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# Ethnomathematics of *Samin* Tribe's Culture: An Approach to Instructional Mathematics Learning

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**Abstract: Ethnomathematics of *Samin* Tribe's Culture: An Approach to Instructional Mathematics Learning. Objectives:** This study aims to explore the ethno-mathematics of the *Samin* tribes' culture that is applied in the form of mathematics instrumental questions on data analysis and probability materials in statistics. **Method**: This research applied a qualitative research design of an ethnographic approach. Ethnography is an approach that utilizes various data collection techniques, such as observation and interviews, which are complemented by the direct involvement of the researchers to gain a deep understanding of their participants. The data collection techniques used were direct observation and in-depth interviews. Data analysis was carried out qualitatively through three main stages, namely data reduction, data presentation, and drawing conclusions. The data presented are the results of observations related to the Samin tribe culture, which are then analyzed for the mathematical elements contained in the culture to be presented in the form of an instrumental question. **Findings:** The results of the exploration of ethnomathematics in the *Samin* tribe revealed cultural elements in the form of objects and non-objects. The Object elements are in the form of *gamelan*, *udheng samin*, and *batik samin*. While non-object elements are cultural practices in the form of the tradition of "*Petung*". The corresponding forms of mathematical connections are mathematical concepts related to geometry, algebra, statistics, probability, combinations, and permutations**. Conclusion:** Based on the results of the exploration, a set of questions related to the *Samin* tribes' culture was produced on the topic of Data analysis and Probability (statistics) for junior high school students. These questions can be applied or implemented in the mathematics learning process, so that mathematics learning based on this culture adds another value of knowledge for the students, instead of mathematics itself. The results of this research are in the form of question prototypes that potential to be developed and validated further, thus can be applied in the learning process.

**Keywords:** ethnomathematics, *samin* tribe, question prototypes, mathematics learning.

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## INTRODUCTION

Education is one of the important indicators in assessing the progress of a country. At the beginning of the 21st century, education faces increasingly complex challenges. Students are required to have various skills as part of the learning outcomes (Szabo et al., 2020). These skills are known as the 6Cs, which include: (1) Communication; (2) Collaboration; (3) Critical Thinking and Problem Solving; (4) Creativity and Innovation; (5) Compassion, and (6) Computational Logic (Martinez, 2022) .

Realizing these skills also demands the development of innovative and creative learning.

Innovative learning applies to all learning environments, including mathematical learning. Technological, digital, social, and even cultural developments can be elements that can be used in the mathematical learning process (Niemi et al., 2018). Integrating cultural elements into the learning process has become common outside of science lessons. However, in science subjects, especially mathematics, using cultural elements is not usually practiced (Genc & Erbas, 2019).

One of the contextual learning approaches that combines culture with learning is Ethno-mathematics. Ethno-mathematics is a branch of science that discusses the relationship between mathematics and culture (Novianti et al., 2023). The term refers to the methods used by a particular cultural group in understanding, explaining, studying, and managing the natural, social, and political environment through activities such as calculating, measuring, classifying, modeling, and drawing conclusions (Bolstad, 2020). Moreover, ethno-mathematics builds a relationship between mathematics and socio-culture. The correlation can be seen from two perspectives: whether mathematics is contained in cultural elements or how mathematics is the basis for creating cultural symbols in society (D'Ambrosio, 2018).

The process of learning mathematics that is linked to students' culture and personal experiences can help students understand culture, society, and environmental issues. Ethno-mathematics also enriches the learning by presenting new topics that students may not have encountered before, which come from various existing cultural practices (Lidinillah et al., 2022). These two things are the main tools in integrating mathematics learning by using cultural elements around the community. According to Fouze & Amit (2023), recently, ethno-mathematics and mathematical literacy have become current issues for understanding mathematics. Furthermore, it is explained that ethnomathematics emphasizes a person's competence that is developed in a cultural group in their daily lives. In addition, according to Bryce & Blown (2024), ethnomathematics in a culture can be used as a new learning approach in the classroom.

Ethnomathematics in the classroom teaches students how to integrate culture and mathematics in a single frame of learning. Several studies conducted related to ethno-mathematics, Lubis et al. (2022), state that local wisdom is oriented towards social sciences to improve concepts, knowledge, and literacy. Another study conducted by Borièiæ et al. (2020) stated that ethno-mathematics is mathematics that grows and develops in a particular culture, which is seen as a lens for viewing and understanding mathematics as a cultural product. In addition, according to Tran et al. (2020), the ethnomathematics approach in the mathematics curriculum aims to make mathematics learning in the classroom more relevant and meaningful for the students, while it also improves the quality of education at a glance. In this case, the integration of ethnomathematics perspectives in mathematics learning helps develop students' intellectual, social, emotional, and political aspects by utilizing their unique cultural backgrounds as a foundation for conveying knowledge, skills, and values.

Based on the explanation mentioned, the description of the ethno-mathematics approach is obtained as figure out in Figure 1.

