	Validator 1		Validator 2		Overall Average
16	1	63	3,94	58	3,63	3,78
16	2	62	3,88	60	3,75	3,81
12	3	47	3,92	46	3,83	3,88
12	4	47	3,92	44	3,67	3,79
16	5	63	3,94	60	3,75	3,84
16	6	63	3,94	63	3,94	3,94
12	7	47	3,92	47	3,92	3,92
12	8	44	3,67	43	3,58	3,63
12	9	45	3,75	46	3,83	3,79
12	10	48	4	48	4	4
12	11	48	4	46	3,83	3,92
16	12	64	4	62	3,88	3,94
16	13	64	4	64	4	4
12	14	48	4	47	3,92	3,96
16	15	63	3,94	64	4	3,97
12	16	48	4	47	3,92	3,96
14	17	56	4	56	4	4

Legend:
S: Total score per question
$\bar{x}$: Average score per question

The items declared valid with the highest average rater score (4.00) were items 10, 13, and 14, while the lowest average rater score was recorded for item 8 (3.63). This variation in validity was influenced by the differing assessment criteria tailored to each item type: 16 aspects for multiple-choice, 14 aspects for complex multiple-choice, and 12 aspects for essay items. The lower score for item 8 was attributed to a discrepancy in perception among validators regarding the alignment of domains, sub-domains, and cultural contexts. Furthermore, in the aspects of command con-straints, conceptual alignment, and sentence clarity, validators assigned a 'suitable' rating, yet the scores did not reach the maximum level. Following these identified gaps, follow-up actions were taken by revising the items based on the qualitative and quantitative feedback from the validators. This process resulted in a final instrument declared feasible after undergoing a refinement stage based on the validation results.

Discussion

Based on the findings of this study, mathematical elements were identified within the grave-stone industry context. These elements include the number domain with subdomains of representa-tion for grades 2, 4, 6, and 8; order properties for grade 10; and operations for grades 2, 4, 6, and 8. In the geometry and measurement domain, the subdomains found are geometric shapes for grades 2, 4, 6, 8, and 10; measurement for grades 2, 4, 6, and 10; and spatial reasoning for grade 2. Fur-thermore, the algebra domain includes subdomains of relations and functions for grade 8, as well as ratio and proportion for grade 6. Finally, the data and uncertainty domain involve subdomains of data and its representation for students in grades 6 and 8. These findings align with the concept of ethnomathematics, which integrates culture, mathematics, and education through research that considers the specific ways certain cultural groups understand and apply mathematical concepts and practices (Budiarto et al., 2022).

Studies that have identified mathematical elements include those in the number domain (rep-resentation and operations) by Siregar dan Yafizham (2023) within trading activities, while order properties were found in the placement of saron bars by Cahyanti et al. (2024). In the geometry and measurement domain, similar findings were reported in the concept of similarity and congruence in the shape of kastangel cookies by Diniyati et al. (2022), while the measurement subdomain was ex-plored by Wahyuni & Suherman (2023) concerning the measurement of small fish using a canteng (a type of cup) as a reference and by Safitri et al. (2021) in the study of the structure of Uma Lengge rooms. In the algebra domain, Siregar & Yahfizham (2023) investigated the concepts of relations, functions, sets, systems of linear equations, and social arithmetic, while Fauziyah & Wahyuni (2024) identified the concepts of ratio and proportion in tempe production. In the domain of data and un-certainty, Rizki & Frentika (2021) found the concept of data and its representation using data on the number of buffalo and buffalo racing participants. Overall, these studies demonstrate the exist-ence of mathematical concepts within cultural contexts in the gravestone industry.

The mathematical elements identified within the cultural context were then developed into test items and validated to assess the feasibility and validity of the items by two validators using several assessment indicators. An item is considered valid if the obtained score corresponds to the total score (Supandi & Farikhah, 2016). In this study, correspondence and accuracy were evaluated based on the suitability of the items with the domain, subdomain, learning progression, cultural context, cognitive level, and item format. Additionally, the items were required to use clear and easily understood language that conforms to proper Indonesian grammar. For multiple-choice and complex multiple-choice items, the items must not provide hints toward the correct answer, must have only one correct answer, must contain an appropriate number of statements according to the grade level, have homogeneous and logical answer options, be clear and unambiguous, have accu-rate answer keys, have functional distractors, have answer options of relatively equal length, avoid the options "all of the above are wrong/correct," and arrange answer choices in ascending order or chronological sequence; for essay items, the instructions or questions and answers must be clear and not open to multiple interpretations, and answers must be in the form of words, phrases, num-bers, or symbols with relatively certain correctness. These aspects became the indicators assessed during the validation process. The scores obtained from the two validators were then used to calcu-late the inter-rater agreement index using Aiken's V, which aims to determine the extent to which experts agree on the validity of the developed items (Rasak et al., 2024). The integration of cultural contexts into numeracy literacy items offers significant benefits, such as broadening students' in-sights into the noble values and local wisdom of their surroundings. This approach enhances educa-tional quality by bridging mathematics and culture to ensure more meaningful learning experiences for students (Nasrum et al., 2025). The use of cultural contexts inherently aligns mathematical con-cepts with students' daily realities. Consequently, this alignment positively impacts specific compe-tencies, including problem-solving, critical thinking, spatial ability, and comprehensive mathemati-cal literacy skills (Ahmad et al., 2025; Johar et al., 2025; Lubis et al., 2021; Pratama & Yelken, 2024; Rosa & Orey, 2021).

This study applies inter-rater reliability to ensure the consistency of coding results based on rater agreement (Gisev et al., 2013). This approach is in line with the primary function of inter-rater reliability, which is to enhance the transparency, consistency, and credibility of the analysis, ensur-ing that the findings truly represent the phenomenon under study and are free from the bias of a single interpreter (Cole, 2024; Díaz et al., 2023; MacPhail et al., 2016). By involving raters, this re-search offers a novelty in which the ethnographic findings at the define stage are no longer subjec-tive based on the researcher's perspective alone. The process of coding cultural data into mathe-matical elements has been verified by several experts; thus, these ethnomathematical analysis re-sults are more accurate, objective, and ready for use in the subsequent item development stage (McDonald et al., 2019).

Validity testing using Aiken's V has been widely applied to verify the validity of developed items (Astuti et al., 2021; Rosmasari, 2023). The results of validity testing that show low validity can be caused by internal factors, such as researchers' negligence in data accuracy or calculation errors, as well as external factors, such as uneven data distribution, extreme differences in validators' re-sponses, and low-quality validators in terms of diligence in scoring or experience. Valid items can be implemented in mathematics research and learning, while invalid items are still presented along with the validity calculation results. In this study, the items whose validity was tested consisted of multi-ple-choice, complex multiple-choice, and essay questions. These items were aligned with AKM-oriented numeracy literacy questions and linked to the selected ethnomathematics context, namely ethnomathematics in the clam industry. The items can be presented in learning devices according to students' conditions and school curricula. Research related to AKM-oriented numeracy literacy items combining ethnomathematics has been proven effective in encouraging and improving stu-dents' numeracy literacy skills (Elina & Maimunah, 2024; Safrida et al., 2024; Wardhani & Oktin-ingrum, 2022). Based on the explanation above, the items developed in this study are expected to be implemented in mathematics research and learning, especially because this study combines vari-ous mathematical concepts within the context of the clam industry into cross-grade item stimuli, an approach that has been underexplored in ethnomathematics and constitutes a fundamental differ-ence from previous studies.

