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Ethnomathematics-Based Instructional Approaches Among Mathematics Instructors in Congressional District 1, Batangas Province

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Abstract

Mathematics is often perceived as abstract and disconnected from real-life contexts, resulting in low student engagement and performance. To address this issue, ethnomathematics has emerged as a culturally responsive approach that connects mathematical concepts to students' cultural experiences and everyday practices. This study determined the level of awareness and extent of utilization of ethnomathematics-based instructional approaches among Mathematics instructors in Congressional District I, Batangas Province, and identified the challenges encountered in its implementation.

A descriptive-correlational research design was employed, involving 115 instructors selected through stratified random sampling. Data were collected using a validated researcher-made questionnaire, supported by focus group discussions, and analyzed using frequency, weighted mean, ranking, and Pearson's r through SPSS. Results revealed a high level of awareness across practical (M = 3.74), social (M = 3.77), and cultural (M = 3.83) dimensions, along with a high extent of utilization in content coverage (M = 3.62) and teaching quality (M = 3.66).

Significant positive relationships were found between awareness and utilization, particularly in the social dimension, which showed a strong relationship with content coverage ($r = 0.552$, $p < .001$) and moderate relationships with teaching quality and assessment practices. The practical dimension also demonstrated significant moderate relationships, while the cultural dimension yielded mixed results, including a non-significant relationship with content coverage ($r = 0.171$, $p = .068$).

Despite these findings, moderate utilization in certain practices indicates a gap between awareness and implementation, with key challenges including curriculum alignment, limited resources, and insufficient training. In response, an Ethnomathematics Instructional Package (EIP) was developed to support instructors in integrating culturally responsive strategies, highlighting the need for strengthened instructional support and professional development.

Keywords: *ethnomathematics, instructional approaches, instructors' awareness, utilization, enrichment activities*

Online ISSN: 3082-5121
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https://journals.aloysianpublications.com
Volume 2 Issue 7 (2026)

Introduction

Mathematics is widely recognized as the universal language of science, technology, and innovation, serving as a foundation for logical reasoning, problem-solving, and analytical thinking across disciplines. In higher education, it plays an essential role in developing students' quantitative and critical-thinking skills necessary for academic success and informed decision-making. Despite its importance, Mathematics is often perceived as abstract and detached from real-world contexts, resulting in low motivation, poor performance, and negative attitudes among students. This highlights the need for instructional approaches that make Mathematics more meaningful, relevant, and connected to learners lived experiences.

One promising framework that addresses this concern is ethnomathematics, introduced by Ubiratan D'Ambrosio (2006). Ethnomathematics examines mathematical ideas embedded in cultural traditions, community practices, and indigenous knowledge systems. By situating abstract concepts within familiar cultural contexts, it enables learners to view Mathematics as both a scientific discipline and a culturally grounded human activity. Studies show that ethnomathematics enhances student engagement, conceptual understanding, and cultural appreciation by linking mathematical ideas to real-life experiences (Mania & Alam, 2021). However, its implementation remains limited due to challenges such as inadequate teacher preparation and weak curricular integration (Sunzuma & Maharaj, 2021).

In the Philippine context, despite rich cultural diversity, Mathematics instruction in many higher education institutions remains largely traditional and procedural, with minimal cultural integration. While Commission on Higher Education (CHED) policies (CMO No. 75, s. 2017; CMO No. 46, s. 2012) and the United Nations Sustainable Development Goals (SDG 4 and SDG 10) advocate for contextualized, inclusive, and culturally responsive education, classroom practices often fail to reflect these principles. Local studies, such as those involving Indigenous communities like the Kabihug Tribe, further demonstrate the potential of ethnomathematics in enriching instruction and promoting cultural appreciation (Alabat & Oledan, 2024). However, such practices remain underutilized due to limited training, lack of structured support, and insufficient instructional materials.

Within tertiary education, Mathematics instruction continues to prioritize procedural mastery, content coverage, and assessment preparation. While these approaches comply with curricular requirements, they often overlook opportunities to integrate students' cultural knowledge into learning experiences. Although some instructors are aware of ethnomathematics, many lack the pedagogical competence and institutional support needed to effectively apply it in instruction and assessment practices (Mabotja, 2024). This gap between awareness and actual utilization underscores the need to examine how ethnomathematics is integrated into teaching practices and to identify barriers to its implementation.

As a Mathematics instructor, it has been observed that there is minimal integration of local culture within the Mathematics curriculum, where instruction largely focuses on abstract concepts and procedural knowledge with little connection to students' cultural backgrounds, lived experiences, and indigenous practices. This lack of contextualization limits students' ability to recognize the relevance of Mathematics in their daily lives and communities. Moreover, existing instructional materials and teaching guides seldom incorporate culturally grounded examples, making it challenging for educators to meaningfully embed ethnomathematical perspectives in their lessons. This observed gap further reinforces the need to examine the extent of awareness and utilization of ethnomathematics-based instructional approaches among Mathematics instructors.