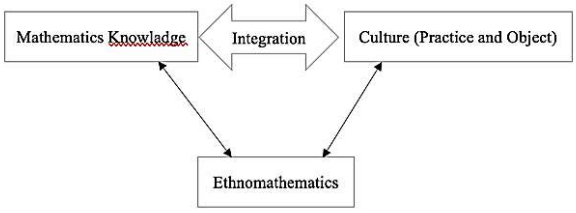


**Figure 1.** Ethnomathematics framework

Bojonegoro Regency is one of the areas in East Java province. Bojonegoro is directly along the borders of Blora Regency, which is one of the regencies in Central Java province. East Java

Province has 29 regencies and nine cities, with a total of 38 regencies/cities. This number certainly has an impact on the diversity of culture, customs, tribes, and also the development of regional tourism (Firdaus & Sukmawan, 2021). The dominant tribe in East Java is the Javanese. In addition, there are other tribes that also exist in the history of East Java, namely the Madurese and *Oseng* (Banyuwangi) tribes. Each region has different cultural characteristics and traditional rituals (Alangui, 2017).

Another strong characteristic of the Bojonegoro is the *Samin* tribe, that located in *Desa Jepang*, Margomulyo District, Bojonegoro Regency, East Java (Riyadi et al., 2021). As one of the tribes that has strong traditions, of course, Samin also upholds very high cultural values and is different from other communities (Huda & Renggani, 2021). The stereotype of the *Samin* is a tribe that still has an old-fashioned background, is uneducated, and is not open to social developments. The name *Samin* itself is taken from the word *Sami* in Javanese means "the same."(Amir & Andrea, 2024). Currently, *Samin* has open to interact with the environment and adapt to the developments.

Meanwhile, some traditions, values, and behaviors developed in the *Samin* tribe are closely related to the habits carried out in their daily lives. These values are called "Saminism". One of the values is that they declare themselves as "*wong sikep*" or "*sedulur sikep*," which is manifested in the form of attitudes or behavior of the *Samin* tribe. The meaning of "*sedulur sikep*" itself is to be humble, avoid jealous and greedy. (Munawaroh et al., 2015).

Based on the results of observations conducted in Bojonegoro, the *Samin* tribe still has strong traditions in the form of values and cultural objects. The form of cultural objects of the *Samin* community is represented in the form of clothing worn, especially the *udheng*, which is known as *udheng Samin*. Even in 2024, the local government issued a written arrangement that all agencies in Bojonegoro area were required to wear *Udheng Samin* on official events. Furthermore, apart from the teachings of "*Sedulur Sikep*", several forms of cultural heritage are currently being developed by the *Samin* tribe, such as the establishment of a *Samin* tribal cultural hall as a center for arts activities to preserve the arts and culture owned by the elders and founders (Yudhiasta et al., 2025). In addition, it is also the center for traditional music arts (*gamelan)* and handicrafts of the *Samin* indigenous tribe.

The results of cultural observations in the *Samin* tribe can be categorized based on non-object culture (tradition) and cultural objects (Martynyshyn & Khlystun, 2024). Non-object culture consists of cultural practices (traditions) that are carried out from generation to generation by the community, namely the tradition of calculating days as the basis to predict the best day to hold weddings, *Sedekah Bumi*, and birthdays. Meanwhile, related to cultural objects in the *Samin* community are *batik*, which includes several styles, *udheng Samin*, and *gamelan*, which are still preserved today.

Culture and society are inseparable things. The existence of the culture must be carried out continuously from generation to generation. As stated by Martynyshyn & Khlystun (2024) that tradition can be interpreted as a habit that is passed down from generation to generation in a community. Through its broad scope, tradition covers various aspects of complex life. Therefore, it is not easy to ignore it or treat it uniformly, because tradition is not something static. In addition, according to Kaliisa et al. (2022), sociocultural theory views the learning process as an inseparable part of the wider social environment, where all cognitive functions are rooted in social interaction. The main goal is to make the learning process visible for the students, study groups, and educators, and to provide

recommendations that encourage and strengthen the learning.

Regarding cultural preservation, cultural exposure is currently carried out through the learning process. Several studies stated that using cultural elements in learning can increase students' awareness of preserving their own culture around them. According to Utami & Sayuti (2020)The activities that connect students' learning atmosphere are learning materials that emerged from indigenous communities around them. Further, the teachers have to be more innovative and creative in utilizing the classroom environment, including the conditions and circumstances around them (Prahmana et al., 2021).

The culture of the *Samin* tribe, as part of the local cultural heritage of Bojonegoro, has great potential to be used as a source of learning, especially in the contextual mathematics learning area. These elements can be viewed from a mathematical perspective, such as number, measurement, geometry, data analysis, and probability. Regarding all the issues mentioned, the research that examines the integration between the cultural elements of the *Samin* tribe with mathematical concepts, especially in the topic of data analysis and probability, is important to be conducted. Data analysis and probability topic is an important part of learning mathematics because it directly equips students with skills that are relevant to everyday life (Olivares et al., 2021). This topic is also contextual and applicable because it is easily related to real life, making it easier for students to understand. In addition, learning data analysis and probability also contributes to the development of mathematical communication skills (Ow-Yeong et al., 2023) .

This approach not only enriches mathematics learning strategies but also presents novelty in ethno-mathematics exploration by utilizing the potential of the culture broadly and deeply.

