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Teachers' Perception of the Challenges Regarding the Integration of Ethnomathematics into Geometry Teaching in Secondary Schools in Port Harcourt Metropolis

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Abstract
The study adopted a descriptive survey research design. The target population of the study consisted of all mathematics teachers in secondary schools within the Port Harcourt metropolis. A stratified random sampling technique was used to determine the sample size. The stratum was based on mathematics teachers in public and private schools. Using the Krejcie and Morgan formula a sample size of 217 was obtained. Data were collected using a researcher-developed questionnaire titled Geometrical Challenges of Integrating Ethnomathematics (GCIE). The Cronbach Alpha Coefficient yielded a reliability of 0.76. Data were analyzed using mean and standard deviation. Findings revealed that for both public and private school the current geometry curriculum provides limited support for the integration of ethnomathematics in classroom teaching. Teachers' pedagogical content knowledge was found to influence the integration process, although gaps exist in training and lesson design skills. The study further revealed that policy and governance strategies have a very high potential to address the challenges of integrating ethnomathematics into geometry teaching. The study concludes that effective integration of ethnomathematics into geometry requires curriculum enhancement, improved teacher capacity building, and strong policy support. Therefore, the study recommendations that Education policy makers and government agencies should develop and implement clear policies that support the integration of ethnomathematics into geometry teaching

Keywords: Challenges, Integration, Ethnomathematics, Geometry, Teachers

Introduction

Every society has a culture and engages in mathematics practices. Ethnomathematics is a term coined by D' Ambrosio in 1990's. It is the study of the relationship between culture and mathematics practices. It emphasizes that mathematical knowledge is not separate from the cultural contexts of the society at large. It acknowledges that indigenous society with their different cultural groups have a valid mathematical ways of counting, recording, classifying and measuring before this present western education. Ethnomathematics therefore provides a framework for understanding how culturally embedded mathematical knowledge can be meaningfully integrated into formal school mathematics. The goal of ethnomathematics is to contribute both to the understanding of culture and mathematics. Enun and Thomas (2025) define ethnomathematics to be a term used to express the link between culture and school mathematics. Also, Fouze and Amit (2023) define ethnomathematical as an approach, in which instruction is based on the integration of cultural-educational elements that express mathematical values from the students' daily life. Geometry is one of the topics in mathematics that diagrams interrelate with culture and daily life.

The Syllabus of mathematics comprises of a number of topics such as algebra, matrices, statistics, vectors and geometry. Geometry draws connections to how geometric shapes and spatial reasoning are used in various cultural activities. By integrating ethnomathematical perspectives, educators can make geometry more relevant and engaging for students. The study of Abasi, Umo, George and George (2025) shows that, Geometry contributes

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to the overall poor performance in mathematics. Enun and Thomas (2025) study found that, most teachers agreed that ethnomathematics concepts could be effectively applied to primary school mathematics teaching. Batiibwe (2024) results imply that ethnomathematics can be used as a pedagogical, learning, or assessment method for teaching and learning mathematics in schools. Similarly, Mania and Alam (2021) findings showed that the ethnomathematics students can grab the lesson easily and with their own culture based instruction. Despite these potential benefits, the effectiveness of integrating ethnomathematics largely depends on teachers, who are responsible for translating curriculum intentions into classroom practice. Sunzuma and Maharaj (2019) study showed that teachers, who serve as the primary agents of mathematics curriculum implementation, often encounter difficulties in translating ethnomathematical ideas into classroom practice. The study of Kyeremeh, Awuah, & Orey, (2025) also showed that, the challenges of translating ethnomathematical include limited curriculum guidance on how cultural knowledge can be incorporated into geometry lessons, inadequate pedagogical training on ethnomathematics-based instructional strategies, insufficient teaching resources, and time constraints within an already overloaded curriculum.

In addition, some teachers lack confidence in identifying relevant cultural practices and aligning them with formal geometric concepts in ways that meet curriculum objectives (Mania & Alam, 2021; Khalil, 2023). This study therefore focuses on teachers' perceptions of the challenges associated with integrating ethnomathematics into geometry teaching in secondary schools within the Port Harcourt metropolis.