Implication

By identifying the mathematical elements in the gravestone industry, students, teachers, and the community are expected to become increasingly aware of the close relationship between cul-ture and mathematics. This awareness creates opportunities for teachers to integrate cultural val-ues into various aspects of learning, such as in the development of teaching materials, assessment construction, and other instructional strategies. The findings of this study are also expected to serve as a reference for similar future research. Other researchers can apply an ethnomathematics approach in different cultural contexts and produce diverse outputs, such as teaching materials or mathematics items using frameworks other than AKM. Furthermore, the items developed in this study are expected to be implemented in classroom learning activities as well as in mathematics re-search conducted by teachers and other researchers.

Limitation

The limitation of this study lies in the selection of subjects and the specific location, which was limited to the gravestone industry in a single area; consequently, the findings may differ if data were collected in different cultural or industrial contexts. Furthermore, while the developed items have been proven content-valid by experts, this study did not include field testing with students to evaluate their practical application. Future researchers are expected to conduct studies in locations with diverse cultural characteristics or different gravestone production processes to obtain more varied results. Additionally, it is suggested that subsequent research implement these items directly in a classroom setting to evaluate their effectiveness and impact on student learning performance.

CONCLUSION

The identified mathematical elements encompass several domains: the number domain, which includes the subdomains of representation, ordering properties, and operations; the geome-try and measurement domain, including geometric figures, measurement, and spatial reasoning; the algebra domain, comprising relations and functions as well as ratios and proportions; and lastly, the data and uncertainty domain, including data and its representations. Based on the validation results of culturally contextualized AKM-oriented items, it was concluded that items 10, 13, and 17 are highly valid and fully comply with AKM item-writing principles, making them suitable for imple-mentation without revision. Items 15, 14, and 16 are also categorized as highly valid and meet AKM criteria; thus, they can be implemented with minor revisions. Items 3, 6, 11, and 12 demonstrate moderate validity on one indicator and high validity on the remaining indicators, indicating they are feasible for implementation with minor revisions. Items 1, 2, 5, 4, 7, 8, and 9 show moderate validity across several indicators; however, as most indicators fall within the highly valid category, these items can be implemented with several revisions. The novelty of this research lies in its systematic approach to bridging ethnomathematical findings from the gravestone industry with national as-sessment standards (AKM). Unlike previous ethnomathematical studies that often stop at identify-ing cultural elements, this research produces stimuli directly derived from ethnographic findings, which are then used to develop concrete AKM test items to measure students' numeracy literacy. This study contributes to mathematics education by providing a replicable model for developing high-quality, standardized numeracy instruments that remain culturally relevant, thus supporting the integration of local wisdom into classroom assessments.

REFERENCES

Afgani, M. W., Paradesa, R., Raden, N., Palembang, F., Zainal, J. K. H., & Km, A. F. (2021). PISA-LIKE PROBLEMS USING ISLAMIC ETHNOMATHEMATICS APPROACH. *Infinity Journal*, *10*(2), 203–216. https://doi.org/10.22460/INFINITY.V10I2.P203-216

Aflah, H., & Andhany, E. (2022). Etnomatematika dalam Budaya Suku Alas di Kabupaten Aceh Tenggara. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *6*(3), 2376–2390.

Ahmad, M., Pricilia, G. M., & Elindra, R. (2025). Realistic mathematics learning model based on Mandailing culture assisted by TPACK: model development study to develop critical thinking skills. *Perspektivy Nauki i Obrazovania*, (3), 282–296. https://doi.org/10.32744/PSE.2025.3.18

Amreta, M. Y. (2024). Development of Numeracy Assessment Based on Ethnomathematics in the Merdeka Curriculum Phase B. *Syaikhuna: Jurnal Pendidikan Dan Pranata Islam*, *15*(1), 12–24. https://doi.org/10.62730/SYAIKHUNA.V15I1.7299

Astuti, A. W., Rahmawati, A. Y., & Richardo, R. (2021). Validitas Isi Instrumen Test Berpikir Komputasi Matematika. *Proceedings Galuh Mathematics National Conference (GAMMA NC)*, 6–10. https://jurnal.unigal.ac.id/GAMMA-NC/article/view/13424/pdf

Asyari, A., Saputra, E., Wulandari, W., Nuraina, N., & Listiana, Y. (2024). Pengembangan soal literasi numerasi berbantuan quizizz dengan menggunakan konteks sosial budaya kota tebing tinggi. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, *7*(2), 285–296. https://doi.org/10.22460/JPMI.V7I2.21648

Bachri, B. S. (2010). Meyakinkan Validitas Data Melalui Triangulasi pada Penelitian Kualitatif. *Teknologi Pendidikan*, *10*(1). https://pdfcoffee.com/meyakinkan-validitas-data-melalui-triangulasi-pada-penelitian-kualitatif-converted-pdf-free.html

Bestari, S. K., & Sari, E. F. (2025). Pengaruh Pembelajaran Etnomatematika Berbasis Makanan Khas Daerah Terhadap Kemampuan Pemecahan Masalah Siswa Materi Pecahan Kelas 5 SD. *Journal of Classroom Action Research*, *7*(2), 868–877. https://doi.org/10.29303/JCAR.V7I2.11365

Bishop, A. J. (1994). *Cultural Conflicts in Mathematics Education: Developing a Research Agenda on JSTOR*.

Budiarto, M. T., Masruroh, A., Azizah, A., K, H. Y. W., Munthahana, J., Awwaliya, R., Nikmah, R., & Yusrina, S. L. (2022). Etnomatematika: Eksplorasi Konsep Matematika pada Motif

Batik Sari Kenongo. In *Etnomatematika Kajian Etnomatematika Pada Budaya Indonesia* (1st ed., p. 27). Zifatama Jawara.

Cahyanti, A., Kurniawan, I., Kristanto, Y. D., & Kurniawan, H. (2024). Kajian Etnomatematika pada Alat Musik Saron di Daerah Yogyakarta. *Jurnal Ilmiah Matematika Realistik*, *5*(1), 150–155.

