



Exploring Ethnomathematics in Traditional Dance Movements: A Study of the Sige Penguten Dance of Lampung, Indonesia

Riana Desmawati¹, Titik Nurhayati², Fatimatuz Zahro Ulbana³, Raden Hari W. Jayaningrat⁴

¹Department of Mathematics Education, Universitas Islam Negeri Raden Intan Lampung, Lampung, Indonesia

^{2,3,4}Unit Pelaksana Teknis Taman Budaya Lampung, Lampung, Indonesia

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ABSTRACT

Purpose of the study: This study aims to determine ethnomathematics activities and mathematical concepts applied in various Sige Penguten dance movements.

Methodology: The type of research used in this study is qualitative research with an ethnographic approach. Data were obtained through interviews, observation, and documentation. The research instruments consisted of the primary instrument, the researcher herself, and supporting instruments in the form of interview guidelines, observation sheets, and documentation tools. Method and source triangulation were used to validate the data.

Main Findings: The results of this study indicate that in each sige penguten dance movement, counting activities are implemented by adjusting the fast or slow music beat in the form of a repetition of 1×8 counts. Some sige penguten dance movements implement measuring activities when the movement moves to adjust to the next floor pattern change. The concept of one-dimensional geometry is depicted from the movement that forms a straight line floor pattern. The concept of two-dimensional geometry is depicted from the shape of the floor pattern in the form of triangles, rectangles, squares, trapezoids, and circles. Reflection and rotation geometric transformations. The conclusion of this study is that in the sige penguten dance movements there are mathematical activities and mathematical concepts.

Novelty/Originality of this study: This research can be used as input for educators to make ethnomathematics an alternative in the mathematics learning process, so that it can help improve learning outcomes and students' interest in mathematics learning.

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Corresponding Author:

Riana Desmawati,

Department of Mathematics Education, Universitas Islam Negeri Raden Intan Lampung, Jl. Letnan Kolonel H Jl. Endro Suratmin, Sukarami, Kec. Sukarami, Kota Bandar Lampung, Lampung, Indonesia

Email: rnadesmawati10@gmail.com

1. INTRODUCTION

Mathematics is not only a formal discipline taught in classrooms but also a cultural product embedded in everyday human activities [1], [2]. Various cultural practices such as architecture, crafts, games, and dances implicitly contain mathematical ideas and patterns [3], [4]. This perspective challenges the conventional view of mathematics as abstract and detached from cultural contexts. Recognizing mathematics as part of culture allows learners to see its relevance in real-life situations [5], [6]. Therefore, exploring mathematics through cultural expressions becomes an important approach in contemporary mathematics education.

Ethnomathematics emerges as a field that examines the relationship between mathematics and culture, emphasizing local knowledge systems [7], [8]. It highlights how different communities develop and apply

mathematical concepts based on their cultural practices. Through ethnomathematics, cultural activities can be used as meaningful contexts for understanding mathematical ideas [9], [10]. This approach has been widely acknowledged for its potential to promote culturally responsive learning. Consequently, ethnomathematics plays a crucial role in bridging formal mathematics with students' cultural backgrounds [11], [12].

Traditional dance is one form of cultural expression that embodies structured movements, rhythms, and spatial patterns [13], [14]. Dance movements often involve symmetry, rotation, counting, sequencing, and proportional relationships [15], [16]. These elements indicate that traditional dances can serve as rich sources of mathematical concepts. However, such mathematical aspects are often overlooked and viewed solely from an artistic perspective. This situation limits the potential of traditional dance as a learning resource in mathematics education [17], [18].

The Sige Penguten dance is a traditional welcoming dance from Lampung, Indonesia, characterized by graceful and structured movements [19], [20]. Each movement in the dance follows specific patterns and formations that reflect cultural values and aesthetics [21], [22]. Despite its cultural significance, studies on the mathematical aspects of the Sige Penguten dance remain very limited [23], [24]. Most existing research focuses on its historical, cultural, or artistic dimensions. As a result, the ethnomathematical potential of this dance has not been sufficiently explored.

Previous ethnomathematics studies have predominantly examined cultural artifacts such as traditional houses, weaving patterns, and local games [25], [26]. Only a limited number of studies have focused on traditional dance as an object of ethnomathematical analysis [27], [28]. Even fewer studies specifically address Indonesian traditional dances within this framework. This indicates a clear research gap in exploring mathematical concepts embedded in traditional dance movements [29], [30]. Addressing this gap is essential to expand the scope of ethnomathematics research.

This study offers novelty by systematically exploring ethnomathematical concepts within the movements of the Sige Penguten dance. It identifies mathematical ideas such as geometry, patterns, symmetry, and sequences embedded in the dance movements [31], [32]. Unlike previous studies, this research emphasizes dance as a dynamic and meaningful source of mathematical knowledge. The study also provides a structured interpretation of how cultural movements can be linked to formal mathematical concepts. Thus, it contributes a new perspective to ethnomathematics and mathematics education research.

The urgency of this study lies in the need for culturally relevant learning approaches in mathematics education. Integrating local culture into mathematics learning can enhance students' engagement and conceptual understanding [33], [34]. At the same time, it supports the preservation of cultural heritage in the context of modern education. By exploring the ethnomathematics of the Sige Penguten dance, this study promotes both educational innovation and cultural appreciation. Therefore, this research is important for educators, researchers, and curriculum developers seeking meaningful and contextual mathematics learning. Based on this, this research aims to determine ethnomathematics activities and mathematical concepts applied in various Sige Penguten dance movements.

2. RESEARCH METHOD

2.1. Type of Research

This research is a qualitative research that aims to describe and understand the phenomenon studied in depth through descriptive explanations in narrative form. Qualitative research is conducted in a natural setting by placing the researcher as the main instrument in data collection [35], [36]. The data collection process is carried out through qualitative methods, namely observation, interviews, and documentation, with inductive data analysis and oriented towards developing theories sourced from field data (grounded theory) [37], [38]. The resulting data are in the form of descriptions in the form of words and pictures, not numbers, with an emphasis on the research process, data validity, and the suitability of findings with real conditions in the field, as well as research results agreed upon with the data source. The approach used is ethnography, which emphasizes participatory observation to study culture as a whole, both material and nonmaterial aspects, through data collection from literature studies, observations, and interviews with cultural figures and artists of Lampung, in order to describe ethnomathematics activities and mathematical concepts contained in the traditional dance movements of Sige Penguten Lampung.