In response, this study aims to determine the level of awareness and extent of utilization of ethnomathematics-based instructional approaches among Mathematics instructors in Congressional District 1 of Batangas Province. Specifically, it seeks to answer the following research questions:

- How may the level of awareness of Mathematics instructors in ethnomathematics-based instructional approaches be assessed in terms of:
  - 1.1. practical dimension;
  - 1.2. social dimension; and
  - 1.3. cultural dimension?
- To what extent do Mathematics instructors utilize ethnomathematics-based instructional approaches relative to:
  - 2.1 content coverage;
  - 2.2 teaching quality; and
  - 2.3 assessment practices?
- Is there a significant relationship between the assessments on the level of awareness in ethnomathematics and on the extent of utilization of ethnomathematics-based instructional approaches?
- What challenges do Mathematics instructors encounter in the utilization of ethnomathematics-based instructional approaches?
- Based on the findings, what enrichment instructional activities may be proposed?

Methodology

Research Design

This study used a descriptive–correlational research design to examine the level of awareness of Mathematics instructors in ethnomathematics-based instructional approaches in terms of practical, social, and cultural dimensions, as well as their extent of utilization in terms of content coverage, teaching quality, and assessment practices. The correlational component determined the relationship between awareness and utilization. A validated researcher-made Likert-type questionnaire served as the main data-gathering instrument.

Participants

The respondents were 115 Mathematics instructors from higher education institutions in Congressional District I of Batangas Province, selected from a population of 162 using the Raosoft Sample Size Calculator with a 95% confidence level and 5% margin of error. A stratified random sampling technique with proportional allocation was used to ensure representation of all institutions involved.

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 7 (2026)

Instruments

The study used a validated researcher-made questionnaire, supplemented by a focus group discussion (FGD) guide to clarify and support quantitative findings. The questionnaire measured awareness, utilization, and challenges related to ethnomathematics-based instruction using a 4-point Likert scale. Content validity was ensured through expert validation by three mathematics education specialists. A pilot test involving 15 instructors was conducted, and reliability was established using Cronbach's alpha.

Procedure

Permission was secured from institutional heads prior to data collection. After approval, questionnaires were distributed personally and via Google Forms over two to three weeks. Informed consent was obtained, ensuring voluntary participation, confidentiality, and the right to withdraw. A focus group discussion was conducted with selected participants, audio-recorded with consent, transcribed, and used solely to support and validate survey results.

Data Analysis

Data were analyzed using SPSS. Frequency and percentage were used for profiling, weighted mean for awareness, utilization, and challenges, and ranking for indicator prioritization. Pearson Product-Moment Correlation Coefficient (Pearson r) was used to determine the relationship between awareness and utilization at a 0.05 level of significance. FGD data were used only for validation and triangulation of quantitative results.

Results

1. Level of Awareness of Mathematics Instructors in Ethnomathematics-based Instructional Approaches.

The following tables present the level of awareness among Mathematics instructors regarding ethnomathematics-based instructional approaches across practical, social, and cultural dimensions.

a. Practical Dimension

Table 1 presents the level of awareness of Mathematics instructors in the practical dimension of ethnomathematics-based instructional approaches.

Table 1
Level of Awareness in Ethnomathematics-based Instructional Approaches in terms of Practical Dimension

Indicators As Mathematics instructor, I am aware of how…	**WM**	**VI**
1. ethnomathematics provides contextual learning experiences that make abstract mathematics more meaningful.	3.97	HA
2. ethnomathematics-based instruction promotes practical and relevant	3.95	HA

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 7 (2026)

learning.		
3. using cultural contexts in teaching can develop students' critical thinking skills.	3.93	HA
4. indigenous systems of measurement and counting can be applied in mathematics instruction.	3.86	HA
5. ethnomathematics can be used to design meaningful and student-centered mathematics lessons.	3.84	HA
6. ethnomathematics connects mathematical concepts with real-life cultural practices.	3.72	HA
7. integrating cultural practices into lessons can enhance students' problem-solving skills.	3.71	HA
8. ethnomathematical activities can be integrated into lesson plans to contextualize instruction.	3.71	HA
9. community-based applications can enhance mathematics instruction.	3.71	HA
10. contextualized learning can enhance students' participation and comprehension in mathematics.	3.68	HA
11. local materials, patterns, and artifacts can be utilized in teaching mathematical concepts.	3.47	MA
12. culturally relevant examples can increase students' engagement and motivation in mathematics.	3.33	MA
Composite Mean	**3.74**	**HA**