Cervantes-Barraza, J. A., & Araujo, A. A. (2023). Design of interactive mathematical tasks that make up the reasoning and the Ethnomathematics program. *Journal on Mathematics Education*, *14*(3), 469–482. https://doi.org/10.22342/JME.V14I3.PP469-482

Cole, R. (2024). Inter-Rater Reliability Methods in Qualitative Case Study Research. *Sociological Methods and Research*, *53*(4), 1944–1975. https://doi.org/10.1177/00491241231156971;CTYPE:STRING:JOURNAL

Creswell, J. W. (2014). Research Design: Quantitative, Qualitative, and Mixed Methods Approaches. In *SAGE* (4th ed.). SAGE. https://books.google.com/books/about/Research_Design.html?hl=id&id=4uB76IC_pOQC

D'Ambrosio, U. (1985). Ethnomathematics and its Place in the History and Pedagogy of Mathematics. *For the Learning of Mathematics*, *5(1)*, 44–48. https://www.jstor.org/stable/40247876

D'Ambrósio, U., & Knijnik, G. (2020). Ethnomathematics. *Encyclopedia of Mathematics Education*, 283–288. https://doi.org/10.1007/978-3-030-15789-0_60

Díaz, J., Pérez, J., Gallardo, C., & González-Prieto, Á. (2023). Applying Inter-Rater Reliability and Agreement in collaborative Grounded Theory studies in software engineering. *Journal of Systems and Software*, *195*, 111520. https://doi.org/10.1016/J.JSS.2022.111520

Dinarti, S., Qomariyah, U. N., & Agustina. (2023). Kemampuan Literasi Matematika Siswa Dalam Menyelesaikan Masalah Pola Bilangan Berbasis Etnomatika Budaya Jombang. *Jurnal Pendidikan Matematika*, *14*(2), 103–112. https://doi.org/10.36709/JPM.V14I2.76

Diniyati, I. A., Ekadiarsi, A. N., Salsabila, Herdianti, I. A. H., Amelia, T., & Wahidin. (2022). Etnomatematika: Konsep Matematika pada Kue Lebaran. *Mosharafa: Jurnal Pendidikan Matematika*, *11*(2), 247–256.

Direktorat Pelindungan Kebudayaan. (2022). *Sebanyak 1728 Warisan Budaya Takbenda (WBTb) Indonesia Ditetapkan*. Direktorat Pelindungan Kebudayaan. https://kebudayaan.kemdikbud.go.id/dpk/sebanyak-1728-warisan-budaya-takbenda-wbtb-indonesia-ditetapkan/

Elina, E., & Maimunah, M. (2024). Pengembangan Soal Tipe Asesmen Kompetensi Minimum (AKM) Berbasis Konteks Budaya Melayu untuk Mengukur Kemampuan Literasi Numerasi Siswa Fase D. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *8*(3), 2118–2132. https://doi.org/10.31004/CENDEKIA.V8I3.3219

Fauzi, F., Muchlis, E. E., & Sumardi, H. (2025). Analisis Hambatan Kemampuan Pemecahan Masalah Siswa SMP pada Materi Aljabar dengan Konteks Budaya Bengkulu. *Indiktika : Jurnal Inovasi Pendidikan Matematika*, *7*(2), 388–400. https://doi.org/10.31851/INDIKTIKA.V7I2.17313

Fauziyah, S., & Wahyuni, F. T. (2024). Etnomatematika: Konsep Matematika pada Proses Pembuatan Keripik Tempe Khas Desa Kalirejo. *Numeracy*, *11*(2), 184–198.

Fitrah, M., Sofroniou, A., Ofianto, Judijanto, L., & Widihastuti. (2024). Reliability and separation index analysis of mathematics questions integrated with the cultural architecture framework using the Rasch model. *Journal of Education and E-Learning Research*, *11*(3), 499–519. https://doi.org/10.20448/JEELR.V11I3.5861

Gisev, N., Bell, J. S., & Chen, T. F. (2013). Interrater agreement and interrater reliability: Key concepts, approaches, and applications. *Research in Social and Administrative Pharmacy*, *9*(3), 330–338. https://doi.org/10.1016/J.SAPHARM.2012.04.004

Hastuti, M., & Setyaningrum, W. (2023). Analisis Kemampuan Number Sense Siswa SMP dalam Meyelesaikan Soal Numerasi Model AKM Berbasis Penalaran. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *12*(2), 2363–2377. https://doi.org/10.24127/AJPM.V12I2.7065

Heryan, U. (2018). Meningkatkan Kemampuan Komunikasi Matematis Siswa Sma Melalui Pendekatan Pembelajaran Matematika Realistik Berbasis Etnomatematika. *Jurnal Pendidikan Matematika Raflesia*, *3*(2), 94–106.

Huda, M. N. (2019). *Nilai-Nilai Budaya Suku Jawa Dalam Tradisi Ngijing Pasca Selametan Nyewu Perspektif Hukum Islam (Studi di Dusun Sribakti Kecamatan Blambangan Umpu Kabupaten Way Kanan)*. Institut Agama Islam Negeri (IAIN) Metro Lampung.

Jafirah, S., Fajriah, N., & Suryaningsih, Y. (2024). Pengembangan Soal Literasi Matematika dengan Konteks Etnomatematika pada Pasar Terapung untuk Siswa Tingkat SMP/MTS. *EDU-MAT: Jurnal Pendidikan Matematika*, *12*(2), 393–403. https://doi.org/10.20527/EDUMAT.V12I2.19007

Johar, R., Fauzan, A., Sugiman, S., Anwar, L., Sa'dijah, C., & Khairunnisak, C. (2025). Developing local instruction theory through ethnomathematics and technological-based realistic mathematics education to support students' spatial ability. *Asian Journal for Mathematics Education*, *4*(4), 553–587. https://doi.org/10.1177/27527263251383572;JOURNAL:JOURNAL:MEAA;ISSUE:ISSUE:DOI

Karim, A. (2017). Makna Ritual Kematian dalam Tradisi Islam Jawa. *Sabda: Jurnal Kajian Kebudayaan*, *12*(2), 161–171.

Kementerian Pendidikan dan Kebudayaan. (2021). *Panduan Penguatan Literasi dan Numerasi di Sekolah* (1st ed.). Direktorat Jenderal Pendidikan Anak Usia Dini, Pendidikan Dasar, dan Pendidikan Menengah Kementerian Pendidikan dan Kebudayaan.

Kurniawan, A. P., Budiarto, M. T., & Ekawati, R. (2022). Pengembangan Soal Numerasi Berbasis Konteks Nilai Budaya Primbon Jawa. *Jurnal Review Pembelajaran Matematika*, *7*(1), 20–34. https://doi.org/10.15642/jrpm.2022.7.1.20-34

Linton, R. (1945). *The cultural background of personality*. Appleton Century.