2.2. Research Subjects

The subjects of this research are resource persons who have the competence and experience in providing relevant information related to the research object. The main resource persons in this research include a functional staff at the Lampung Cultural Park Technical Implementation Unit who has academic knowledge regarding the history and development of the Sige Penguten dance [20], [39]. In addition, Head of Division I of the Lampung Arts Council at the Lampung Provincial Education and Culture Office plays a role as an important figure involved in the deliberation and preservation of the Lampung Sige Penguten dance. This research also involves, a Lampung dance artist who is currently active in the practice and inheritance of dance directly. The selection of research

subjects was carried out purposively, adjusted to the needs and depth of information required in the research [40], [41].

2.3. Sampling Techniques

The sampling technique used in this study was purposive sampling, which determines the sample based on specific considerations relevant to the research objectives [42], [43]. These considerations were based on the selection of informants deemed to have in-depth understanding and experience related to the research object. This technique enabled the researcher to obtain more accurate data that met the research needs [44], [45]. Sample selection was entirely determined by the researcher, considering the adequacy and depth of the required information. Therefore, purposive sampling was deemed appropriate to support this qualitative research.

2.4. Data Collection Procedures

The data collection procedure in this study is a series of steps taken by the researcher to obtain data in accordance with the research objectives. Data collection was conducted through several methods, namely observation, interviews, and documentation, which complement each other [46], [47]. The selection of these methods is adapted to the characteristics of qualitative research, which emphasizes an in-depth understanding of the phenomena being studied. By combining these methods, the researcher is expected to obtain accurate and comprehensive data. Each method is applied systematically according to the research needs in the field.

The observation method is used to directly gather factual data about the research object in its natural setting. Observations are conducted using a participant observation approach, in which the researcher is present at the research location without directly participating in the activities being observed [48], [49]. In this study, the researcher applies a passive participation technique, acting as an observer, thus not influencing the ongoing activities. Observations are conducted openly, with the data sources informed that the activity is part of the research. Furthermore, the observations are unstructured because the focus of the observations evolves as the research process progresses in the field.

The interview method is used to obtain in-depth data through a question-and-answer process between the researcher and the informant [50], [51]. This study uses semi-structured interviews, which allow the researcher to flexibly develop questions based on the informant's responses. Prior to conducting the interviews, researchers developed interview guidelines to ensure the data collected remained relevant to the research focus [52], [53]. Interviewee selection was based on specific criteria, including understanding the research object, active participation in the target environment, and willingness to devote time to providing information [54], [55]. This method enabled researchers to explore the perspectives, experiences, and meanings of the interviewees in greater depth.

Documentation methods were used to complement the data obtained from observations and interviews [56], [57]. Documentation in the form of written notes, photographs, and works related to the research object were used to strengthen and verify the data obtained. These documents provided additional information regarding the cultural context and activities being studied. The use of documentation also assisted researchers in maintaining the validity of the data. Thus, documentation played a crucial role in enriching and strengthening research findings.

2.5. Research Procedures

This research procedure draws on the ethnographic approach developed by Spradley, which emphasizes an in-depth understanding of cultural meanings through direct engagement with informants [58], [59]. The initial stage of the research began with the selective identification of informants, individuals directly involved with the research object and possessing a strong understanding and communication skills regarding the required information. Once informants were identified, the researcher conducted interviews while observing research ethics, such as respecting the interests and privacy of informants and clearly communicating the research objectives [60], [61]. During the data collection process, the researcher compiled ethnographic records in the form of field notes, visual documentation, and other supporting recordings to capture the cultural phenomena under study. These records served as the basis for understanding the context and meaning of the observed cultural activities.

The next stage involved asking descriptive questions to obtain detailed explanations of the research object. The interview data were then analyzed through ethnographic analysis, emphasizing the symbols, meanings, and interpretations conveyed by the informants. The researcher then conducted domain analysis by identifying key terms that were systematically related to the research focus [62], [63]. To deepen understanding of the informants' cultural knowledge structure, the researcher posed structural questions tailored to the informants' backgrounds and experiences. Taxonomic analysis was conducted to group and categorize the cultural symbols identified within a specific domain. The entire process concluded with an ethnographic narrative describing the research findings and the meaning of the informants' experiences related to the traditional Sigeh Penguten dance movements of Lampung.

2.6. Research Instruments

A research instrument is a tool used to collect data related to the variables or phenomena being studied. In qualitative research, the researcher acts as the primary instrument, directly involved in the data collection process and cannot be replaced by another party [64], [65]. Data are obtained through verbal interactions and are enriched by the researcher's observations, listening, and appreciation of the traditional Sige Penguten Lampung dance movements. To support the researcher's role as the primary instrument, this study uses an interview guide as the primary instrument for data collection [66], [67]. In addition, supporting instruments such as observation sheets, documentation, and field notes are used to complement and strengthen the data obtained during the research process.

2.7. Data Analysis

Data analysis in this study was conducted to organize and structure the qualitative data obtained through interviews, observations, and documentation for ease of understanding and interpretation [68], [69]. Data were analyzed in narrative form, linking various pieces of information to gain a comprehensive understanding of the phenomena being studied. The analysis process was conducted systematically to explore the cultural meanings inherent in the research object.

The data analysis model used refers to Spradley's ethnographic approach, which includes domain analysis, taxonomic analysis, component analysis, and theme analysis. Domain analysis was conducted to obtain a general overview of the research object, which was then developed in more detail through taxonomic and component analysis [70], [71]. Next, theme analysis was conducted by linking various domains to identify the main theme that represents the overall research findings. Data analysis was conducted continuously, both during the field data collection process and after all data had been collected.

The validity of the data in this study was maintained through several data validity checking techniques, namely extended observation, increased diligence, and triangulation. Extended observation was achieved by conducting repeated observations and interviews to ensure data consistency. Increased diligence was achieved through careful and continuous observation to ensure accurate and systematic data collection. In addition, source triangulation and method triangulation were used to compare data from various sources and data collection techniques to strengthen the validity of research findings.