Statement of the Problem

Despite the increasing recognition of ethnomathematics as a culturally approach to mathematics education, its integration into geometry teaching remains limited in many secondary schools. Several studies have documented the benefits of ethnomathematics for enhancing students' understanding, interest, and achievement in mathematics (Batiibwe, 2024; Modesta & Anthony, 2021; Mania & Alam, 2021). However, empirical evidence suggests that the practical integration of ethnomathematics into geometry is constrained by curriculum inadequacies, limited teacher preparation, and weak policy implementation (Sunzuma & Maharaj, 2019; Khalil, 2023; Kyeremeh, Awuah & Orey, 2025). Although these studies provide valuable insights, very few have specifically examined teachers' perceptions of the challenges associated with integrating ethnomathematics into geometry teaching, particularly within private and public secondary schools teachers. Despite the rich cultural diversity within Port Harcourt metropolis that could support ethnomathematics-based instruction none of the identified studies were conducted within. This gap in literature necessitates an empirical investigation into teachers' perceptions of the challenges affecting the integration of ethnomathematics into geometry teaching in secondary schools in Port Harcourt metropolis.

Purpose of the Study

The purpose of this study is to examine the challenges associated the integration of ethnomathematics into geometry teaching within the Port Harcourt metropolis reflection. Specifically, the study seeks to determine:

1. The extent to which the current curriculum supports the integration of ethnomathematics in classroom teaching within the Port Harcourt metropolis.
2. The extent to which teachers' pedagogical content knowledge influences the integration of ethnomathematics into geometry teaching within the Port Harcourt metropolis.
3. The extent to which policy and governance strategies address the challenges of integrating ethnomathematics into geometry teaching within the Port Harcourt metropolis.

Research question

1. To what extent does the current curriculum support the integration of ethnomathematics in classroom teaching within the Port Harcourt metropolis?
2. To what extent does teachers' pedagogical content knowledge influence the integration of ethnomathematics into geometry teaching within the Port Harcourt metropolis?
3. To what extent can policy and governance strategies address the challenges of integrating ethnomathematics into geometry within the Port Harcourt metropolis?

Methodology

The study adopted a descriptive survey research design. This design was considered appropriate because it enables the systematic collection of quantitative data from a defined population in order to describe existing conditions, opinions, and perceptions as they occur naturally. The target population of the study consisted of all mathematics

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teachers in public and private secondary schools within the Port Harcourt metropolis because they are directly responsible for teaching geometry at the secondary school level and for implementing curriculum innovations, including ethnomathematics based instructional approaches, in the classroom. A stratified random sampling technique was used for the study. This was based on school type (public and private secondary schools) to ensure proportional representation of mathematics teachers from both categories. Using the Krejcie and Morgan (1970) sample size determination formula, a sample size of 217 mathematics teachers was drawn from the total population (see Appendix 2). Proportional allocation was applied to determine the number of teachers selected from public and private secondary schools based on their respective population sizes. Teachers within each stratum were then selected using simple random sampling.

Data was collected using a questionnaire titled "Geometrical Challenges of Integrating Ethnomathematics (GCIE)" questionnaire developed by the researcher. The instrument was designed in line with the objectives and research questions of the study. The questionnaire consisted of 15 items structured on a four-point Likert scale of Very High Extent (VHE), High Extent (HE), Low Extent (LE), and Very Low Extent (VLE). The questionnaire was divided into sections corresponding to the major variables of the study: curriculum support for integrating ethnomathematics into geometry, teachers' pedagogical content knowledge, and policy and governance strategies related to ethnomathematics integration. The GCIE questionnaire was subjected to face and content validity. Copies of the questionnaire were given to experts in mathematics education and measurement and evaluation, who assessed the clarity, relevance, and adequacy of the items in relation to the research objectives. Their comments and suggestions were used to refine the instrument before final administration. The reliability of the instrument was determined using the Cronbach Alpha reliability method. A pilot test was conducted using mathematics teachers outside the study area but with similar characteristics. The data obtained from the pilot study were analyzed using Cronbach's Alpha Reliability Coefficient which yielded a reliability of 0.76. Descriptive statistics, specifically mean and standard deviation was used to answer the research questions. The decision rule classified mean scores within the range of 1.00 – 1.49 as Very Low Extent, 1.50 – 2.49 as Low Extent (LE) and 2.50–3.49 as High Extent (HE), 3.50 – 4.00 as Very High Extent. The results were presented in tables for clarification.