## METHOD

### Research Design

The current study used a qualitative approach with an ethnographic strategy. Ethnography was chosen since it allows researchers to understand in depth cultural phenomena through direct interaction with research subjects (Forberg & Schilt, 2023). This method aims to explore the knowledge and meaning systems that guide the lives of certain cultural groups (Thompson et al., 2021). The focus of the study lies in the exploration of the *Samin* tribe to identify and interpret the mathematical elements that emerge in the culture of the *Samin* tribe. The researchers did not come from the community and had no previous personal relationship or cultural ties with the Samin community. The researchers act as facilitators in bridging between local culture and academic knowledge. The researcher explained the purpose of the research, data collection, data implementation, and the community's right to refuse to provide specialized information.

Mathematical elements analyzed both objects and non-objects, which are then explained in the form of mathematical representations

### Search Strategy

Data were obtained through direct observation and in-depth interviews. The method used in this research was direct observation of the traditional leader of the *Samin* tribe, *batik* artisans, and *gamelan* music activists. The traditional chief is a central figure in the life of the *Samin* community who has an important role in maintaining the cultural values of the *Samin* tribe. While batik artisans are the owners of Micro, Small, and Medium Enterprises (MSMEs) that preserve *Samin batik*, and *gamelan* music activists are the leaders of *gamelan* music groups.

The observations were conducted directly in the neighborhood where the traditional chief

lives and performs his functions. The researcher was present at the location to observe the interaction of the traditional chief with community members and listen to his involvement in customary activities. The researcher established informal communication to create closeness with the traditional chief and residents. This is important so that the information obtained truly reflects the actual situation, without being contrived. The observation process was carried out over four weeks for two to four hours each day, depending on the ongoing activities

**Inclusion and Exclusion Criteria**

Observations were made on the cultural practices of the *Samin* tribe, while interviews were aimed at obtaining information on the types of culture, both objective and non-objective. In addition, a literature review was conducted from various sources, such as scientific journals, articles, and other relevant documents, to enrich the data and strengthen field findings. This combination of techniques aims to obtain a comprehensive picture as a basis for exploring mathematical elements in the culture of the *Samin* tribe

**Data analysis**

Data analysis was conducted qualitatively through three main stages: data reduction, data presentation, and drawing conclusions. Data obtained from observations and interviews were analyzed to identify mathematical elements. The main focus of the analysis lies in the types of culture that exist in the *Samin* tribe, both object and non-objective cultures. The results of the analysis are used to compile ethno-mathematics-based question instruments that can be applied in culture-based mathematics learning, especially in the topics of Data Analysis and Probability for junior high school students. After the observation results were collected, the next step was to categorize the elements based on the appropriate type of mathematical concept and then analyze them in the form of mathematical understanding. This process is done while maintaining the cultural meaning to avoid misinterpretation. The results of this process can then be formulated into contextual problems that integrate cultural values in mathematics learning so that students can learn mathematics through experiences that are close to their lives.

The instrument developed in this research is still at the initial analysis stage in producing an initial instrument prototype. However, the initial analysis related to this prototype has been adjusted to the analysis of mathematical connection material in the form of relevant mathematics material or concepts. This instrument has further potential validation so that it can be used optimally in the learning process and research related to the integration of ethnomathematics and local culture in mathematics education.

## ■ RESULT AND DISCUSSION

The following are the results of cultural observations of the *Samin* ethnic community:

***Gamelan* Musical Instruments**

*Gamelan* is one of the Javanese cultures that has been recognized by UNESCO since 2014. The *Samin* tribe preserves this culture too by now. *Gamelan* comes from the basic word of Javanese "*gamel*", meaning to beat or hit, and the suffix "*an*", which makes the word *gamelan* a noun in Javanese terminology. Musical instruments in *gamelan* include *saron, kendang, slenthem, rebab, bonang, bonang penyerang, demung, kenong, kethuk, kempyang, suwukan, gambang, siter, peking, flute, and gong.* The term *gamelan* music orchestra among the Javanese is called "*Karawitan,*" which means complicated, subtle, and small(Fajarianty et al., 2022).

Generally, *gamelan* art in the *Samin* community acquires knowledge through oral tradition and hands-on learning. They possess musical skills that have been passed down from

generation to generation. In learning rhythm, they absorb patterns of beats, repetitions, and rhythmic structures through repeated practice and active participation in groups. Although they do not explicitly use numerical notation or mathematical symbols, gamelan players of the *Samin* community apply proportional logic and repetitive rhythmic patterns that contain mathematical aspects. For example, percussion patterns are composed of a certain number of beats such as 4, 8, or 16 which demonstrate an understanding of time units, grouping, and systematic rhythmic division. *Gamelan* musical instruments can be seen in the Table 1.