Linuhung, N., Sudarman, S. W., & Agustina, R. (2025). Development of Ethnomathematics-Based Numeracy Literacy Questions in Peci Tapis Lampung. *JTAM (Jurnal Teori Dan Aplikasi Matematika)*, *9*(2), 629–642. https://doi.org/10.31764/JTAM.V9I2.30095

Lubis, A. N. M. T., Widada, W., Herawaty, D., Nugroho, K. U. Z., & Anggoro, A. F. D. (2021). The ability to solve mathematical problems through realistic mathematics learning based on ethnomathematics. *Journal of Physics: Conference Series*, *1731*(1), 012050. https://doi.org/10.1088/1742-6596/1731/1/012050

MacPhail, C., Khoza, N., Abler, L., & Ranganathan, M. (2016). Process guidelines for establishing Intercoder Reliability in qualitative studies. *Qualitative Research*, *16*(2), 198–212. https://doi.org/10.1177/1468794115577012

Mahyudi, D. (2014). *Pandangan Teologi Islam Tentang Tradisi Ngijing Pada Upacara Selametan Nyewu Di Kabupaten Deli Serdang*. 211.

Mania, S., & Alam, S. (2021). Teachers' Perception toward the Use of Ethnomathematics Approach in Teaching Math. *International Journal of Education in Mathematics, Science and Technology*, *9*(2), 282–298. https://doi.org/10.46328/IJEMST.1551

Marbun, L. R. P., Putra, Z. H., Noviana, E., Gunawan, Y., Afrillia, Y. M., Anriana, R., & Ahmad, S. (2026). Ethnomathematics exploration of tandok of the Batak Toba tribe as geometry learning resources for elementary school. *Ethnography and Education*. https://doi.org/10.1080/17457823.2026.2641176

McDonald, N., Schoenebeck, S., & Forte, A. (2019). Reliability and inter-rater reliability in qualitative research: Norms and guidelines for CSCW and HCI practice. *Proceedings of the ACM on Human-Computer Interaction*, *3*(CSCW), 23. https://doi.org/10.1145/3359174;CSUBTYPE:STRING:JOURNAL;SERIALTOPIC:TOPIC:ACM-PUBTYPE

Miftah, R. N., & Setyaningsih, R. (2022). Pengembangan LKPD Berbasis Asesmen Kompetensi Minimum (AKM) pada Materi Geometri untuk Meningkatkan Kemampuan Literasi Numerasi. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(3), 2199–2208. https://doi.org/10.24127/AJPM.V11I3.5780

Mosimege, M., & Egara, F. O. (2023). Students' Perceptions of Mathematics Teachers' Usage of Ethnomathematics Materials in the Teaching and Learning of Mathematics. *International Journal of Multicultural Education*, *25*(2), 443–459. https://www.ijmejournal.org/ijme/index.php/ijme/article/view/v25-2-33.html

Mudhar. (2017). *Validitas dan Reliabilitas : Cara Mudah Analisis Secara Manual, Microsoft Exel dan SPSS* (Ayuni, Ed.). Adi Buana University Press.

Mulyani, S., Lusiana, L., & Jumroh, J. (2024). Pengembangan Soal Asesmen Kompetensi Minimum (AKM) Matematika pada Materi Peluang untuk Peserta Didik SMP. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *13*(3), 1054–1063. https://doi.org/10.24127/AJPM.V13I3.8409

Munthahana, J., Budiarto, M. T., & Wintarti, A. (2023). The Application of Ethnomathematics in Numeracy Literacy Perspective: A Literature Review. *Indonesian Journal of*

Science and Mathematics Education, *6*(2), 177–191. https://doi.org/10.24042/IJSME.V6I2.17546

Nasrum, A., Salido, A., & Chairuddin. (2025). Unveiling Emerging Trends and Potential Research Themes in Future Ethnomathematics Studies: A Global Bibliometric Analysis (From Inception to 2024). *International Journal of Learning, Teaching and Educational Research*, *24*(2), 206–226. https://doi.org/10.26803/IJLTER.24.2.11

Nihaya, A. A., Kesumawati, N., & Dirgantara, M. R. D. (2022). Peningkatan Kemampuan Pemecahan Masalah Matematis Siswa Melalui Pembelajaran Matematika Berbasis Etnomatematika Sekolah Dasar. *Jurnal Cakrawala Pendas*, *8*(4), 1427–1438. https://doi.org/10.31949/JCP.V8I4.3265

Nur, A. S., Kartono, Zaenuri, & Rochmad. (2022). Teacher's perception of culture-based mathematics learning. *AIP Conference Proceedings*, *2633*(1). https://doi.org/10.1063/5.0102825/2830498

Ozgen, K., & Bindaka, R. (2011). Determination of Self-Efficacy Beliefs of High School Students towards Math Literacy. *Educational Sciences: Theory and Practice*, *11*(2), 1085–1089. https://eric.ed.gov/?id=EJ927392

Prabawati, M. N. (2016). Etnomatematika Masyarakat Pengrajin Anyaman Rajapolah Kabupaten Tasikmalaya. *Infinity Journal*, *5*(1), 25–31. https://doi.org/10.22460/infinity.v5I1.p25-31

Pratama, R. A., & Yelken, T. Y. (2024). Effectiveness of ethnomathematics-based learning on students' mathematical literacy: a meta-analysis study. *Discover Education 2024 3:1*, *3*(1), 202-. https://doi.org/10.1007/S44217-024-00309-1

Priyani, N. E. (2022). Pengembangan Literasi Numerasi Berbantuan Aplikasi Etnomatematik Puzzle Game pada Pembelajaran Matematika di Sekolah Perbatasan. *Jurnal Didaktika Pendidikan Dasar*, *6*(1). https://ojsdikdas.kemdikbud.go.id/index.php/didaktika/article/view/536/387

Pusat Asesmen Pendidikan. (2022). *Asesmen Nasional*. Kemdikbud. https://pusmendik.kemdikbud.go.id/an/page/asesmen_kompetensi_minimum

Puspadewi, K. R., Atmaja, I. M. D., & Noviyanti, P. L. (2025). Balinese Ethnomathematics in Numeracy Education: Culturally-Inspired Questions for Middle School Students. *Jurnal Pedagogi Dan Pembelajaran*, *8*(1), 100–107. https://doi.org/10.23887/JP2.V8I1.89054

Rachmawati, F. K., Lestari, N. D. S., Oktavianingtyas, E., Trapsilasiwi, D., & Murtikusuma, R. P. (2024). Profil Literasi Numerasi Siswa SMA dalam Menyelesaikan Soal AKM Konten Aljabar Berdasarkan Kemampuan Matematika. *JIPM (Jurnal Ilmiah Pendidikan Matematika)*, *12*(2), 294–309. https://doi.org/10.25273/JIPM.V12I2.18983

Rahmat, A. S. (2023). *Pengembangan LKPD Berbasis Etnomatematika Budaya Lampung untuk Meningkatkan Kemampuan Literasi Matematis Peserta Didik* [Universitas Lampung]. http://digilib.unila.ac.id/id/eprint/75090

Rasak, R. F., Husein, & M, H. (2024). Pengembangan LKPD Model PBL pada Materi Momentum dan Impuls untuk Meningkatkan Hasil Belajar Siswa Development of PBL Model Worksheets on Momentum and Impulse Material to Improve Student Learning Outcomes. *Jurnal Penelitian Pendidikan Fisika*, *9*(3), 163–170.