3. RESULTS AND DISCUSSION

3.1. Subject Method Triangulation I

Based on the analysis of observation results and analysis of documentation results, the following results were obtained:

Table 1. Triangulation Results of Subject I Method

No	Indicator	Interview Results	Observation Results	Documentation Results
1	History of the Sige Penguten Dance in Lampung	Actually, it is not a change of name, sige penguten is actually a manifestation of worship, where before 1989 the sembah dance had many forms, while to become a provincial icon it must be one, Lampung's sembah dance used to have cenggremo dance, sembah dance, sembah dance, various offering dances with different forms, so I proposed a seminar on sembah dance. We invited two Lampung cultural figures, namely pepadun and saibatin in 1989, an agreement	The information obtained is in accordance with the original history of the Lampung Sige Penguten dance.	It is fully realized that currently the worship dance (sige penguten dance) of the Lampung region has not shown uniformity, movement, or costume, dance form, because each region of customary law in the Lampung region displays different types of worship dance according to the background of the region concerned, therefore the regional government through the Department of Education and Culture feels the need to formulate the Lampung regional worship dance so that it becomes a characteristic of the Lampung region and produces the sige penguten dance.

		was made from sembah dance to sigeh penguten dance.
2	Sigeh Penguten Dance Movements from Lampung	<p>The movements of the Lampung Saibatin and Lampung Pepadun worship dances are standardized in the Sigeh Pengeten dance. The name "Sigeh Pengeten" is taken from the everyday environment of the Lampung people, which contains the philosophy of the deep religious and social values of the Lampung community.</p>
3	Counting Activities	<p>Each movement has a clear calculation. The count in traditional dance is even, namely 1 8, because 1-8 determines the tempo of the beat.</p>
4	Measuring Activities	<p>For example, the 45° gubuh gakhang movement is technically oblique to the eyes and oblique to the ears (practicing the movement).</p>
5	Geometric Study 1. One-Dimensional Geometry 2. Two-Dimensional Geometry 3. Geometric Transformations	<p>From the shape of the floor pattern of the Sigeh Pengeten dance, it forms symmetry, for traditional dance it usually forms triangles, arrows, trapezoids, then straight lines, diagonals and circles, these are the compositions of traditional dance.</p>

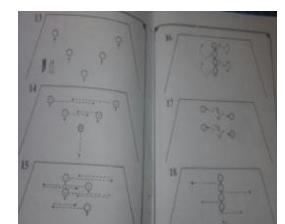
By looking at the guidebook and observing the dance movements, the same results were obtained.



4. Bentuk Tarj :

- 1. Lapah Tebeng (masuk 4 x 8)
- 2. Seluang Mudik (2 x 8)
(sampai meletakan sirih)
- 3. Sembah (2 x 8)
- Jeng Sipuh/Mejong Simpuh 1 x 8
- Jen Silo Ratu/Jeng Mekak 2 x 8
- Jen Geppek/Jeng Ipekk 4 x 6
- Seluang Mudik 2 x 8 berdiri
- Kilit Mundur)
- N getir)
- Mempan Bias) 1 x 8
- Nginyau Bias)
- Kenut Melayang)





Subject I's valid data is as follows:

1. History of the Lampung Sigeh Penguten Dance

Subject S1 briefly explained the history of the Lampung Sigeh Pengeten dance according to actual events because the informant was involved in the history of the Lampung Sigeh Pengeten dance.

2. Sigeh Penguten Dance Movements from Lampung

Subject S1 clearly explains several movements of the Sigeh Pengeten dance, starting from naming them and then grouping the movements according to the guidebook.

3. Counting Activities

Subject S1 explains information about calculating in each form of movement change that is practiced.

4. Measuring Activities

Subject S1 provided information regarding measuring activities when forming formations to form floor patterns and also measuring in each form of dance movement.

5. Geometry Study

The study of geometry in the Sigeh Pengeten dance movements will be explained in more detail by the researcher.

Conclusion:

Subject I provided clear information regarding the history of the Lampung Sigeh Pengeten dance, the movements of the Lampung Sigeh Pengeten dance, and even provided information related to several mathematical activities and mathematical concepts applied to the Lampung Sigeh Pengeten dance.

3.2. Subject Method Triangulation II

Based on the analysis of observation results and analysis of documentation results, the following results were obtained:

Table 2. Results of Triangulation of Subject II Method

No	Indicator	Interview Results	Observation Results	Documentation Results
1	History of the Sigeh Penguten Dance in Lampung	In the past, perhaps the Sembah dance was famous, which means just a worship dance, so it was not very accurate because the Lampung Pepadun and Lampung Sai Batin dances were only used in their respective environments, while Lampung Province had to have a dance to welcome guests, not in the name of Lampung Pepadun or Lampung Sai Batin, so traditional figures, cultural figures and artists made an agreement in 1989 to form a special dance to welcome guests in Lampung Province, namely the Sigeh Pengeten dance.	Obtained the appropriate history of the sigeh penguten dance.	The data obtained is the same as the original history of the Sigeh Penguten dance in the book Tari Sembah Sigeh Penguten which is used as a guide.
2	Sigeh Penguten Dance Movements from Lampung	The naming of dance movements is based on the daily activities of the people of Lampung, so like bekal huwi is splitting wood, mempan bias is washing rice, then jong silo ratu is sitting a princess, kenui floats like a flying bird, because this dance is a graceful welcome to guests so it shows the attitude of a princess and that between Lampung pepadun and Lampung sai batin the movements are the same only slightly different in language then standardized in the sigeh penguten	Data from informants in the form of explanations regarding the names of dance movements were taken from those found in the Lampung community and the division of movements was based on the guidebook.	The results obtained are in accordance with the form of dance movements in the guidebook.

dance. The grouping is more to the level, for example from above, the first movement lapah tebeng is walking straight forward sitting jong silo ratu then ngerujung down is one package.

Must use the count, dancing is still guided by the count of 1 8 and always 8 back to 1-8 (practicing the count). The count is slow and fast, for example 1, 2 slow counts can become 1, 2, 3, 4 fast counts. Each variety is usually 1-8, every 8 changes movement. And each variety, for example the first sitting when putting down the tepak, the second sitting when taking the tepak, the third sitting when the last prayer is counted, the same as the shape of the sigeh penguten formation, the shape of a triangle, the dancers must be odd because one of them is the queen. So there is a calculation of movement, calculation of variations, and also the shape of the floor pattern or from various formations.

The informant gave an example of calculating in the form of a dance according to the guidebook.



3 Counting Activities

The floor pattern of eight must be a movement, there is one more movement that rotates clockwise, namely a circle, namely lipetto, with a circle there must be an axis and for example in There is a lipetto movement, the hand must not be straight, it must form an angle, the ngrujung must be slanted, if it is straight it becomes a floating samber. Lipetto must be L-shaped or right-angled so there must be a difference in each movement, there must be no mistakes in the attitude or axis of movement, the movement will be different

Appropriate data was obtained when the informant demonstrated the movement.