**Table 1.** *Gamelan* musical tools

| NO | Instrument | Function |
|---|---|---|
| 1 | *Kenong* 1.2.3.5.6  | The function of *Kenong* is to set the tempo of the *gendhing* being played, emphasizing the rhythm and determining the limits of each *gatra* based on the form of *gendhing*. It is played by hitting it |
| 2 | *Kethuk*  | The function of *Kethuk* is to support the rhythm of *gendhing*. It also clarifies the fall of light strokes, strengthens the drum in determining the form of the *gendhing*. It is played by hitting it |
| 3 | *Kempyang*  | *Kempyang* has a contribution as a rhythm keeper to support the rhythm of the *gendhing*. *Kempyang* operated by clarifies the fall of heavy strokes. |
| 4 | *Bonan Penerus*  | *Bonang Penerus* are played together with the *bonang barung* in an interwoven song pattern. It has the highest tone among other types of *bonang* |
| 5 | *Kempul* 1,2,3,5,6 *(Kempul Slendro*) | *Kempul Slendro* has the function to emphasize the rhythm in a *gendhing*. For example, giving a sign to |

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| |  | end the song/*Gendhing*<br>This musical instrument has the same shape as a *gong*, but it is smaller than a *Gong.* There are 8-10 of them, each of which has a different tone. *Kempul* is divided into two types, namely *slendro kempul*, which has a tone of 1,2,3,5,6, and *pelog kempul*, which has a tone of 1,2,3,5,6,7. *Kempul* is played by hitting it with a beater with a thick cloth on the top. *Kempul* functions to emphasize the rhythm of *gendhing*. |
| 6 | *Gong Suwukan*<br>  | As a sign of the end of a gendhing played before *Gong Gedhe*, it is played by hitting it. |
| 7 | *Gong Gedh*e<br>  | As a sign of the end of *gendhing*, giving balance to the song.<br>It is played by hitting. |
| 8 | *Bonang Barung*<br>  | *Bonang Barung* was used to open and guide the flow of the song being played.<br>It is played by hitting it |
| 9 | *Saron*<br>  | *Saron* has the functions as a song keeper or melody filler (chopping gamelan). Produces low tones.<br>It is played by hitting it. |

| | | |
|---|---|---|
| 10 | *Peking*<br>  | *Peking* has a Function as a melody filler (chopping *gamelan*). Produces high notes and is played by hitting. |
| 11 | *Demung/Balungan*<br>  | *Demung/ balungan* Plays *balungan* patterns. It is played by hitting it. |
| 12 | *Gendher*<br>  | *Gendher* as a reference for tuning in a set of *gamelan ageng*. It is played by hitting it. |
| 13 | *Slenthem*<br>  | *Slenthem* has a function as an emphasizer or indicator of the song.<br>It is played by hitting it |
| 14 | *Kendhang*<br>  | *Kendhang* has a function to set the rhythm.<br>It is played by hitting it. |

In the structure of a *gamelan* music presentation, various mathematical elements can be introduced to students. One of them is a number pattern. *Gamelan* music has a regular and repetitive rhythmic arithmetic level. In addition, *gamelan* music also contains fractional

elements and decimals. In playing *gamelan*, a *gatra* usually consists of several beats that are divided equally between instruments. For example, if a *gatra* consists of four beats and is played by two alternating instruments, then each instrument plays ½ of the number of beats.

Not only that, but *gamelan* can also be used to introduce simple statistics. By counting the number of beats of a particular instrument, the frequency of gong appearances, or the length of time each instrument is played, students can learn to calculate the mean, mode, or median of data. Overall, the integration of *gamelan* music in mathematics learning provides a great opportunity to develop contextual and cultural approaches to learning.

### *Batik* of the *Samin* Tribe

One of the cultural objects that is still preserved by the Samin tribe is *Batik. Batik* is one of the cultural heritages. *Batik* has several patterns that have stories or philosophies behind the choice of their patterns. This is in accordance with research of Prahmana & D'Ambrosio (2020), which states that the findings from the exploration of mathematical concepts in designing *batik* patterns show that they have applied the concept of geometric transformation independently. This understanding is obtained through a self-taught learning process, and their creative ideas emerge from direct experience in designing *batik* patterns. *Samin* artisans generally do not use technical or formal terms to explain the patterns they create. Instead, they use everyday language that is contextual and based on direct experience. In practice, the logic they use is intuitive, based on observations of nature and community customs. For example, the *'Obor Sewu'* pattern represents the enlightenment of many people and is a symbol of struggle. The following is a set of *Batik* patterns from the *Samin* tribe of Bojonegoro:

**Table 2.** Bojonegoro *samin* tribe *batik's* patterns

| No | *Jarik Samin* Patterns | Descriptions |
|---|---|---|
| 1 | "*Paseksen Luhur*"  | "*Paseksen Luhur*" *Cempaka Mulya* flower is a symbol of loyalty of love in strengthening the intention to build a household. Based on the believe of the Javanese terminology "*siji kanggo selawase"*. It shows the strength of the heart that always uphold noble values, leading to peace of mind that synergizes with the harmony of the universe. |
| 2 | "*Margomulyo*"  | "*Margomulyo*" The visual form of *Sekar Wijaya Kusuma* symbolizes authority based on a sense of *menep semeleh* (Javanese terminology) means prioritizing togetherness and cooperation. |
| 3 | "*Margo Utomo*"  | "*Margo Utomo*" A pattern that symbolizes the sincerity of heart that brings inner and outer peace. It also shows how intelligence in "*nggulawentah rasa"* (Javanese terminology) synergizes with harmony and harmony |