Legend: Highly Aware: 3.50-4.00 (HA), Moderately Aware :2.50-3.49 (MA), Slightly Aware:1.50-2.49 (SA), Least Aware: 1.00-1.49(LA)

The results show that Mathematics instructors demonstrated a high level of awareness in the practical dimension, with a composite mean of 3.74 (Highly Aware [HA]). This indicates that respondents are highly aware of the use of ethnomathematics in connecting mathematical concepts to real-life and community-based contexts. Among the indicators, the highest mean was obtained for ethnomathematics providing contextual learning experiences that make abstract mathematics more meaningful (WM = 3.97, HA), followed by promoting practical and relevant learning (WM = 3.95, HA) and developing critical thinking through cultural contexts (WM = 3.93, HA). The lowest mean was observed in culturally relevant examples increasing students' engagement and motivation (WM = 3.33, Moderately Aware [MA]) and the use of local materials, patterns, and artifacts (WM = 3.47, MA). The Focus Group Discussion (FGD) revealed that participants observed improved student understanding when lessons are

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Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 7 (2026)

contextualized, although challenges were reported in identifying appropriate local materials and culturally relevant examples.

b. Social Dimension

Table 2 presents the level of awareness of Mathematics instructors in the social dimension of ethnomathematics-based instructional approaches.

Table 2
Level of Awareness in Ethnomathematics-based Instructional Approaches in terms of Social Dimension

Indicators As Mathematics instructor, I am aware of how…	**WM**	**VI**
1. ethnomathematics allows students to relate mathematics to their everyday social life.	3.96	HA
2. group work and collaborative tasks can enhance students' engagement in learning mathematics.	3.87	HA
3. community-oriented activities can develop students' teamwork and leadership skills.	3.87	HA
4. peer interaction can enhance students' mathematical communication and reasoning skills.	3.84	HA
5. collaboration in mathematics learning can be strengthened when lessons reflect real community practices.	3.83	HA
6. ethnomathematics can encourage active participation through culturally grounded group activities.	3.83	HA
7. including local social practices in teaching can foster inclusivity and a sense of belonging among students.	3.82	HA
8. students' social backgrounds can influence their understanding of mathematical concepts.	3.71	HA
9. ethnomathematics promotes cooperation and social interaction among students.	3.70	HA
10. mathematics learning can reflect social values and community collaboration.	3.63	HA
11. integrating social and community experiences can motivate students to learn mathematics.	3.58	HA
12. social learning through ethnomathematics can enhance participation and	3.57	HA

Online ISSN: 3082-5121
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https://journals.aloysianpublications.com
Volume 2 Issue 7 (2026)

shared discovery in mathematics.

Composite Mean	**3.77**	**HA**

Legend: Highly Aware: 3.50-4.00 (HA), Moderately Aware :2.50-3.49 (MA), Slightly Aware:1.50-2.49 (SA), Least Aware: 1.00-1.49(LA)

The social dimension obtained a composite mean of 3.77 (HA), indicating a high level of awareness among Mathematics instructors. The highest mean was observed for ethnomathematics allowing students to relate mathematics to their everyday social life (WM = 3.96, HA), followed by collaborative tasks enhancing engagement (WM = 3.87, HA) and community-oriented activities developing teamwork and leadership skills (WM = 3.87, HA). The lowest mean was observed in social learning enhancing participation and shared discovery (WM = 3.57, HA) and integrating social experiences to motivate learning (WM = 3.58, HA). FGD results indicated that participants frequently observed increased student engagement during collaborative activities, but sustaining structured social learning strategies across lessons remained a challenge.

c. Cultural Dimension

Table 3 presents the level of awareness of Mathematics instructors in the cultural dimension of ethnomathematics-based instructional approaches.

Table 3
Level of Awareness in Ethnomathematics-based Instructional Approaches in terms of Cultural Dimension

Indicators As Mathematics instructor, I am aware of how…	**WM**	**VI**
1. cultural contexts can provide meaningful foundations for mathematical instruction.	3.93	HA
2. local cultural games and crafts can be used to teach mathematical skills.	3.93	HA
3. integrating cultural contexts in teaching can enhance students' critical and creative thinking.	3.92	HA
4. incorporating cultural elements in mathematics teaching can strengthen students' cultural awareness and identity.	3.92	HA
5. mathematical concepts can be found in cultural traditions and indigenous practices.	3.90	HA
6. acknowledging students' cultural backgrounds can promote equitable learning opportunities.	3.83	HA
7. ethnomathematics promotes respect for cultural diversity and different ways	3.83	HA