4 Measuring Activities

	Geometric Study		
	1. One-Dimensional Geometry	The shape of the Sigeh Pengeten formation is triangular, the dancers must be odd because one of them is the queen.	The same data was obtained when the informant practiced the direct movement.
5	2. Two-Dimensional Geometry		Data according to the Sembah Sigeh Penguten Dance guidebook.
	3. Geometric Transformations		

Subject I's valid data is as follows:

1. History of the Lampung Sigeh Penguten Dance
The S2 subject explains a brief history based on the book Sigeh Penguten Worship Dance.
2. Sigeh Penguten Dance Movements from Lampung
S2 subjects can clearly explain the movements of the Sigeh Penguten dance, including their divisions and skillfully exemplifying several movements.
3. Counting Activities
Subject S2 explained that counting activities are involved in every movement of the Lampung Sigeh Pengeten dance.
4. Measuring Activities
Subject S2 explains the activity of measuring distances in adjusting the shape of the formation so that the floor pattern complies with established rules.
5. Geometry Study
The Master's subject explains several geometries in floor patterns and dance movement forms, which will be detailed by the researcher.

Conclusion:

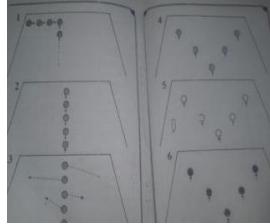
The S2 subjects provided accurate information regarding the history of the Lampung Sigeh Pengeten dance, were able to expertly explain the dance movements, and were able to provide information regarding the mathematical activities and mathematical concepts within the Lampung Sigeh Pengeten dance.

3.3. Subject Method Triangulation III

Based on the analysis of observation results and analysis of documentation results, the following results were obtained:

Table 3. Results of Triangulation of Subject III Method

No	Indicator	Interview Results	Observation Results	Documentation Results
1	History of the Sigeh Penguten Dance in Lampung	Since there was no specific welcoming dance that would be a Lampung identity, traditional figures, artists, and cultural figures collaborated to develop a special welcoming dance for Lampung province. In 1989, the regional government approved the Sigeh Pengeten dance.	The data obtained is based on the story of subject S3 clearly because subject S3 is one of those who played a role in the formation of the Lampung Sigeh Pengeten dance agreement.	The same data was obtained in the S3 subject manual.
2	Sigeh Penguten Dance Movements from Lampung	Subject S3 explained that the Sigeh Pengeten dance movements are the same as the previous Sembah dance movements and the Sigeh Pengeten dance movements are not the same as other traditional dance movements because they have their own	Observations were made by directly observing each form of movement in the Lampung Sigeh Pengeten dance.	The data obtained is in accordance with the guidebook.

		characteristics, namely as a guest welcomer where the name of each movement comes from various Lampung community environments.
3	Counting Activities	<p>The movement count is used to count 1-8 continuously like that, then multiplying means repetition.</p> <p>Researchers observed directly the movement count.</p>
4	Measuring Activities	<p>When there is a lower level, there is a flat level, there is a middle level, our upright position is really upright so it is straight, different from Javanese dance, the Sigehe dance has a 45° angle and measuring the distance displacement is usually the effect of the previous movement.</p> <p>Direct observation by looking at the form of movement that corresponds to an angle of so many degrees.</p> 
5	Geometric Study	<p>1. One Dimensional Geometry</p> <p>2. Two-Dimensional Geometry</p> <p>3. Geometric Transformation</p> <p>The floor pattern forms an isosceles triangle, symmetrical, really facing each other when it's split, when it's pumping, it's a zigzag but it has its own line, there are 4 of them.</p> <p>Observing directly as exemplified by the informant.</p> 
<p>Subject I's valid data is as follows:</p> <ol style="list-style-type: none"> 1. History of the Sigehe Penguten Dance in Lampung The S3 subject provided clear information on the history of the Sigehe Penguten dance in Lampung. 2. Movements of the Sigehe Penguten Dance in Lampung The S3 subject was proficient in explaining and exemplifying the movements of the Sigehe Penguten dance in Lampung. 3. Counting Activities The S3 subject explained that all movements involve counting. 4. Measuring Activities The S3 subject explained that measuring in the Sigehe Penguten dance is applied unconsciously, namely when adjusting formations and movement shapes. 5. Geometry Studies The S3 subject briefly explained the geometry studies, for example, various simple geometric shapes in floor patterns resulting from formations. This will be explained in detail by the author. 		

Conclusion:

The doctoral subject was able to explain the history of the Sigehe Pengeten dance. He was also proficient in explaining and practicing the movements. He also clearly demonstrated the mathematical significance of the Sigehe Pengeten dance in Lampung.

The Sigehe Pengeten dance is a traditional Lampung dance that serves as a welcoming ceremony for guests. This dance embodies the Lampung people's identity, as they consider "the guest is king," reflecting the

Lampung people's hospitality, generosity, and openness in interacting with others. The Lampung people consider the Sige Pengeten dance a mandatory dance performed at special events that invite important figures. This dance is a traditional group dance, where the Sige Pengeten dancers must be an odd number. The odd number is due to the fact that one dancer is responsible for carrying the "tepak" (traditional cloth) containing the Sige Pengeten. The dance typically consists of five dancers, but more can be performed depending on the need. The dancers, consisting of Lampungnese mulli-mulli, possess a graceful style, demonstrated by the gentleness of each sige pengeten movement.

Dance movement is the most important element of the Sige Pengeten dance. In addition to being presented in the form of movements for the enjoyment of its artistic value, each movement of the Sige Pengeten dance conveys a sense of respect conveyed by the host to the guests who have arrived, as demonstrated through the Lampung mulli-mulli greeting. The various movements of the Sige Pengeten dance include the Lapah Tebeng movement, the Seluang Mudik movement, the Merunduk movement, the Jong Silo Khatu movement, the Sembah movement, the Ngakhunjung movement, the Kilat Mundur movement, the Makku Khaccang movement, the Ghubuh Gakhang movement, the Ngiyau Bias movement, the Samber Melayang Jalan movement, the Tolak Tebeng movement, the Mempam Bias movement, the Belah Huwi movement, and the Lipatto movement.

The Sige Pengeten dance movements are based on a crucial factor: a fixed count in each dance movement, thus creating a visually beautiful dance movement. Another important factor is the adjustment in the form of the Sige Pengeten dance, which has rules for the shape of the hands and feet, and how to measure distance to form standardized formations. The Sige Pengeten dancers each have their own positioning points to form several floor patterns in the form of simple geometry. This proves that the Sige Pengeten dancers were unaware of applying ethnomathematics concepts, specifically to the Sige Pengeten dance movements. Ethnomathematics in the Sige Pengeten dance movement forms includes counting, measuring, and several geometric studies such as one-dimensional geometry, two-dimensional geometry, and geometric transformations.