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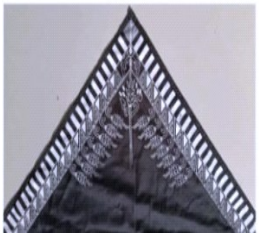
|---|---|---|
| |  | of nature. |
| 4 | "*Margo Kinasih*"<br>  | "*Margo Kinasih*"<br>Symbolize the purity of love, bringing the spirit of harmony in realizing noble ideals. |
| 5 | *" Manunggal Jati "*<br>  | "*Manunggal Jati*"<br>The visual form of *Sekar Wijaya Kusuma* symbolizes authority based on patience and self-discipline, prioritizing harmony, peace, and unity. |
| 6 | *"Kamulyan Jati"*<br>  | "*Kamulyan Jati*"<br>Symbolizes authority that is based on a sense of compassion and compassion, prioritizing togetherness and cooperation. |
| 7 | *"Obor Sewu"*<br>  | "Obor Sewu"<br>The visual form of the torch symbolizes *pepadang* (Javanese terminology) means the light of the heart in living the dynamics of life, becoming a control of behavior and attitude, both in speech and actions. Harmony is built from the construction of values of honesty, patience, hard work / trokal, and narimo / accepting sincerely to achieve the noble goal of life. |

**"*Udheng Samin*"**

*Udheng Samin* is one of the traditional accessories associated with the Samin cultural tribe. "*Udheng Samin*" is one of the identities of the Samin tribe worn by men as one of their characteristics. *Udheng* is a headband used by Javanese men, especially in traditional customs and rituals. *Udheng Samin* has characteristics that distinguish it from other udhengs in general. Some of the characteristics and values contained in *Udheng Samin are* that *Udheng Samin* is made of batik cloth with the pattern "*Obor Sewu* (a thousand torches)". This reflects the Samin values, which prioritize simplicity, avoiding luxury or excessive appearance. *Udheng Samin* does not need additional accessories but shows beauty in its simplicity. The design of "*Udheng Samin*" is smaller and quite different from *blangkon* (a larger, circular Javanese traditional hat). *Udheng Samin* has narrow shapes with simple ties, reflecting their spirit of life that is not excessive..

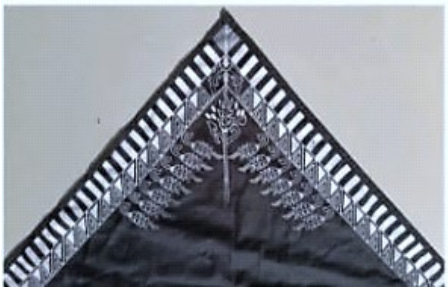


**Figure 2. a.** *Udheng samin batik* patterns

**Figure 2. b.** *The shapes of Udheng Samin*

**Cultural Practices of the *Samin* Tribe**

Several forms of cultural practices or traditions that are still owned by the *Samin Tribe* currently are the traditions of birth, marriage, death, and *selamatan-selametan* (Javanese terminology to show gratitude to God). The following are the traditions or cultural practices of the *Samin* Tribe.

This tradition is a non-object culture that is still used for various purposes in Javanese calculations, even though at that time, people did not know formal mathematics (Prahmana et al., 2021). The term calculation in Javanese is called *Petung*. *Petung* means calculation (Utami et al., 2019). However, *petung* in Javanese calculations does not always mean mathematical calculations. *Petung* is more about considerations in making decisions. For example, one of the considerations in holding a wedding is not carried out on the unlucky day of the parents or the death day of the parents, namely the 7th-day, 40th-day, one-year, or second anniversary of the death of the parents. The consideration made not to use the anniversary of the death of parents as the day to hold the wedding is one of the *petung*. Although the *petung* that is carried out does not always involve calculations, the existing *petung* contains calculation concepts.

**Table 3.** Cultural ceremony and tradition of the *samin* tribe

| No | Traditions | Values & Descriptions |
|---|---|---|
| 1 | Birth Traditions | After the baby was born, the community holds a *brokohan* tradition or post-birth celebration, which is usually held on a particular day on the Javanese calendar (*sepasar or sapeken*), then continued with a *selapanan brokohan*, which is 35 days after birth based on the Javanese calendar. There are also annual *brokohan* traditions. Currently, some people call the annual *brokohan* as a birthday celebration. This event is attended generally by women surrounded (neighbors and relatives). The main purpose is to visit and pray for the baby's and mother's safety. As a part of entertaining the guests, they are usually given "*mbel-mbel"* (triangular cakes, resembling a pyramid or cone). |
| 2 | *Selametan* Tradition | In addition to *selamatan* or *brokohan* related to birth, marriage, and death events, there are several ancestral *selamatan* traditions, such as the *Suroan, Muludan, Rejeban, Nyadran* (village cleaning), *Maleman*, and *Besaran* traditions. *Suroan* is usually carried out in the month of Muharram (in the Islamic calendar) to represent the Hijri New Year. *Muludan* is commemorated in the month of *Rabiulawal* to commemorate the birth of the Prophet Muhammad. *Rejeban* is held in the month of *Rejeb* as a commemoration of the *Isra' Mi'raj* of the |

| | | |
|---|---|---|
| | | Prophet Muhammad. *Maleman* is carried out on certain nights during the month of *Ramadan*. Meanwhile, *Besaran* is held on *Eid al-Adha*, and *Nyadran* is usually held in the month of *Ruwah* before the month of Ramadan. |
| 3 | Marriage | *Samin* believes in the principle of endogamy, which is marrying only fellow members of the *Samin* tribe, the basis of marriage life, but currently no longer as an absolute rule. The *Samin* community today no longer limits itself to searching partners only within its group, but has begun to establish relationships outside the community, even outside the village. Currently, around 75% of *Samin* community members choose their life partners independently, while the rest, around 25%, still undergo matchmaking by family. |