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 7 (2026)

of mathematical thinking.		
8. cultural artifacts (e.g., weaving, patterns, and architecture) demonstrate mathematical ideas.	3.83	HA
9. cultural practices and traditions influence the development of mathematical knowledge.	3.83	HA
10. mathematics can serve as a tool for preserving and promoting culture.	3.82	HA
11. recognizing cultural heritage in teaching can promote appreciation of mathematics.	3.72	HA
12. teaching mathematics through culture can strengthen students' sense of identity and pride.	3.71	HA
COMPOSITE MEAN	**3.83**	**HA**

Legend: Highly Aware: 3.50-4.00 (HA), Moderately Aware :2.50-3.49 (MA), Slightly Aware:1.50-2.49 (SA), Least Aware: 1.00-1.49(LA)

The cultural dimension recorded a composite mean of 3.83 (HA), indicating a high level of awareness in integrating cultural contexts into mathematics instruction. The highest means were observed in cultural contexts providing foundations for instruction (WM = 3.93, HA) and the use of cultural games and crafts (WM = 3.93, HA). The lowest mean was observed in strengthening students' identity and pride through mathematics (WM = 3.71, HA) and recognizing cultural heritage in teaching (WM = 3.72, HA). FGD findings showed that participants observed increased learner interest when cultural elements are integrated, although identity-related outcomes were not consistently emphasized.

2. Utilization of Ethnomathematics-Based Instructional Approaches

The following tables present the extent of utilization of ethnomathematics-based instructional approaches among Mathematics instructors in terms of content coverage, teaching quality, and assessment practice.

a. Content Coverage

Table 4 below presents the extent of utilization of ethnomathematics-based instructional approaches in terms of content coverage.

Table 4
Extent of Utilization of Ethnomathematics-based Instructional Approaches in terms of Content Coverage

Indicators In my teaching, I…	**WM**	**VI**
1. use real-life community scenarios to illustrate mathematical concepts and	3.97	HU

applications.		
2. incorporate traditional games and local crafts as instructional examples.	3.73	HU
3. ensure instructional content reflects both curriculum standards and cultural relevance.	3.70	HU
4. consistently integrate culturally relevant examples in mathematics instruction.	3.70	HU
5. adapt instructional materials to reflect local culture and traditions.	3.62	HU
6. integrate ethnomathematical concepts across different mathematics topics.	3.62	HU
7. integrate cultural contexts and community-based situations in explaining mathematical concepts.	3.60	HU
8. embed mathematical ideas within cultural contexts in lesson content.	3.60	HU
9. relate mathematical topics to students' everyday cultural and community practices.	3.55	HU
10. include ethnomathematical examples when teaching mathematics lessons.	3.54	HU
11. modify lesson content to reflect students' cultural backgrounds and experiences.	3.46	MU
12. use indigenous systems of counting and measurement in relevant mathematics topics.	3.37	MU
Composite Mean	**3.62**	**HU**

Legend: Highly Utilized: 3.50-4.00 (HU), Moderately Utilized: 2.50-3.49 (MU), Slightly Utilized: 1.50-2.49 (SU), Least Utilized: 1.00-1.49(LU)

The extent of utilization in content coverage yielded a composite mean of 3.62 (Highly Utilized [HU]), indicating frequent integration of ethnomathematics-based approaches in instructional content. The highest mean was observed in using real-life community scenarios (WM = 3.97, HU), followed by incorporating traditional games and crafts (WM = 3.73, HU). The lowest mean was observed in the use of indigenous counting and measurement systems (WM = 3.37, Moderately Utilized [MU]) and adapting content based on cultural backgrounds (WM = 3.46, MU). FGD results revealed frequent use of real-life examples, while limited integration of indigenous systems was attributed to lack of familiarity and resource constraints.

b. Teaching Quality

Table 5 below presents the extent of utilization of ethnomathematics-based instructional approaches in terms of teaching quality.

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 7 (2026)

Table 5
Extent of Utilization of Ethnomathematics-based Instructional Approaches in terms of Teaching Quality

Indicators In my teaching, I…	**WM**	**VI**
1. facilitate discussions on the cultural roots of mathematical ideas.	3.87	HU
2. facilitate collaborative learning activities that promote cultural exchange of mathematical ideas.	3.83	HU
3. promote active participation through culturally meaningful learning tasks.	3.77	HU
4. employ interactive strategies that connect mathematics to students' cultural experiences.	3.75	HU
5. use hands-on and collaborative activities reflecting community practices.	3.70	HU
6. reflect on instructional practices to ensure cultural responsiveness.	3.67	HU
7. guide students in exploring relationships between culture and mathematics.	3.63	HU
8. adapt teaching strategies to accommodate diverse cultural learning styles.	3.62	HU
9. use culturally relevant examples to facilitate explanation and discussion of mathematical concepts.	3.62	HU
10. encourage students to share mathematical ideas based on their cultural backgrounds.	3.61	HU
11. use storytelling and cultural narratives in teaching mathematics.	3.49	MU
12. use questioning techniques linking mathematics concepts with cultural applications.	3.37	MU
Composite Mean	**3.66**	**HU**