The findings of this study reinforce the view that local cultural practices have great potential as sources for contextual mathematics learning. The presence of counting, measurement, and geometric concepts in the Sige Pengeten dance movements demonstrates that mathematics is inseparable from the social and cultural life of the community. This aligns with the ethnomathematics perspective, which emphasizes that mathematical concepts develop naturally through human activities within their cultural environment. Thus, mathematics is not merely understood as an abstract discipline, but as a social construct that grows out of everyday practices, including in traditional dance.

The integration of mathematical concepts into the movement structure of the Sige Pengeten dance also reflects the order, balance, and harmony that are core values in Lampung culture. The symmetrical floor pattern, the use of geometric formations, and the regular rhythm of movement demonstrate the existence of mathematical principles that support the dance's visual beauty. This order serves not only an aesthetic function but also reflects philosophical values such as harmony, togetherness, and social order. Therefore, mathematics learning that incorporates elements of traditional dance can help students understand mathematical concepts while instilling local cultural values.

From a pedagogical perspective, the results of this study open up opportunities for the development of a culture-based mathematics learning model. Using the Sige Pengeten dance as a learning context allows students to learn concepts of geometry, transformation, and measurement in a more concrete and meaningful way. This approach has the potential to increase learning motivation, conceptual understanding, and active student engagement in the learning process. Furthermore, ethnomathematics-based learning can strengthen students' cultural identity and foster an appreciation for regional cultural heritage.

Furthermore, this study emphasizes the importance of preserving traditional arts in formal education. Integrating traditional dance into mathematics learning not only supports pedagogical innovation but also contributes to efforts to preserve local culture amidst globalization. Thus, mathematics education is oriented not only toward academic achievement but also toward character development and students' cultural awareness. This aligns with national education goals, which emphasize a balance between cognitive, affective, and psychomotor aspects.

However, implementing traditional dance-based ethnomathematics requires careful planning, particularly in aligning mathematics material with the core competencies of the curriculum. Teachers need to have a sufficient understanding of the cultural elements and mathematical concepts contained within them for effective learning. Therefore, teacher training and development of contextual teaching materials are strategic steps to support the successful implementation of this approach in schools.

This research has a positive impact on the development of local culture-based mathematics learning, particularly through the integration of ethnomathematics elements into the traditional Sige Pengeten dance. The findings can serve as a basis for teachers in designing more contextual, meaningful, and experience-centered learning strategies. This approach has the potential to enhance students' conceptual understanding, learning motivation, and appreciation of mathematics and regional culture. Furthermore, this research contributes to the

preservation of Lampung's cultural heritage by presenting traditional dance as an innovative learning resource in schools, thereby strengthening students' cultural identity amidst the globalization of education.

However, this study has several limitations. First, the study focused only on one type of traditional dance, Sige Penguteng, so the generalizability of the findings to other cultural forms or regions is limited. Second, the qualitative approach with a relatively limited number of informants allows for subjectivity in data interpretation, despite triangulation of methods and sources. Third, this study has not empirically tested the effectiveness of implementing dance-based ethnomathematics in improving students' mathematics learning outcomes. Therefore, further research is recommended to expand the object of study, use experimental or mixed-method designs, and test the impact of implementation directly on the cognitive, affective, and psychomotor aspects of students.

4. CONCLUSION

From observing the movements of the Sige Penguteng Lampung dance that form the dance floor pattern, it can be concluded that there are ethnomathematics activities and geometric concepts that are applied as follows: the mathematical activities in question are the activity of calculating the beats in performing each movement and the activity of measuring in several movements when the dancer adjusts his footsteps to change formation so that the floor pattern formed is appropriate, the geometric study is in the form of one-dimensional geometry, namely straight lines and two-dimensional geometry in the form of isosceles triangles, trapezoids, rectangles, squares and circles. The concept of geometric transformation is in the form of reflection and rotation. It is recommended that further research expand the scope of study to include other forms of local art and culture to gain a more comprehensive understanding of the potential of ethnomathematics in mathematics learning. Furthermore, research using an experimental or mixed-methods design is needed to empirically test the effectiveness of ethnomathematics-based learning on improving students' learning outcomes, motivation, and appreciation of local culture.

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REFERENCES

- [1] M. M. A. Maba, D. H. Siswanto, and N. Z. Caesaria, "Ethnomathematical Exploration of the Apem Wonolelo Tradition in Sleman Regency," *J. Padamu Negeri*, vol. 2, no. 4, pp. 161–171, 2025, doi: 10.69714/x4xp7f07.
- [2] B. A. Khasanah, R. C. I. Prahmana, S. Adiputra, and M. Arnal-Palacián, "The beauty of mathematics in Indonesian culture: An impactful and meaningful context in number patterns learning," *JRAMathEdu (Journal Res. Adv. Math. Educ.)*, vol. 10, no. 2, pp. 68–80, 2025, doi: 10.23917/jramathedu.v10i2.10441.
- [3] S. Orhani, "Geometric patterns in Albanian carpets: An ethnomathematical approach to cultural heritage and mathematics education," *Cult. Educ. Futur.*, vol. 3, no. 3, pp. 361–379, Dec. 2025, doi: 10.70116/29802741114.
- [4] M. S. K. Batiibwe, "The role of ethnomathematics in mathematics education: A literature review," *Asian J. Math. Educ.*, vol. 3, no. 4, pp. 383–405, Dec. 2024, doi: 10.1177/27527263241300400.
- [5] I. Novikasari, A. Muttaqin, and N. Elebiary, "Teaching Math and Preserving Culture: The Intersection of Values in Indonesian Pedagogy," in *Values and Valuing in Mathematics Education*, Singapore: Springer Nature Singapore, 2024, pp. 361–379. doi: 10.1007/978-981-99-9454-0_17.
- [6] M. Barete and E. Taja-on, "Students' Perception in Learning the Course Mathematics in the Modern World: A Qualitative Study," *East Asian J. Multidiscip. Res.*, vol. 3, no. 7, pp. 2721–2738, Jul. 2024, doi: 10.55927/eajmr.v3i7.10071.
- [7] S. K. Sata, "Advancing Mathematical Innovation Through Ethnomathematics: Developing a Framework for Translating Indigenous Spatial Reasoning and Numeracy Systems into Modern Computational Algorithms," *World J. Arts, Educ. Lit.*, vol. 1, no. 3, pp. 31–40, 2024.
- [8] A. Kumar and S. Gopinath, "Integrating Ethnomathematics in Indian Classrooms: Strengthening Conceptual Understanding through Cultural Relevance," *Indig. Wisdom A Multidiscip. J. Indig. Stud.*, vol. 1, no. 1, pp. 1–22, 2025.
- [9] D. Harefa, "Mathematics as a philosophical foundation in hombo batu: exploring nias' local wisdom through the perspective of mathematics," *Afore J. Pendidik. Mat.*, vol. 4, no. 1, pp. 13–26, Apr. 2025, doi: 10.57094/afore.v4i1.2557.
- [10] D. Harefa and I. W. Suastra, "Mathematics Education Based on Local Wisdom: Learning Strategies Through Hombo Batu," *Afore J. Pendidik. Mat.*, vol. 3, no. 2, pp. 1–11, 2024, doi: 10.57094/afore.v3i2.2236.
- [11] I. P. A. A. Payadnya, I. G. A. P. A. Wulandari, K. R. Puspadiwi, and S. Saelee, "The significance of ethnomathematics learning: a cross-cultural perspectives between Indonesian and Thailand educators," *J. Multicult. Educ.*, vol. 18, no. 4, pp. 508–522, Oct. 2024, doi: 10.1108/JME-05-2024-0049.
- [12] A. Solihin, N. Mariana, I. Rahmawati, and Z. Abidin, "Cultural Exploration as Realistic Context in Mathematics Learning: An Ethnomathematics Perspective in Indonesian Elementary Education," *Glocal Prax. Elem. Educ.*, vol. 2, no. 1, pp. 34–50, 2025.
- [13] T. Ding, "Analysis on the Application Value of Repetition Technique in Dance Choreography Based on Chinese Traditional Cultural Vision," *J. Humanit. Arts Soc. Sci.*, vol. 9, no. 4, pp. 712–717, Apr. 2025, doi: 10.26855/jhass.2025.04.008.
- [14] T. Li and H. Zhong, "Analyzing Traditional Cultural Elements and Style Integration Patterns in Dance Movements Based on Matrix Decomposition Technique," *J. Comb. Math. Comb. Comput.*, vol. 127b, pp. 997–1012, Dec. 2025, doi:

10.61091/jcmcc127b-056.

[15] D. H. Siswanto, N. Janah, and E. Fitriana, "Unveiling Ethnomathematical Concepts in Jathilan Art: An Ethnographic Study of Cultural Geometry and Mathematical Literacy," *JPIM J. Penelit. Ilm. Multidisipliner*, vol. 02, no. 03, pp. 2323–2334, 2025.

[16] A. Rahima, I. Sakinah, A. Pratiwi, A. F. Zahra, S. Ulum, and A. Muchyidin, "Ethnomathematical Exploration of the Kelana Mask Dance in Cirebon, Indonesia: Geometric Concepts and Cultural Integration," *J. Math. Instr. Soc. Res. Opin.*, vol. 5, no. 1, pp. 241–255, 2026.

[17] E. Endilina, N. Mariana, E. B. Rahaju, and B. Purwoko, "Ethnomathematics in Traditional Indonesian Dance," *J. Innov. Res. Prim. Educ.*, vol. 4, no. 4, pp. 2992–3001, Oct. 2025, doi: 10.56916/jirpe.v4i4.1871.

[18] Y. Zhao, "Teaching traditional Yao dance in the digital environment: Forms of managing subcultural forms of cultural capital in the practice of local creative industries," *Technol. Soc.*, vol. 69, p. 101943, May 2022, doi: 10.1016/j.techsoc.2022.101943.

[19] D. Habsary, N. K. Adzan, and I. Bulan, "Analysis of the Movements in Sige Penguteng Dance Using Labanotation: Benefits and Challenges in Documenting Traditional Dance," *ICSIGER- Int. Conf. Sci. Emerg. Technol.*, vol. 1, no. 1, pp. 101–106, 2025.

[20] D. E. Trisnawati, J. Masunah, and Y. Kasmahidayat, *Changes in the Form of the Sige Penguteng Dance at Sanggar Khatua Menangsi Lampung Selatan*. Atlantis Press SARL, 2024. doi: 10.2991/978-2-38476-100-5_16.

[21] K. I. Sulastuti *et al.*, "A Javanese Dance is A Representation of Rasa in Javanese Culture," *Mudra J. Seni Budaya*, vol. 39, no. 4, pp. 481–493, Oct. 2024, doi: 10.31091/mudra.v39i4.2798.

[22] G. B. Ege and E. Omuris, "Latin dance: a socio-cultural exploration of body and dance," *J. Interdiscip. Art Educ.*, vol. 5, no. 3, pp. 175–183, 2024, [Online]. Available: <https://dergipark.org.tr/en/pub/jiae/issue/87184/1524572>

[23] V. D. Agustino, I. Farahsanti, and E. Praisetyaningsih, "Exploration of Ethnomathematics in Roro Ngigel Dance: Representation of Motion and Pattern in Mathematics," *Absis Math. Educ. J.*, vol. 7, no. 2, pp. 108–117, Dec. 2025, doi: 10.32585/absis.v7i2.7798.

[24] S. Pangestuti, R. C. I. Prahmana, and F. A. Fran, "Unlocking mathematical marvels: Exploring number patterns in the Rangku Alu traditional game," *J. Elem.*, vol. 10, no. 2, pp. 441–458, Jun. 2024, doi: 10.29408/jel.v10i2.25621.

[25] D. Dezfoolian and A. Nemati, "From Playground to Cultural Ground: The Youth-Driven Revival of Traditional Iranian Games for Intangible Cultural Heritage Preservation," *Museum Int.*, vol. 77, no. 1–2, pp. 118–131, Jan. 2025, doi: 10.1080/13500775.2025.2540217.

[26] B. B. F. Resi, F. A. Nay, W. Ellissi, and M. E. Bria, "Mathematical Literacy through Local Wisdom: A Literature Review on Ethnomathematics Representations in Textbooks and Teaching Modules," *EduMatSains J. Pendidik. Mat. dan Sains*, vol. 10, no. 1, pp. 235–244, 2025.

[27] D. Setiyadi, Zaenuri, and Trimurtini, "Trends in Ethnomathematics Research Through Traditional Dance for Primary Mathematics Education: A Bibliometric Analysis," *Proc. Int. Conf. Sci. Educ. Technol.*, vol. 11, pp. 46–56, 2025.

[28] R. M. Hariastuti, U. Negeri, S. Universitas, and P. Banyuwangi, "Indonesian traditional dance: ethnomathematics on culture as a basis of learning mathematics in elementary schools," *İlköğretim Online*, vol. 20, no. 1, pp. 936–947, 2021, doi: 10.17051/ilkonline.2021.01.90.