Based on the explanation above, the ethnomathematics form of the *Samin* consists of cultural groups of arts, crafts, and cultural practices that are both object and non-object. In more detail, the arts in the *Samin* are *Gamelan* arts. The type of craft that develops in the community is *Batik*. Meanwhile, the cultural practice that is still carried out by the Samin community is the Javanese calculation tradition. Several forms of ethnomathematics from *Samin* that have been defined are materials that can be developed in the form of mathematics teaching materials. The development of materials or teaching materials using the ethnomathematics of Samin Bojonegoro is carried out through an analysis of the integration between cultural elements and mathematical concepts that correspond to the mathematics material.

**Table 4.** Etnomathematics forms of the *samin* tribe, bojonegoro

| Culture Form | Object | Mathematical elements | Junior High School Mathematical Concept |
|---|---|---|---|
| Arts | *Gamelan* | Counting, measuring, & shapes | Algebra, probability, geometry (space geometry), Data Analysis and Probability (statistics) |
| Crafts | *Batik Samin* & *Udheng Samin* | Counting, measuring, & shapes | Algebra, Geometry (flat figures), Data Analysis and Probability (statistics), Social Arithmetic |
| Rituals | Brith tradition | Counting, Explaining | Algebra (Numbers), Geometry |
| | *Selamatan* | Counting, Explaining | Algebra (Numbers), |
| | Marriage | Counting, Explaining | Probability, Algebra |

The *Petung* tradition in learning mathematics can be interpreted as the use of mathematical concepts that arise naturally in local culture. Three relevant mathematical concepts in this practice are combinatorics, probability, and algebra.

Firstly, the concept of combinatorics appears in the process of determining the compatibility between prospective couples based on their respective *wetons*. Secondly, the concept of probability can also be recognized in the *Petung* tradition, especially when determining the auspicious day for a wedding. In one month of the Javanese calendar, only certain days are considered suitable or "good" according to the results of *petung* calculations. Thirdly, the practice of *petung* can also be modelled using algebraic concepts, especially in the calculation

and representation of *neptu* values. Each day and market has a fixed value (e.g, Monday=4, Kliwon=8), and a person's total *neptu* is the sum of the values of the day and market of birth. The *Petung* tradition is a concrete example of how local culture can be integrated into modern education creatively to form a meaningful and holistic learning process.

The *Obor Sewu Samin batik* pattern is concrete evidence that local culture has great potential to be utilized in mathematics learning. With the ethnomathematics approach, teachers can connect various concepts such as geometry, transformation, number patterns, counting operations, area calculations, and statistics to the context of students' daily lives. The *Obor Sewu* pattern is dominated by the repetition of shapes such as triangles, trapezoids, parallelograms, and symmetrical lines that form the pattern of fire or torch flame. Each visual element reflects the basic concepts of flat geometry that can be introduced to students through direct observation of *batik* patterns. Furthermore, the regular repetition of patterns on the fabric reflects the concept of geometric transformations, such as translation, reflection, rotation, and dilation.

Based on the description explained above, the application in mathematics learning can be in the form of mathematical problems in a cultural context. The following is an example of a mathematical problem using one of the cultural objects of the *Samin* tribe context, namely *Udheng Samin* and *Batik Samin*, in the Data Analysis and Probability (Statistics) material for junior high school students.

***Problem 1 is related to determining the Average (Mean)***

"*Udheng Samin*" is made from batik cloth that has its characteristic pattern, namely the *Obor Sewu* (Thousand Torches) pattern. The "*Obor Sewu*" pattern has the meaning of *pepadang* or enlightening the heart in living life, and as a control of behavior and attitudes, both in speech and actions. The cloth made for "*Udheng Samin*" is rectangular with a specific size. As a form of cultural preservation, in 2024, the Bojonegoro district government, through the Regent's Circular, appealed to all state civil servants (ASN) to wear *udheng Obor Sewu Samin* Pattern in official events. Due to this circular, one of the "*Udheng Samin*" production houses experienced an increase in sales, as seen in Table 5.