Legend: Highly Utilized: 3.50-4.00 (HU), Moderately Utilized: 2.50-3.49 (MU), Slightly Utilized: 1.50-2.49 (SU), Least Utilized: 1.00-1.49(LU)

Teaching quality obtained a composite mean of 3.66 (HU), indicating high utilization of ethnomathematics-based instructional strategies. The highest mean was recorded in facilitating discussions on the cultural roots of mathematics (WM = 3.87, HU). The lowest means were observed in questioning techniques linking mathematics and culture (WM = 3.37, MU) and storytelling approaches in instruction (WM = 3.49, MU). FGD findings indicated frequent use of collaborative learning strategies, while challenges were reported in designing culturally grounded questions and integrating storytelling in abstract mathematical topics.

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 7 (2026)

c. Assessment Practices

Table 6 below presents the extent of utilization of ethnomathematics-based instructional approaches in terms of assessment practices.

Table 6
Extent of Utilization of Ethnomathematics-based Instructional Approaches in terms of Teaching Quality

Indicators In my teaching, I…	**WM**	**VI**
1. design assessment tasks that promote creativity and cultural expression in solving mathematical problems.	3.83	HU
2. align assessment activities with both curriculum standards and culturally relevant contexts.	3.83	HU
3. include group-based assessments that reflect community collaboration and practices.	3.72	HU
4. use project-based assessments that integrate ethnomathematical concepts.	3.71	HU
5. provide opportunities for students to explain mathematical ideas using cultural references.	3.70	HU
6. design assessment tasks that incorporate real-life cultural and community contexts.	3.64	HU
7. use culturally relevant examples in quizzes, tests, and classroom exercises.	3.62	HU
8. assess students' understanding through performance tasks based on cultural practices.	3.60	HU
9. allow students to demonstrate mathematical understanding using indigenous or local methods.	3.59	HU
10. take into account students' cultural background when interpreting and making decisions based on assessment results.	3.49	MU
11. use alternative assessment methods (e.g., portfolios, performances, or demonstrations) grounded in cultural contexts.	3.49	MU
12. evaluate students' ability to apply mathematics in culturally meaningful situations.	3.30	MU
Composite Mean	**3.63**	**HU**

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal
of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 7 (2026)

Legend: Highly Utilized: 3.50-4.00 (HU), Moderately Utilized: 2.50-3.49 (MU), Slightly Utilized: 1.50-2.49 (SU), Least Utilized: 1.00-1.49(LU)

Assessment practices obtained a composite mean of 3.63 (HU), indicating high utilization of ethnomathematics-based approaches in evaluation. The highest means were observed in designing culturally grounded creative assessments (WM = 3.83, HU) and aligning assessments with curriculum and cultural contexts (WM = 3.83, HU). The lowest mean was observed in assessing students' application of mathematics in cultural contexts (WM = 3.30, MU) and the use of alternative assessment methods (WM = 3.49, MU). FGD results showed that while performance-based assessments are used, difficulties remain in evaluating culturally contextualized mathematical application.

3. Relationship Between the Assessed Level of Awareness and the Extent of Utilization of Ethnomathematics-Based Instructional Approaches

The table below shows the relationship between Mathematics instructors' levels of awareness across the practical, social, and cultural dimensions and the extent to which they utilize ethnomathematics-based instructional approaches.

a. Practical Dimension and Extent of Utilization of Ethnomathematics-Based Instructional Approaches

Table 7 presents the relationship between the practical dimension and the extent of utilization of ethnomathematics-based instructional approaches across three key areas: content coverage, teaching quality, and assessment practices.

Table 7
Relationship Between Practical Dimension and Extent of Utilization of Ethnomathematics-Based Instructional Approaches

Variables	r-values	p-values	Interpretation	Decision on Ho	Verbal Interpretation
Content Coverage	0.388	0.000	Moderate positive relationship	Reject H_o	Significant
Teaching Quality	0.245	0.008	Weak positive relationship	Reject H_o	Significant
Assessment Practices	0.306	0.001	Moderate positive relationship	Reject H_o	Significant

Legend: Coefficient of correlation (r): $\pm$1.0 (Perfect relationship), $\pm$.76 to .99 (Very Strong relationship), $\pm$.51 to .75 (Strong relationship), $\pm$.26-.50 (Moderate Relationship, $\pm$.11 to .25 (Weak relationship), $\pm$.01 to .10 (Very weak relationship), .00 (No relationship)

The results revealed that all computed p-values were less than the 0.05 level of significance (p = 0.000, 0.008, and 0.001), indicating that all relationships are statistically significant. Thus, the null hypothesis was rejected across all variables.