[29] A. H. Abdullah *et al.*, "The Impact of Ethnomathematics Activities Using Zapin and Kuda Kepang Dances on Students' Academic Achievement and Appreciation of Isometric Transformations," *J. Pendidik. Mat.*, vol. 19, no. 2, pp. 299–322, Apr. 2025, doi: 10.22342/mej.v19i2.pp299-322.

[30] B. Ma, "Application of Deep Learning in the Restoration and Design of Traditional Dance Movements," *Int. J. High Speed Electron. Syst.*, vol. 2540721, pp. 1–35, 2025, doi: 10.1142/s0129156425407211.

[31] Y. M. S. Suárez and M. M. González, "Curricular Integration of Mathematics and Dance to Improve Geometric Reasoning in Secondary School Students," *Rev. Gestão Soc. e Ambient.*, vol. 19, no. 1, pp. 1–41, 2025, doi: 10.24857/rgsa.v19n1-102.

[32] J. Song and L. Ding, "Reconstructing dance movements using a mathematical model based on optimized nature-inspired machine learning," *Artif. Intell. Rev.*, vol. 58, no. 5, p. 147, Feb. 2025, doi: 10.1007/s10462-025-11142-9.

[33] M. Firdaus and A. A. Nasution, "Integrating Mathematics, Community, Culture, and Place: A Conceptual Framework for Instructional Design," *J. Educ. Teaching, Learn.*, vol. 8, no. 2, pp. 249–260, 2023.

[34] R. N. Mendoza, I. Dewi, and E. Simamora, "Philosophy-Infused Culture-Based Learning Models In Mathematics Education," *Mathline J. Mat. dan Pendidik. Mat.*, vol. 9, no. 1, pp. 47–62, Jan. 2024, doi: 10.31943/mathline.v9i1.562.

[35] Ruslin, S. Mashuri, M. Raslak, and F. Alhabysi, "Semi-structured Interview: A Methodological Reflection on the Development of a Qualitative Research Instrument in Educational Studies," *IOSR J. Res. Method Educ.*, vol. 12, no. 1, pp. 22–29, 2022, doi: 10.9790/7388-1201052229.

[36] H. R. Ganesha and P. S. Aithal, "How to Choose an Appropriate Research Data Collection Method and Method Choice Among Various Research Data Collection Methods and Method Choices During Ph.D. Program in India?," *Int. J. Manag. Technol. Soc. Sci.*, vol. 7, no. 2, pp. 455–489, 2022, doi: 10.47992/ijmts.2581.6012.0233.

[37] S. P. Chand, "Methods of Data Collection in Qualitative Research: Interviews, Focus Groups, Observations, and Document Analysis," *Adv. Educ. Res. Eval.*, vol. 6, no. 1, pp. 303–317, 2025, doi: 10.25082/aere.2025.01.001.

[38] B. Akkaya, "Grounded Theory Approaches: A Comprehensive Examination of Systematic Design Data Coding," *Int. J. Contemp. Educ. Res.*, vol. 10, no. 1, pp. 89–103, Mar. 2023, doi: 10.33200/ijcer.1188910.

[39] D. Habsary and M. B. T. Sampurno, "Negotiation of Aesthetic Habits, Cultural Symbols, and Identity of Lampung Culture," *Aisthesis*, vol. 17, no. 1, pp. 155–169, 2024, doi: 10.7413/2035-8466011.

[40] N. Dahal *et al.*, "Participant selection procedures in qualitative research: experiences and some points for consideration," *Front. Res. Metrics Anal.*, vol. 9, pp. 1–13, 2024, doi: 10.3389/frma.2024.1512747.

[41] T. Asefa, W. Tesfaye, G. Bitew, and H. Tezera, "Lived experiences of dysphagia-related quality of life among esophageal cancer patients: a qualitative study," *Health Qual. Life Outcomes*, vol. 23, no. 1, p. 2, Jan. 2025, doi: 10.1186/s12955-

024-02319-x.

[42] O. Tajik, J. Golzar, and S. Noor, "Research Education Non-empirical Article: Purposive Sampling," *Int. J. Educ. Lang. Stud.*, vol. 2, no. 2, pp. 1–9, 2024.

[43] P. Cash, O. Isaksson, A. Maier, and J. Summers, "Sampling in design research: Eight key considerations," *Des. Stud.*, vol. 78, p. 101077, 2022, doi: 10.1016/j.destud.2021.101077.

[44] A. Almusaed, A. Almissad, and I. Yitmen, "Qualitative Data Collection and Management," in *Practice of Research Methodology in Civil Engineering and Architecture*, Cham: Springer Nature Switzerland, 2025, pp. 417–454. doi: 10.1007/978-3-031-97393-2_13.

[45] M. S. Charli, S. K. Eshete, and K. L. Debela, "Learning How Research Design Methods Work: A Review of Creswell's Research Design: Qualitative, Quantitative and Mixed Methods Approaches," *Qual. Rep.*, vol. 27, no. 12, pp. 2956–2960, Jan. 2022, doi: 10.46743/2160-3715/2022.5901.

[46] D. Anggraeni, S. Mustoip, and H. Hanifah, "Analysis of Student Social Interaction in the Salted Egg Making Project in Elementary Schools," *EduBase J. Basic ...*, vol. 5, no. 2, pp. 163–167, 2024, [Online]. Available: <https://jurnal.uibbc.ac.id/index.php/edubase/article/view/2879%0Ahttps://jurnal.uibbc.ac.id/index.php/edubase/article/download/2879/1210>

[47] C. W. Hoerudin, S. Syafruddin, A. Mayasari, O. Arifudin, and S. Lestari, "E-Learning as A Learning Media Innovation Islamic Education," *QALAMUNA J. Pendidikan, Sos. dan Agama*, vol. 15, no. 1, pp. 723–734, 2023, doi: 10.37680/qalamuna.v15i1.4466.

[48] C. B. Uwamusi and A. Ajisebiyawo, "Participant observation as research methodology: Assessing the validity of qualitative observational data as research tools," *Asian J. Soc. Sci. Manag. Technol. ISSN*, vol. 5, no. 3, pp. 19–32, 2023.

[49] J. Seim, "Participant Observation, Observant Participation, and Hybrid Ethnography," *Sociol. Methods Res.*, vol. 53, no. 1, pp. 121–152, Feb. 2024, doi: 10.1177/0049124120986209.

[50] F. N. Damayanti, "The Creative Process and Melodic Structure Analysis of Mahalini's Song Sial, Mawang's Version," *Repert. J.*, vol. 6, no. 2, pp. 269–277, 2026.