**Table 5.** *Udheng samin sales*

| No | Months | Sales number |
|---|---|---|
| 1 | January | 40 |
| 2 | February | 50 |
| 3 | Maret | 70 |
| 4 | April | 95 |
| 5 | Mey | 100 |
| 6 | June | 120 |
| 7 | July | 135 |

The question is: Based on the table above, determine the average sales of the production house in 7 months! Problem 1 is the exploration of the cultural object of the *Samin* tribe, namely *Udheng Samin*. The problem is presented in the form of a story problem related to the number of sales of *Udheng Samin* in each month. The problem story is developed from the type of pattern used in *Udheng Samin*. Students are asked to find the average number of sales from all the data provided. Through this type of problem, students find new things or new information related to the culture of the *Samin* tribe, especially about *Udheng Samin*. This is in accordance with what was conveyed by Okebukola (2020). The integration of cultural elements in the learning process provides important opportunities for students to learn, because the culture that is included contains moral values and deep life views.

***Problem 2 is related to determining the Average (Mean)***

One of the cultural objects that is still preserved by the *Samin* community is *Batik*. As one of the cultural heritages, *batik* has several patterns that have stories or philosophies behind

their selection of the pattern. The selection and creation of this pattern affect the selling price of the batik. The following is a table of Batik patterns from the *Samin* Bojonegoro community and their sales prices.

**Table 6.** *Samin batik* patterns sales price

| Patterns | Price |
|---|---|
| *"Paseksen Luhur"* | *100.000/m* |
| *"Margomulyo"* | *150.000/m* |
| *"Margo Utomo"* | *150.000/m* |
| *"Margo Kinasih"* | *150.000/m* |
| *" Manunggal Jati "* | *100.000/m* |
| *"Kamulyan Jati"* | *100.000/m* |
| *"Obor Sewu"* | *100.000/m* |

The question: If in this year the selling price of batik increases by 12% from the price in the table, then to what extent is the average selling price of the *batik*? In the case of problem 2, it was a form of ethnomathematics problem based on the results of exploration on the form of cultural objects of the *Samin* tribe, namely *Samin Batik*. The problem is presented in the form of story problems about the selling price of each *batik* pattern. In addition, the types of *Samin batik* patterns are also presented. Students were asked to calculate the average selling price of batik after experiencing an increase in price. Through problem 2, students will obtain information related to *Samin* batik, both in terms of existing *batik* patterns and also their selling prices.

***Problem 3 is related to the tradition of "Petung"***

In Javanese culture, there is a hereditary tradition called "*petung*". *Petung* is a calculation of auspicious days based on *weton* (day of birth according to the Javanese calendar) that is used to determine the right time to do important activities, such as marriage, moving house, harvesting, and opening a business.

Based on the tradition of "*Petung*", there were 30 *Petung* calculations carried out over the past few months. The records contain information on whether the activities carried out on certain market days (in the Javanese calendar: *Legi, Pahing, Pon, Wage, and Kliwon)* went smoothly (successful) or not smoothly (unsuccessful). The following is a recap of the data:

**Table 7.** Market day and number of events

| Market Day | Number of Events | Number of Successful Events |
|---|---|---|
| *Legi* | 6 | 4 |
| *Pahing* | 7 | 5 |
| *Pon* | 5 | 2 |
| *Wage* | 6 | 3 |
| *Kliwon* | 6 | 5 |

The communities will carry out 20 important activities next month, such as opening a business and holding a celebration. They plan to divide the activities evenly across the five market days, each getting four activities. Based on the data above, calculate the relative frequency of success for each market day!

The essay question raises the probability and expected frequency against the background of the *petung* tradition in Javanese society. It is a concrete example of the application of the ethnomathematics approach in the learning process. Ethnomathematics itself is an approach in mathematics education that traces how mathematical ideas emerge and are used in various cultural settings, including in traditional community practices. In the context of the test, students are invited to examine data from the calculation of *petung*, which is a method of determining good days based on the Javanese market systems such as *Legi, Pahing, Pon, Wage*, and *Kliwon*. This tradition is used by the community as a guide in planning important activities in order to obtain a good result, and indirectly, they have collected empirical data on the success rate of each market.

Through this problem, students not only learn statistical material such as frequency, relative

frequency, probability based on empirical data, and expected frequency, but also see how traditional communities apply patterns and data in daily life. This confirms that mathematical concepts are not only derived from theories in textbooks, but also live and grow in the culture of local communities.

As one form of integration between cultural and mathematical elements in the sample problem above, it can be seen through the ethnomathematics problem presented in the question. The short story about *Udheng Samin* and *Batik Samin* inserted at the beginning of the question functions as a form of cultural literacy introduced to students. This is in line with what was conveyed by (Umbara et al., 2023) that ethnomathematics and mathematical literacy are both important concepts in understanding the application of mathematics in everyday life. Ethnomathematics highlights the abilities of individuals from various cultural groups in using mathematics in everyday activities. At the same time, mathematical literacy emphasizes mathematical and social needs that reflect a person's level of mathematical proficiency (Kolar & Hodnik, 2021). Students will understand culture indirectly when they understand the problem. Students will get mathematical and non-mathematical information at the same time. Culture and mathematics learning can be linked to strengthening character in the teaching and learning process through an ethno-mathematics approach (Sunzuma & Maharaj, 2021). In addition, the instrument has strong potential to integrate mathematics learning through introducing the local culture by using the ethnomathematics approach (Acharya et al., 2021). However, to find out the extent to which students' understanding develops, further research or classroom trials are needed that can provide empirical evidence of the impact of such question-based learning