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 7 (2026)

For content coverage, a moderate positive correlation was obtained (r = 0.388, p = 0.000), indicating that higher practical awareness is associated with greater integration of ethnomathematical concepts in instructional content. This relationship is statistically significant.

For teaching quality, a weak positive correlation was observed (r = 0.245, p = 0.008), suggesting that practical awareness has a positive but relatively limited association with instructional delivery practices. Despite the weaker magnitude, the relationship remains statistically significant.

For assessment practices, a moderate positive correlation was identified (r = 0.306, p = 0.001), indicating that increased practical awareness corresponds to more frequent use of ethnomathematics-based assessment strategies. This relationship is also statistically significant.

Overall, the findings show that the practical dimension is significantly associated with all domains of utilization, with the strongest relationship observed in content coverage.

b. Social Dimension and Extent of Utilization of Ethnomathematics-Based Instructional Approaches

Table 8 presents the relationship between the social dimension and the utilization of ethnomathematics-based instructional approaches in terms of content coverage, teaching quality, and assessment practices.

Table 8
Relationship Between Social Dimension and Extent of Utilization of Ethnomathematics-Based Instructional Approaches

Variables	r-values	p-values	Interpretation	Decision on Ho	Verbal Interpretation
Content Coverage	0.552	0.000	Strong positive relationship	Reject Ho	Significant
Teaching Quality	0.270	0.004	Moderate positive relationship	Reject Ho	Significant
Assessment Practices	0.379	0.000	Moderate positive relationship	Reject Ho	Significant

Legend: Coefficient of correlation (r): ±1.0 (Perfect relationship), ±.76 to .99 (Very Strong relationship), ±.51 to .75 (Strong relationship), ±.26-.50 (Moderate Relationship, ±.11 to .25 (Weak relationship), ±.01 to .10 (Very weak relationship), .00 (No relationship)

All computed p-values were below the 0.05 level of significance (p = 0.000, 0.004, and 0.000), indicating statistically significant relationships across all variables. Hence, the null hypothesis was rejected.

For content coverage, a strong positive correlation was obtained (r = 0.552, p = 0.000), indicating that higher social awareness is strongly associated with increased integration of ethnomathematical concepts in lesson content.

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal
of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 7 (2026)

For teaching quality, a moderate positive correlation was found (r = 0.270, p = 0.004), indicating a statistically significant but relatively weaker association between social awareness and instructional delivery practices.

For assessment practices, a moderate positive correlation was also observed (r = 0.379, p = 0.000), suggesting that social awareness contributes to the development of culturally responsive assessment strategies.

Overall, the social dimension demonstrated significant relationships across all utilization indicators, with the strongest effect observed in content coverage.

c. Cultural Dimension and Extent of Utilization of Ethnomathematics-Based Instructional Approaches

Table 9 presents the relationship between the cultural dimension and the extent of utilization of ethnomathematics-based instructional approaches in terms of content coverage, teaching quality, and assessment practices.

The results show mixed levels of statistical significance. For teaching quality (p = 0.035) and assessment practices (p = 0.000), the p-values are below 0.05, indicating significant relationships and leading to the rejection of the null hypothesis. However, for content coverage (p = 0.068), the relationship is not statistically significant; thus, the null hypothesis is not rejected.

Table 9
Relationship Between Cultural Dimension and Extent of Utilization of Ethnomathematics-Based Instructional Approaches

Variables	r-values	p-values	Interpretation	Decision on Ho	Verbal Interpretation
Content Coverage	0.171	0.068	Weak positive relationship	Failed to Reject Ho	Not Significant
Teaching Quality	0.197	0.035	Weak positive relationship	Reject Ho	Significant
Assessment Practices	0.326	0.000	Moderate positive relationship	Reject Ho	Significant

Legend: Coefficient of correlation (r): ±1.0 (Perfect relationship), ±.76 to .99 (Very Strong relationship), ±.51 to .75 (Strong relationship), ±.26-.50 (Moderate Relationship, ±.11 to .25 (Weak relationship), ±.01 to .10 (Very weak relationship), .00 (No relationship)

For content coverage, a weak positive correlation was observed (r = 0.171, p = 0.068), indicating a non-significant relationship between cultural awareness and integration of ethnomathematical content in lessons.