Retnawati, H. (2016). *Analisis Kuantitatif Instrumen Penelitian (Panduan Peneliti, Mahasiswa, dan Psikometrian)*. Parama Publishing.

Rizki, H. T. N., & Frentika, D. (2021). Etnomatematika dalam Budaya Barapan Kebo Sebagai Inovasi Pembelajaran Matematika. *Jurnal Riset Dan Inovasi Pembelajaran*, *1*(2), 252–264. https://doi.org/10.51574/JRIP.V1I2.98

Rohmah, A. N., Sutama, S., Hidayati, Y. M., Fauziati, E., & Rahmawati, L. E. (2022). Planning for Cultivation Numerical Literacy in Mathematics Learning for Minimum Competency Assessment (AKM) in Elementary Schools. *Elementary School Forum (Mimbar Sekolah Dasar)*, *9*(3), 503–516. https://doi.org/10.53400/mimbar-sd.v9i3.51774

Rosa, M., D'Ambrosio, U., Orey, D. C., Shirley, L., Alangui, W. V, Palhares, P., Gavarrete, M. E., & D'Ambrosio, U. (2016). An Overview of the History of Ethnomathematics. *Current and Future Perspectives of Ethnomathematics as a Program*, 5–10. https://doi.org/10.1007/978-3-319-30120-4_2

Rosa, M., & Orey, D. C. (2006). Abordagens Atuais do Programa Etnomatemática: delineando um caminho para a ação pedagógica. *Boletim de Educação Matemática*, *19*(26), 1–6. http://www.edu/indiv/o/oreyd.

Rosa, M., & Orey, D. C. (2011). Ethnomathematics: the cultural aspects of mathematics. *Revista Latinoamericana de Etnomatemática*

Perspectivas Socioculturales de La Educación Matemática, 4(2), 32–54. https://www.revista.etnomatematica.org/index.php/RevLatEm/article/view/32

Rosa, M., & Orey, D. C. (2021). An Ethnomathematical Perspective of STEM Education in a Glocalized World. *Bolema: Boletim de Educação Matemática*, *35*(70), 840–876. https://doi.org/10.1590/1980-4415V35N70A14

Rosmasari, A. (2023). *Etnomatematika pada Aktivitas Petani Cabai di Dusun Laharpang Desa Puncu* [Institut Agama Islam Negeri Kediri]. https://etheses.iainkediri.ac.id/12839/

Rosnelli, & Ristiana, P. A. (2023). Independent Curriculum Learning Management to Improve Students' Literacy and Numerical Competence in Schools. *International Journal of Education in Mathematics, Science and Technology*, *11*(4), 946–963. https://doi.org/10.46328/ijemst.3513

Russell, B., & Purcell, J. (2009). *Online Research Essentials: Implementing and Designing Research Studies*. 344. https://books.google.co.id/books?id=9RtFR5wqVSoC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Safina, D., & Budiarto, M. T. (2022). Literasi Matematis Berbasis Budaya Sidoarjo dalam Perspektif Etnomatematika. *MATHEdunesa*, *11*(1), 12–25. https://doi.org/10.26740/MATHEDUNESA.V11N1.P12-25

Safitri, A. H. I., Novaldin, I. D., & Supiarmo, M. G. (2021). Eksplorasi Etnomatematika pada Bangunan Tradisional Uma Lengge. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *5*(3), 3311–3321.

Safrida, L. N., Susanto, S., Suwito, A., & Ambarwati, R. (2024). Pengembangan Instrumen Literasi Numerasi Berbasis Etnomatematika Pertanian Bagi Siswa Sekolah Dasar. *EDU-MAT: Jurnal Pendidikan Matematika*, *12*(2), 383–392. https://doi.org/10.20527/EDUMAT.V12I2.20202

Salsabila, A., Johar, R., Yuhasriati, Y., Yanti, S., & Suryawati, S. (2023). The Development of Problems for 'Asesmen Kompetensi Minimum' Type Based on Ethnomathematics about Farmer Activities in Aceh Besar Regency. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *14*(1), 28–41. https://doi.org/10.15294/KREANO.V14I1.39101

Sari, D. R., Isnaniah, I., Zakir, S., & Imamuddin, M. (2025). Pengembangan Instrumen Tes Literasi Numerasi dengan Konteks Budaya Minangkabau untuk Melatih kemampuan Literasi Numerasi Siswa. *Juring (Journal for Research in Mathematics Learning)*, *8*(3), 237–248. https://doi.org/10.24014/JURING.V8I3.37393

Sedyawati, E. (1997). Konsep dan Strategi Pelestarian Warisan Budaya. *International Workshop on Balinese Cultural Heritage*, 177–181. https://repositori.kemdikbud.go.id/10820/1/kumpulan%20sambutan%20dan%20makalah%201996-1997%20dirjen%20kebudayan%20di%20sedyawati.pdf

Sekretariat GTK. (2021). *Asesmen Nasional, Semua Guru Berperan dalam Kemampuan Bernalar Siswa*. Direktorat Jenderal Guru Dan Tenaga Kependidikan, Kementerian Pendidikan, Kebudayaan, Riset, Dan Teknologi, Republik Indonesia. https://gtk.kemdikbud.go.id/read-news/asesmen-nasional-semua-guru-berperan-dalam-kemampuan-bernalar-siswa

Setianingsih, W. L., Ekayanti, A., & Jumadi, J. (2022). Analisis Kemampuan Numerasi Siswa SMP dalam Menyelesaikan Soal Tipe Asesmen Kompetensi Minimum (AKM). *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(4), 3262–3273. https://doi.org/10.24127/AJPM.V11I4.5915

Setiyani, Waluya, S. B., Sukestiyarno, Y. L., & Cahyono, A. N. (2022). Mathematical Reflective Thinking Process of Prospective Elementary Teachers Review from the Disposition in Numerical Literacy Problems. *International Journal of Educational Methodology*, *8*(3), 405–420. https://doi.org/10.12973/ijem.8.3.405

Sianturi, M., Suliantin, R., & Sianturi, I. A. J. (2025). Connecting Cultures with Mathematics: A Study on Incorporating Indigenous Papuan Cultural Contexts to Mitigate Errors in Solving Math Word Problems. *Journal of Intercultural Studies*. https://doi.org/10.1080/07256868.2024.2440467

Siregar, S., & Yahfizham, Y. (2023). Etnomatematika pada Transaksi Jual Beli Masyarakat Pesisir di Sibolga. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *7*(2), 1877–1889.