Ethnomathematics itself is believed as a bridge between mathematics and culture. This relationship has an important role in learning activities, since ethnomathematics combines various mathematical practices that have developed historically in various cultures (Kabuye Batiibwe, 2024). Research by Meeran et al. (2024) identified several aspects of mathematics related to culture, namely arithmetic, geometry, number patterns, algebra, statistics, and modeling. The connection between culture and mathematics makes mathematics learning more meaningful, because when cultural elements are integrated into teaching, teachers provide a relevant context for students (Dampson, 2021). In the context of ethnomathematics, meaningful learning refers to several things: 1) Students understand mathematical concepts more easily because they are presented through a real context, 2) Students develop a stronger cultural identity because their cultural is valued in learning, 3) Students become more motivated to learn because mathematics feels relevant to their lives (Oladejo et al., 2022)

The use of students' familiar elements is believed to have a positive impact on their cognitive abilities in mathematics, especially through a curriculum that contains cultural values (Fouze & Amit, 2023b). The mathematical information presented in the problem given above, related to the number of sales and selling prices, is used to calculate the average sales, which is an application of the Data Analysis and Probability topic. Non-mathematical information will be obtained by students related to the culture of the *Samin* tribe, which is related to the *Udheng Samin* pattern and the types of *Samin Batik* that emerged in this problem.

In addition, this instrument presents a new approach to ethno-mathematics, based on mathematics learning and geometry material. This is in accordance with Omere & Ogedengbe (2022) that culture-based learning that uses materials in the student's environment and cultural activities around students can be applied to the learning process on certain materials. The use of culture-based instruments produced for data and

probability materials also provides innovations in mathematics learning. This is also in accordance with research by Mosimege & Egara (2023) which states ethnomathematics material refers to real objects that generally come from the culture and environment around students, used as a means to explore and understand mathematical concepts. The material covers all concepts in mathematics subjects, which are not only limited to the use of resources from the environment, such as statues, works of art, and traditional symbols that display various forms of symmetry, but also the customs or inherent cultural activities.

Moving for a more authentic direction, a researcher or teacher can develop learning with several concrete steps, including 1) involving traditional leaders or local cultural practitioners to explore indigenous knowledge that contains mathematical structures. 2) analyze cultural practices in depth to find mathematical relations used by the community in these practices (for example, *neptu* calculations, market day cycle patterns, and the logic of determining good days), 3) develop questions and activities that are based on exploration, not just counting exercises, for example by asking students to reconstruct how *petung* works mathematically or comparing local calculation systems with modern mathematical systems. In this way, ethnomathematics is not only a tool to attract students' interest in learning, but also a means to appreciate and understand the logic of thinking and local knowledge systems that have so far been underrepresented in formal learning (Rodríguez-Nieto et al., 2025)

Several previous studies have focused on linking the culture to mathematics through a geometric approach. In contrast, this study takes a different perspective, namely by raising the story behind the *Samin* tribe culture as a learning material in the form of culture-based mathematics problems in the Data Analysis and Probability topic. Furthermore, problems formed from this culture can be used to explore how students solve ethnomathematics problems. Research by Tong et al. (2021) showed that based on an analysis of student answer patterns in their research, students' statistical reasoning abilities vary depending on the learning approach applied. However, the use of ethno-mathematics contexts has been shown to play a significant role in helping students' understanding (Rosa & Orey, 2021). This context makes it easier for students to understand the problems given because they feel close to the situation being raised. In addition, the application of ethno-mathematics also provides a more meaningful learning experience in solving mathematical problems (Nursyahidah et al., 2025).

## ■ CONCLUSION

This study provides results in the form of ethnomathematics from the *Samin* Tribe culture, which is then developed in the form of sample question instruments on data analysis and probability topics using the cultural context of the *Samin* tribe. The question instrument provides an overview of the *Samin* tribe culture, which can make it easier for students to understand the questions because they are related to the real context. This instrument was designed based on the results of the exploration of the *Samin* tribe's culture, and this approach has the potential to support students' understanding of mathematics materials. Instruments that have been developed through the ethnomathematics approach can be further validated by expert validation and readability tests. In addition, the effectiveness of the instruments can be tested to determine the extent to which the instruments are able to help students' understanding of mathematical concepts. This research gives an important conceptual contribution to the field of ethnomathematics through the process of identifying and recording the mathematical potential inherent in the cultural life of the *Samin* community. The findings indicate that the values, habits, and ways of thinking of the *Samin* community contain unique and previously unexpected mathematical elements.

Therefore, this research opens up new opportunities for further research that examines *Samin*'s local wisdom from a mathematical perspective. More broadly, this contribution enriches the diversity of ethnomathematics in Indonesia and supports the development of contextualized mathematics learning rooted in local culture. These results indicate that the use of local culture around students can be applied in the form of question instruments. However, this study still has limitations, in accordance with the instruments produced use a specific cultural context, namely *Udheng Samin* and *Batik Samin*, and focus on Data Analysis and Probability topic in Junior High Schools. Further research is crucial to be conducted to overcome the limitations of the current study. Further research can be developed in a universal culture context and applied to other mathematical materials and prototype question instruments that have further potential to be developed and validated so that they can be applied in the learning process.

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