[51] R. Rosialani, Muhammad Ridwan Caesar, Edi Iskandar, and Iin Endah Setyawati, "Evaluation of Public Policy on Street Children (Case Study of the Bandung City Social Services Agency)," *Soc. Impact J.*, vol. 4, no. 2, pp. 211–219, 2025, doi: 10.61391/sij.v4i2.261.

[52] H. Taheroost, "How to Conduct an Effective Interview; A Guide to Interview Design in Research Study (Zaidan)," *Int. J. Acad. Res. Manag.*, vol. 11, no. 1, pp. 39–51, 2022, [Online]. Available: www.elredit.com

[53] M. N. Laryeafo and O. C. Ogbewe, "Ethical consideration dilemma: systematic review of ethics in qualitative data collection through interviews," *J. Ethics Entrep. Technol.*, vol. 3, no. 2, pp. 94–110, Dec. 2023, doi: 10.1108/JEET-09-2022-0014.

[54] R. Shadiev, X. Chen, B. L. Reynolds, Y. Song, and F. Altinay, "Facilitating cognitive development and addressing stereotypes with a cross-cultural learning activity supported by interactive 360-degree video technology," *Br. J. Educ. Technol.*, vol. 55, no. 6, pp. 2668–2696, Nov. 2024, doi: 10.1111/bjet.13461.

[55] M. Zarei, S. Mojarrab, L. Bazrafkan, and N. Shokrpour, "The role of continuing medical education programs in promoting iranian nurses, competency toward non-communicable diseases, a qualitative content analysis study," *BMC Med. Educ.*, vol. 22, no. 1, p. 731, Oct. 2022, doi: 10.1186/s12909-022-03804-x.

[56] I. Agustina, L. A. Siregar, D. L. Husain, A. Asfahani, and P. Pahmi, "Utilization of Digital Technology in Children's Education to Enhance Creative and Interactive Learning," *J. Educ. Soc. Cult.*, vol. 10, no. 2, p. 2023, 2023, doi: 10.32505/tarbawi.v10i2.6970.

[57] A. Mayasari, O. Arifudin, S. Herawati, A. Rosanti, and R. A. Prayogi, "Optimizing Student Management to Improve Educational Service Quality: A Qualitative Case Study in Integrated Islamic Elementary Schools," *EDUKASIA J. Pendidik. dan Pembelajaran*, vol. 5, no. 2, pp. 799–808, 2024, doi: 10.62775/edukasia.v5i2.1965.

[58] E. Crosina, M. Mismetti, A. De Massis, M. G. Pratt, and T. A. Williams, "Ethnography in Entrepreneurship Research: Promises, Pitfalls, and Practical Pathways," *Entrep. Theory Pract.*, vol. 49, no. 6, pp. 1499–1534, Nov. 2025, doi: 10.1177/10422587251364820.

[59] P. J. Shannon, L. Soltani, and E. Sugrue, "Exploring the use of focused ethnography in social work research: A scoping review," *Qual. Soc. Work*, vol. 23, no. 5, pp. 777–796, Sep. 2024, doi: 10.1177/14733250231214199.

[60] J. Kanazawa *et al.*, "Ethical and practical considerations for HIV cure-related research at the end-of-life: a qualitative interview and focus group study in the United States," *BMC Med. Ethics*, vol. 23, no. 1, p. 2, Dec. 2022, doi: 10.1186/s12910-022-00741-8.

[61] H. Wondimu and A. Kebede, "Cultural, economic, and symbolic value of the enset crop in Sebat-Bet Guraghe, Southwest Ethiopia: a qualitative study," *Humanit. Soc. Sci. Commun.*, vol. 9, no. 1, pp. 1–11, 2022, doi: 10.1057/s41599-022-01179-4.

[62] Y. Gan, D. Li, N. Robinson, and J. Liu, "Practical guidance on bibliometric analysis and mapping knowledge domains methodology – A summary," *Eur. J. Integr. Med.*, vol. 56, p. 102203, Dec. 2022, doi: 10.1016/j.eujim.2022.102203.

[63] I. Passas, "Bibliometric Analysis: The Main Steps," *Encyclopedia*, vol. 4, no. 2, pp. 1014–1025, Jun. 2024, doi: 10.3390/encyclopedia4020065.

[64] S. Sukmawati, S. Sudarmin, and S. Salmia, "Development of Quality Instruments and Data Collection Techniques," *J. Pendidik. dan Pengajaran Guru Sekol. Dasar*, vol. 6, no. 1, pp. 119–124, 2023, doi: 10.55215/jppgusda.v6i1.7527.

[65] C. Wallwey and R. L. Kajfez, "Quantitative research artifacts as qualitative data collection techniques in a mixed methods research study," *Methods Psychol.*, vol. 8, p. 100115, Nov. 2023, doi: 10.1016/j.metip.2023.100115.

[66] B. T. Khoa, B. P. Hung, and M. H. Brahmi, "Qualitative research in social sciences: data collection, data analysis and report writing," *Int. J. Public Sect. Perform. Manag.*, vol. 12, no. 1/2, pp. 187–209, 2023, doi: 10.1504/IJPSPM.2023.132247.

[67] S. Bhalla, N. Bahar, and K. Kanapathy, "Pre-testing Semi-structured Interview Questions Using Expert Review and

Cognitive Interview Methods," *Int. J. Bus. Manag.*, vol. 7, no. 5, pp. 11–19, 2023, doi: 10.26666/rmp.ijbm.2023.5.2.

[68] H. Morgan, "Conducting a Qualitative Document Analysis," *Qual. Rep.*, vol. 27, no. 1, pp. 64–77, 2022, doi: 10.46743/2160-3715/2022.5044.

[69] I. Fitrianto and A. Saif, "The Role of Virtual Reality in Enhancing Experiential Learning: A Comparative Study of Traditional and Immersive Learning Environments," *Int. J. Post Axial Futur. Teach. Learn.*, vol. 2, no. 2, pp. 97–110, 2024, [Online]. Available: <https://journal.amorfati.id/index.php/postaxial/article/view/300>

[70] L. S. Asipi, U. Rosalina, and D. Nopiyadi, "The Analysis of Reading Habits Using Miles and Huberman Interactive Model to Empower Students' Literacy at IPB Cirebon," *Int. J. Educ. Humanit.*, vol. 2, no. 3, pp. 117–125, Aug. 2022, doi: 10.58557/ijeh.v2i3.98.

[71] G. Marzi, M. Balzano, A. Caputo, and M. M. Pellegrini, "Guidelines for Bibliometric-Systematic Literature Reviews: 10 steps to combine analysis, synthesis and theory development," *Int. J. Manag. Rev.*, vol. 27, no. 1, pp. 81–103, Jan. 2025, doi: 10.1111/ijmr.12381.