Supandi, S., & Farikhah, L. (2016). Analisis Butir Soal Matematika pada Instrumen Uji Coba Materi Segitiga. *JIPMat: Jurnal Ilmiah Pendidikan Matematika*, *1*(1).

Suryanti, R., Fadlil, M., Jahidin, J., & Utami, S. (2023). Analysis of students' numeration literacy levels in solving HOTS questions based on ethnomathematics. *International Education Trend Issues*, *1*(2), 276–284. https://doi.org/10.56442/IETI.V1I3.286

Susanto, N. C. P., Hartati, S. J., & Setiawan, W. (2022). Peningkatan Literasi Numerasi dan Karakter Berpikir Kritis Siswa SD Berbasis Etnomatematika. *JIPMat*, *7*(2), 48–69. https://doi.org/10.26877/JIPMAT.V7I2.12534

Syaifuddin, M., Rahmah, K., Sah, R. W. A., & Fauza, M. R. (2022). Development of The AKM Test with Javanese Cultural Context to Measure Numeracy Literacy Skills in Statistical Materials for High School Student. *Wacana Akademika: Majalah Ilmiah Kependidikan*, *6*(3), 245–254. https://jurnal.ustjogja.ac.id/index.php/wacanaakademika/article/view/12783

Thiagarajan, S., & Others, A. (1974). *Instructional Development for Training Teachers of Exceptional Children: A Sourcebook.* Council for Exceptional Children, 1920 Association Drive, Reston, Virginia 22091 (Single Copy, $5.50).

Tim Substansi Asesmen Akademik. (2023). *Framework Asesmen Kompetensi Minimum (AKM)* (Revisi). Pusat Asesmen Pendidikan Badan Standar, Kurikulum dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset dan Teknologi.

Umbara, U., Prabawanto, S., & Anwar, A. S. (2025). Ethnomathematics study: The use of modulo concept in Kampung Naga. *Infinity Journal*, *14*(2), 513–530. https://doi.org/10.22460/INFINITY.V14I2.P513-530

Umbara, U., Prabawanto, S., & Jatisunda, M. G. (2023). Combination of mathematical literacy with ethnomathematics: How to perspective sundanese culture. *Infinity Journal*, *12*(2), 393–414. https://doi.org/10.22460/INFINITY.V12I2.P393-414

Utami, W. B., Aulia, F., Permatasari, D., Taqiyuddin, M., & Widodo, S. A. (2022). KETUPAT EID TRADITION OF THE NORTH COAST OF JAVA AS AN ALTERNATIVE MATHEMATICS LEARNING MEDIA. *Infinity Journal*, *11*(1), 177–192. https://doi.org/10.22460/INFINITY.V11I1.P177-192

Wahyuni, E., & Suherman, S. (2023). Eksplorasi Nilai Budaya Mayarakat Suku Mandar untuk Materi Matematika Sekolah Dasar. *Jurnal Riset Pendidikan Dasar*, *6*(1), 53–65.

Wardhani, D. A. P., & Oktiningrum, W. (2022). Pengembangan Soal AKM dengan Ethnomatematika Berbasis Canva untuk Siswa Mengukur Literasi Numerasi Siswa Sekolah Dasar. *Aksioma: Jurnal Program Studi Pendidikan Matematika*, *11*(4), 3860–3871. https://ojs.fkip.ummetro.ac.id/index.php/matematika/article/view/6241

Widhiarso, W. (2011). Melibatkan Rater dalam Pengembangan Alat Ukur. *Faculty of Psychology, Gajah Mada University*. https://scholar.google.com/citations?view_op=view_citation&hl=id&user=AbCYXroAAAAJ&cstart=20&pagesize=80&citation_for_view=AbCYXroAAAAJ:eI34FqJmdUoC

Wongpakaran, N., Wongpakaran, T., Wedding, D., & Gwet, K. L. (2013). A comparison of Cohen's Kappa and Gwet's AC1 when calculating inter-rater reliability coefficients: A study conducted with personality disorder samples. *BMC Medical Research Methodology*, *13*(1), 1–7. https://doi.org/10.1186/1471-2288-13-61/tables/7

Worth, J., Sizmur, J., Ager, R., & Styles, B. (2015). Improving Numeracy and Literacy: Evaluation Report and Executive Summary. *Education Endowment Foundation*. https://eric.ed.gov/?id=ED581142

APPENDIX

Table 1 Inter-rater Reliability Calculation

No. Concept	Category		Total Rater	pe Calculation		pa Calculation	
	Agree	Disagree		Sigma Agree	Sigma Disagree	Sigma Agree	Sigma Disagree
1	3	0	3	1	0	1	0
2	3	0	3	1	0	1	0
3	3	0	3	1	0	1	0
4	3	0	3	1	0	1	0
5	3	0	3	1	0	1	0
6	3	0	3	1	0	1	0
7	3	0	3	1	0	1	0
8	3	0	3	1	0	1	0
9	3	0	3	1	0	1	0
10	3	0	3	1	0	1	0
11	3	0	3	1	0	1	0
12	3	0	3	1	0	1	0
13	3	0	3	1	0	1	0
14	3	0	3	1	0	1	0
15	3	0	3	1	0	1	0
16	3	0	3	1	0	1	0
17	3	0	3	1	0	1	0
18	3	0	3	1	0	1	0
19	3	0	3	1	0	1	0
20	3	0	3	1	0	1	0
21	3	0	3	1	0	1	0
22	3	0	3	1	0	1	0
23	2	1	3	0,66667	0,33333	0,33333	0
24	3	0	3	1	0	1	0
25	3	0	3	1	0	1	0
26	3	0	3	1	0	1	0
27	2	1	3	0,66667	0,33333	0,33333	0
28	3	0	3	1	0	1	0
29	3	0	3	1	0	1	0
30	3	0	3	1	0	1	0
31	3	0	3	1	0	1	0
32	3	0	3	1	0	1	0
33	3	0	3	1	0	1	0
34	3	0	3	1	0	1	0
35	3	0	3	1	0	1	0
36	3	0	3	1	0	1	0
37	3	0	3	1	0	1	0
38	3	0	3	1	0	1	0
39	3	0	3	1	0	1	0
40	3	0	3	1	0	1	0
41	2	1	3	0,66667	0,33333	0,33333	0
42	3	0	3	1	0	1	0
43	2	1	3	0,66667	0,33333	0,33333	0
44	3	0	3	1	0	1	0
45	3	0	3	1	0	1	0
46	2	1	3	0,66667	0,33333	0,33333	0
Average	2,89	0,1087		Total: 44	2	Total: 43	0
n'	46			Sigma pe: -1922		Sigma Total: 43	
				Pe: -961		Pa: 0,927536232	
Gwet AC_1 Koefisien: 0,999925							