For teaching quality, a weak but significant positive correlation was found (r = 0.197, p = 0.035), suggesting that cultural awareness has a slight influence on instructional delivery practices.

Online ISSN: 3082-5121
Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 2 Issue 7 (2026)

For assessment practices, a moderate positive correlation was obtained (r = 0.326, p = 0.000), indicating a statistically significant relationship between cultural awareness and the use of culturally responsive assessment strategies.

Overall, the cultural dimension showed a mixed pattern of influence, with the strongest and most significant relationship observed in assessment practices, followed by teaching quality, while content coverage was not statistically significant.

4. Challenges Encountered by Mathematics Instructors

Table 10 shows the challenges encountered by the Mathematics in utilizing ethnomathematics-based instructional approaches. The composite mean of 3.41, interpreted as Agree (A), indicates that instructors generally experience notable challenges in implementing ethnomathematics in classroom practice. This suggests that although instructors are able to apply ethnomathematics-based approaches to some extent, several constraints limit their consistent and effective integration. These challenges are primarily associated with curriculum alignment, assessment demands, instructional resources, teacher preparedness, and contextual adaptability.

Among the indicators, the most prominent challenge identified was the difficulty in aligning ethnomathematics-based activities with standardized assessment requirements and evaluation criteria (WM = 3.71, SA). This indicates that instructors strongly agree that integrating culturally grounded activities within formal assessment frameworks is difficult. Similarly, challenges related to alignment with the prescribed mathematics curriculum (WM = 3.62, SA) and concerns regarding academic rigor and relevance (WM = 3.62, SA) were also rated as strongly agreed upon, suggesting that institutional and curricular expectations present significant barriers to implementation. The difficulty in integrating local cultural practices with formal mathematical content (WM = 3.57, SA) and the lack of adequate training or professional development (WM = 3.50, SA) further highlight structural and capacity-related constraints.

Table 10
Challenges Encountered by Mathematics Instructors

Indicators *In my teaching, I…*	**WM**	**VI**
1. I experienced difficulty in aligning ethnomathematics-based activities with standardized assessment requirements and evaluation criteria.	3.71	SA
2. I encountered difficulties in aligning ethnomathematics-based activities with the prescribed mathematics curriculum.	3.62	SA
3. I perceived concerns regarding the academic rigor and relevance of ethnomathematics in mathematics instruction.	3.62	SA
4. I experienced challenges in integrating local cultural practices with formal mathematics content.	3.57	SA
5. I had not undergone adequate training or professional development related to	3.50	SA

ethnomathematics-based instruction.		
6. I experienced difficulty in adapting ethnomathematics-based instruction to diverse classroom contexts and learner needs.	3.47	A
7. I had insufficient access to instructional materials and resources grounded in local cultural contexts.	3.45	A
8. I was constrained by limited instructional time when implementing ethnomathematics-based lessons.	3.44	A
9. I possessed limited knowledge and understanding of ethnomathematics concepts required for instructional use.	3.33	A
10. I observed minimal support or unfavorable attitudes toward ethnomathematics-based instruction within my professional environment.	3.24	A
11. I was restricted by curriculum completion requirements, which reduced opportunities for culturally contextualized activities.	3.00	A
12. I had limited familiarity with the indigenous cultural practices necessary for effective ethnomathematics integration.	2.97	A
Composite Mean	**3.41**	**A**

Legend: Strongly Agree: 3.50-4.00 (SA), Agree: 2.50-3.49 (A), Disagree: 1.50-2.49 (D), Strongly Disagree: 1.00-1.49(SD)

Moderate challenges were also observed in areas such as adapting ethnomathematics-based instruction to diverse classroom contexts (WM = 3.47, A), limited access to culturally grounded instructional materials (WM = 3.45, A), and time constraints in implementing contextualized lessons (WM = 3.44, A). In addition, instructors reported limited knowledge of ethnomathematics concepts (WM = 3.33, A) and minimal institutional support or unfavorable professional attitudes (WM = 3.24, A), indicating that both individual and organizational factors affect implementation.

The least reported challenges were restricted opportunities due to curriculum completion requirements (WM = 3.00, A) and limited familiarity with indigenous cultural practices (WM = 2.97, A). Although these obtained relatively lower mean values, they are still interpreted as existing challenges, suggesting that gaps in cultural knowledge and contextual familiarity remain present but are less critical compared to structural constraints.

The results of the focus group discussion (FGD) support these quantitative findings. Participants emphasized that strict curriculum requirements and standardized assessment expectations significantly limit their ability to consistently integrate ethnomathematics into instruction. They also reported difficulty in identifying appropriate cultural examples and materials, particularly for abstract mathematical topics. However, participants noted that while familiarity with cultural practices can be developed over time, aligning ethnomathematics with formal curriculum and assessment systems remains the most pressing challenge.