Table 2 Domain of Numbers

Sub Domain (SD)	Grade (G)	Learning Progression (LP)	Cultural Context
Representation	2	Understanding integers up to two digits.	**Tools for Making Gravestones (*Kijing*).** **The dimensions of the bucket** are $height = 24\ cm, diameter = 33\ cm\ and\ 22\ cm$, with a capacity to hold 7 basins of cement or sand. **The basin** measures $height = 7\ cm, diameter = 22\ cm\ and\ 18\ cm$, with a capacity to hold 27 ounces of sand and 17 ounces of cement. **The dipper** measures $height = 11\ cm, diameter = 16\ cm\ and\ 11.5\ cm$. The tool for forming the central hole in the tall gravestone (kijing tinggi) has dimensions of $length = 73\ cm, width = 16\ cm, and\ height = 5\ cm$. The tool for forming the central hole in the white gravestone (kijing putih) measures $length_1 = 75\ cm, length_2 = 80\ cm, width = 11\ cm, and\ height = 5\ cm$. The tool for forming the hole for the gravestone head on both the white and tall gravestones measures $length = 13\ cm, width = 6\ cm, and\ height = 4\ cm$.
			Tool Placement Distance for Gravestone Construction. - **Gravestone casting:** Position the wooden piece in the center with distances of 20 cm and 12.5 cm, and place rectangular wooden blocks on the right and left sides at distances of 5.5 cm and 8 cm, respectively.  - To form the gravestone head, cover the mold with slurry and install a 60 cm bent iron bar or two iron bars, each measuring 30 cm.
			The monthly volume of Gravestone production and sales. On average, monthly production consists of 27 white gravestones and 4 to 10 ceramic or granite gravestones. Sales typically rise during the month of Ramadan, whereas in other months, they tend to fluctuate.
		Understanding simple unit fraction $\frac{1}{n}(where\ n = 2\ s.d.9)$.	**Materials for Making Gravestone.** For the white gravestone mixture, combine 3 buckets of sand with 1 bucket of gray cement, then add $1\frac{1}{2}$ buckets of water. For the mixture used in ceramic or granite gravestone bases, mix 3 buckets of sand with $\frac{1}{2}$ sack of gray cement, followed by $1\frac{3}{4}$ buckets of water. For the white mixture, blend 4 basins of white mill (finely ground limestone) with 1 basin of white cement; for the gray mixture, combine 3 basins of white mill with 1 basin of gray cement. Pour each of the white and gray mixtures into buckets to be mixed with water, reserving 1 basin for sprinkling.
	4	Understanding integers up to four digits.	Time of Gravestone Installation. Generally, it is carried out on the thousandth day or three years after the body is buried. The installation of the gravestone is often done during the month of Ramadan or on other days, depending on when the family can perform the ceremony.
		Recognizing equivalent fractions; expressing fractions as decimals only for proper fractions.	Paper length for the gravestone head mold is cut 0.5–1 cm larger than the original size.
			Thickness of the High Gravestone Mold. (The mold thickness is $2 - 2{,}5\ cm$). Prepare the following materials: *aci* (a blue-colored cement mixture), sand, grey cement, oil, and pre-shaped square iron bars in the form of a gravestone. Prepare the mold (rough form), then smooth the surface and apply *aci*. Mix cement and sand in a 1:1 ratio, coat the mold with oil, apply *aci*, and sprinkle dry cement on top. Add the rough mixture above it and level the surface. Install 1 to 4 iron bars vertically or horizontally, depending on the size. Flatten the surface to resemble the original gravestone, smooth it, and ensure the corners are slightly slanted. Let it dry for 24 hours. Construct the sides using the same procedure. Before the mold dries completely, create a handle for opening the mold or for attaching a hanging hook. The mold can be removed after one week.
	6	Understanding integers up to six digits.	**Employee wages** are calculated daily and paid monthly. The total wage is $IDR\ 75{,}000$ per day including meals, or $IDR\ 100{,}000$ per day without meals.
			Gravestone Delivery Service Fees. The delivery fee is determined by travel distance: IDR 50,000 for a range of 1–5 kilometers, and from IDR 100,000 for distances between 6 and 10 kilometers.
			Gravestone Installation Fees. The installation team comprises three individuals. The installation cost varies according to the gravestone type, with a fee of IDR 150,000 for white gravestones and IDR 200,000 for ceramic or granite gravestones. The cost is equally shared among the workers.
		Expressing fractions as percentages or vice versa (including proper fractions and mixed numbers).	**Materials for Making Gravestone.** Based on the components of the materials used to make the gravestone, the white gravestone mixture comprises 54.54% sand, 18.18% gray cement, and 27.27% water. The mixture for ceramic or granite gravestone contains 43.8% sand, 30.66% gray cement, and 25.55% water. The

<table>
<tr><td></td><td></td><td></td><td>white mixture contains 80% white mill and 20% white cement, while the gray mixture contains 75% white mill and 25% gray cement.</td></tr>
<tr><td></td><td>8</td><td>Understanding integers, exponents, and square roots.</td><td>Gravestone Pricing.
<table>
<tr><th>Item name</th><th>Price for Consumers (IDR)</th><th>Price for Distributors (IDR)</th></tr>
<tr><td>White gravestone + foundation</td><td>600.000</td><td>–</td></tr>
<tr><td>White gravestone</td><td>500.000</td><td>350.000</td></tr>
<tr><td>Small sized white gravestone</td><td>300.000</td><td>200.000</td></tr>
<tr><td>Tall gravestone (ceramic)</td><td>1.500.000</td><td>1.100.000</td></tr>
<tr><td>Tall gravestone (granite)</td><td>1.750.000</td><td>1.300.000</td></tr>
<tr><td>Hero gravestone (ceramic)</td><td>1.500.000</td><td>1.100.000</td></tr>
<tr><td>Hero gravestone (granite)</td><td>1.750.000</td><td>1.300.000</td></tr>
<tr><td>Foundation</td><td>100.000 – 150.000</td><td>75.000</td></tr>
</table></td></tr>
<tr><td>Properties of Order</td><td>10</td><td>Ordering numbers, including negative integers, decimals, percentages, and fractions.</td><td>The sequence of cylindrical tools used in gravestone production, ranked either from largest to smallest or from smallest to largest: bucket, basin, and dipper.</td></tr>
<tr><td>Operations</td><td>2</td><td>Using addition/ subtraction of two integers (with a maximum of two digits).</td><td>Materials for Making Gravestone.</td></tr>
<tr><td></td><td>4</td><td>Using addition/ subtraction/ multiplication/division of two integers (with a maximum of four digits).</td><td>The gravestone head is made by overlaying the mold with slurry and installing a 60 cm bent iron bar or two iron bars, each 30 cm long.</td></tr>
<tr><td></td><td>6</td><td>Using addition/ subtraction/ multiplication/ division of two integers, fractions, or decimals (with a maximum of six digits).</td><td>Employee salary.
Distribution of gravestone installation wages.</td></tr>
<tr><td></td><td>8</td><td>Performing operations on numbers (integers, fractions, decimals, percentages, and whole-number exponents).</td><td>Gravestone Pricing. If the requested ceramic or granite model is not available, the buyer may provide their own ceramic or granite material. The price of the gravestone will then be adjusted according to the price of the ceramic or granite supplied by the buyer.
Employee salaries are deducted according to the amount of debt for repayment on payday.</td></tr>
</table>

Table 3 Geometry and Measurement Domains

<table>
<tr><th>SD</th><th>G</th><th>LP</th><th>Cultural Context</th></tr>
<tr><td>Geometric Shapes</td><td>2</td><td>Recognizing rectangular prisms and cubes.</td><td>Types of gravestones.

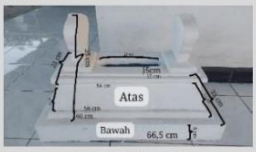


Figure 1. Small White Gravestone

Figure 2. Large White Gravestone

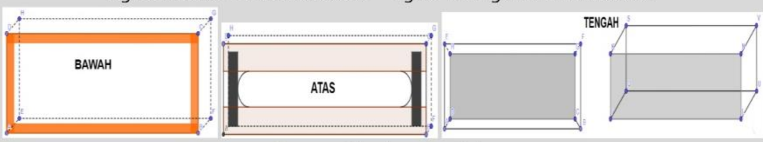
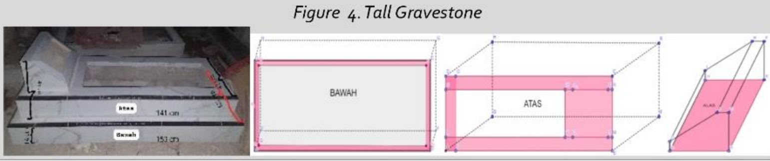


Figure 3. Sketch on GeoGebra

Figure 4. Tall Gravestone



</td></tr>
</table>

			Figure 5. Hero's Gravestone
			The shape of each type of gravestone (*kijing*) after drying.  *Figure 6 Base Mold of the Hero Gravestone*  *Figure 7 Base Mold of The Tall Gravestone*  Figure 8 White Gravestone
			The shape of wooden tools used to make gravestones.  *Figure 9 Hole Punch Tool for Tall Gravestone*  *Figure 10 Hole Punch Tool for White Gravestone*  *Figure 11 Hole Punch Tool for the Gravestone Head Mold*
	4	Recognizing prisms, cylinders, pyramids, cones, and spheres.	Shape of the hero gravestone.
			Shape of the tool for making gravestones representing a cylindrical solid.
	6	Distinguishing various three-dimensional shapes (rectangular prisms, cubes, pyramids, prisms, cylinders, cones, and spheres) based on their characteristics and nets.	Types of gravestones.
			Tools for Making Gravestones.
	8	Applying the concept of the Pythagorean Theorem.	Measurement of the height of buckets and dippers, as well as the mold-making process for each type of gravestone to ensure the mold stands upright at a $90°$ angle.
	10	Applying the concepts of similarity and congruence	**Shape of the Tall Gravestone Made from Ceramic and Granite.** Tall gravestones made from ceramic or granite illustrate the mathematical concept of congruence, as they share the same shape and dimensions. These gravestones are rectangular in form, with two headstones, and are taller than hero gravestones. The bottom section measures $143 \times 51 \times 11\ cm$, while the upper section (including the headstones) measures $135 \times 43.5 \times 71\ cm$.
			Shape of the Hero Gravestone Made from Ceramic and Granite. Hero gravestones made from ceramic or granite reflect the mathematical concept of congruence, as they share identical dimensions and shapes. Each is rectangular in form with a single headstone. The bottom section measures $153 \times 63 \times 14\ cm$, while the upper section (including the headstone) measures $141 \times 47 \times 45\ cm$.
Measurement	2	Measuring the length and weight of objects using non-standard units.	Bucket capacity is based on scoop or basin measurements.
			Weight of gravestone mixture materials measured using basin and bucket.
	4	Determining the length and weight of objects using standard units.	Measurement of tools for making gravestones (**Measurements of buckets, basins, and dipper)**
			Measurement of ceramic or granite lengths to be cut and installed on the gravestone base.
	6	Calculating time conversion and duration and converting standard weight units.	Gravestone installation time.
			Calculation of the material volume a bucket can hold using a basin.
			Measurement of gravestone mixture ingredients using a basin and a bucket.
		Calculating and estimating the perimeter and area of two-dimensional shapes and their combinations (including those requiring conversion of standard length/distance units).	Measurement of the Site for Gravestone Installation. - The white gravestone is rectangular with two gravestone heads, and the size of the large white gravestone is almost the same as the tall gravestone. The smaller white gravestone's lower part measures 66.5 cm in length, 35 cm in width, and 8 cm in height, while the upper part of the gravestone has a lower length of 60 cm, middle length of 56 cm, upper length of 54 cm; lower width of 27 cm, middle width of 25 cm, upper width of 21 cm; and a height of 35 cm (including the head). The opening length is 26 cm, with right-left widths of 5 cm and 2 cm, respectively. Meanwhile, the large gravestone's lower part measures 135 cm in length, 54 cm in width, and 12 cm in height. The upper part approximately measures 123 cm in lower length, 118 cm in middle length, and 120 cm in upper length; lower width of 43 cm, middle width of 36 cm, upper width of 33 cm; and a height of 60 cm (including the head), with right-left widths of 9.5 cm and 3 cm, respectively. - **Shapes of tall gravestones and hero gravestones (ceramic and granite)**

	10	Calculating and estimating the volume and surface area of prisms, cylinders, pyramids, cones, spheres, and their combinations.	The fabrication of new buckets, scoops, or basins with different shapes but identical volumes is carried out using the height and diameter of the original object as references.
			Calculation of the material volume capacity of buckets, basins, or scoops used for making a type of gravestone.
Spatial Reasoning	2	Recognizing the relative position of an object (front-back, left-right, top-bottom).	Position of gravestone installation and mold during the gravestone fabrication process.

Table 4 Algebraic Domain

SD	G	LP	Cultural Context
Relations and Functions	8	Presenting, analyzing, and solving problems using relations, functions, and linear equations along with their graphs.	Delivery and installation costs of gravestones. A linear equation can be used to determine gravestone installation costs, with x representing the price for white gravestones and y for ceramic or granite gravestones.
Ratios and Proportions	6	Solving real-life problems related to ratios.	**Materials for making gravestone,** the creation of gravestone head molds, and the thickness of tall gravestone molds.

Table 5 Data Domains and Uncertainties

SD	G	LP	Cultural Context
Data and Representation	6	Presenting, analyzing, and interpreting data in the form of bar charts or tables.	**The number of gravestone production and sales each month.**
	8	Determining and using the mean, median, and mode in problem-solving.	