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5. Proposed Enrichment Instructional Activities

The proposed intervention, the Ethnomathematics Instructional Package (EIP), is developed in response to identified gaps between instructors' high awareness and the challenges in applying ethnomathematics in practice. These challenges include integrating cultural contexts, aligning with curriculum requirements, and designing appropriate instructional and assessment strategies.

The EIP serves as a structured instructional guide featuring culturally responsive lesson frameworks, real-life learning activities, and performance-based assessment tools. It is designed to support instructors in translating their understanding of ethnomathematics into consistent and effective classroom implementation across Mathematics subjects.

The goal is to enhance Mathematics instruction by making it more contextualized, meaningful, and culturally responsive, ultimately improving teaching effectiveness, student engagement, and learning outcomes.

Discussion

The findings indicate that Mathematics instructors demonstrate a high level of awareness and utilization of ethnomathematics-based instructional approaches across practical, social, and cultural dimensions. This suggests that instructors recognize the importance of contextualizing mathematical concepts through real-life, cultural, and community-based experiences. However, despite this strong awareness, the results also reveal persistent challenges in implementation, particularly in aligning ethnomathematics with curriculum requirements, standardized assessment systems, and instructional design. This reflects a gap between conceptual understanding and consistent classroom practice.

The significant relationships between awareness and utilization further show that increased awareness contributes to greater application of ethnomathematics, particularly in content coverage and assessment practices. Notably, the social dimension exhibited the strongest relationship, indicating that socially grounded approaches play a crucial role in facilitating implementation. This supports the view of Sugiman et al. (2025) that ethnomathematics is inherently embedded in social systems and is strengthened through interaction and collaboration. In contrast, the cultural dimension showed weaker and inconsistent relationships, particularly in content coverage, suggesting that although instructors recognize cultural relevance, its integration into structured lesson planning remains limited.

These findings are consistent with previous studies emphasizing the value of ethnomathematics in enhancing meaningful learning. As noted by Asante (2020), contextualized instruction enables learners to connect abstract mathematical concepts with familiar experiences, thereby improving comprehension. Similarly, Sunzuma et al. (2021) highlighted that integrating cultural elements enhances the relevance and applicability of mathematical knowledge. However, the challenges identified in this study—particularly in curriculum alignment and assessment practices—support the findings of Mania and Alam (2021), who reported that concerns regarding academic rigor and standardized evaluation often hinder the adoption of ethnomathematics. Furthermore, Nur et al. (2023) emphasized that the effectiveness of ethnomathematics depends on teachers' ability to meaningfully integrate cultural elements, which may be constrained by limited training and resources.

In terms of implications, the results highlight the need for targeted instructional and institutional support. The development of structured resources, such as the proposed Ethnomathematics Instructional Package (EIP), can help bridge the gap between awareness and practice by providing concrete lesson frameworks, culturally responsive strategies, and appropriate assessment tools. Additionally, the findings suggest the importance of professional development programs focused on enhancing teachers' competence in integrating ethnomathematics into curriculum and assessment. At the policy level, there is a need to promote flexibility in curriculum design and assessment systems, allowing educators to incorporate culturally grounded and context-based approaches more effectively.

Despite these contributions, the study has certain limitations. The reliance on self-reported data may introduce response bias, and the focus on a specific geographic area may limit the generalizability of the findings. Future research may consider incorporating observational or experimental methods, as well as expanding the scope to different educational contexts, to further validate and extend the results.

Conclusion

Based on the findings, the following conclusions were drawn:

1. Mathematics instructors demonstrate a high level of awareness of ethnomathematics-based instructional approaches; thus, continuous professional development programs should be implemented to further strengthen their competencies in culturally responsive teaching practices.
2. The high level of utilization of ethnomathematics-based instructional approaches suggests the need to sustain and enhance instructional practices through the validation, refinement, and adoption of the Ethnomathematics Instructional Package (EIP) as a supplementary teaching resource.
3. Since awareness significantly relates to the extent of utilization, higher education institutions should provide adequate instructional support, including culturally relevant materials, localized resources, and flexible curriculum implementation to reinforce this relationship.
4. The identified gap between awareness and implementation highlights the need for academic leaders and administrators to strengthen institutional support systems by integrating ethnomathematics into instructional supervision, evaluation, and faculty development programs.
5. Given the challenges in curriculum alignment, assessment practices, and cultural integration, targeted training programs should be conducted to address these specific concerns and effectively bridge the gap between awareness and practice in Mathematics instruction.

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