Results

Research Question 1: To what extent does the geometry curriculum support the integration of ethnomathematics in classroom teaching?

Table 1: the extent to which the current curriculum support the integration of ethnomathematics in classroom teaching.

		Public N(129)			Private N(88)		
S/N	**Questionnaire Statement**	**Mean**	**Std**	**Remark**	**Mean**	**Std**	**Remark**
1	The geometry curriculum does not explicitly includes cultural examples.	2.57	1.179	**HE**	2.50	1.27	**HE**
2	The curriculum provides opportunities for teachers to adapt local cultural practices into geometry lessons.	2.30	1.235	**LE**	2.38	1.32	**LE**
3	Curriculum materials (textbooks, guides) contain few examples of culture that support geometry teaching.	2.53	1.198	**HE**	2.56	1.23	**HE**
4	The curriculum adequately prepares students to connect mathematical concepts with real-life cultural practices.	2.29	1.238	**LE**	2.41	1.31	**LE**

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5	Inadequate curriculum integration poses a major challenge to cultural teaching of mathematics.	2.32	1.227	**LE**	2.53	1.25	**HE**
	Grand mean	**2.40**		**LE**	**2.44**		**LE**

Low Extent (LE = 1.50 – 2.49), High Extent (HE = 2.50 – 3.49)

The Table 1 shows the extent the current curriculum support the integration of ethnomathematics in classroom teaching in secondary schools within the Port Harcourt metropolis. The grand mean score of 2.40 for public school teachers and 2.44 for private school teachers both fall within the Low Extent (1.50–2.49) range, indicating weak overall curriculum support. Although some individual items recorded mean scores above the 2.50 cut-off point such as 2.57 (SD = 1.179) and 2.53 (SD = 1.198) for public schools, and 2.50 (SD = 1.27) and 2.56 (SD = 1.23) for private schools. These isolated values were not strong enough to raise the overall grand mean into the High Extent category. In contrast, several items recorded lower mean scores such as 2.30, 2.29, and 2.32 for public schools and 2.38 and 2.41 for private schools, reflecting limited opportunities for adapting local cultural practices, weak real-life cultural connections, and inadequate curriculum integration. Therefore, the current curriculum support the integration of ethnomathematics in classroom teaching to a Low Extent.

Research Question 2: To what extent does teachers' pedagogical content knowledge influence the integration of ethnomathematics into geometry teaching?

Table 2: The extent teachers' pedagogical content knowledge influence the integration of ethnomathematics into geometry teaching.

		Public N(129)			Private N(88)		
S/N.	**Questionnaire Statement**	**Mean**	**Std**	**Remark**	**Mean**	**Std**	**Remark**
6	I am familiar with the concept of ethnomathematics.	2.56	1.22	**HE**	3.53	0.22	**VHE**
7	I have adequate training to integrate ethnomathematics into geometry lessons.	2.34	1.29	**LE**	2.47	1.23	**LE**
8	I can design geometry lessons that incorporate local cultural practices.	2.37	1.26	**LE**	2.14	1.18	**LE**
9	My pedagogical knowledge allows me to explain abstract concepts using cultural examples.	2.65	1.19	**HE**	2.59	1.13	**HE**
10	Lack of pedagogical training is a barrier to integrating cultural examples in teaching mathematics.	2.62	1.23	**HE**	3.53	0.58	**VHE**
	Grand mean	**2.5**		**HE**	**2.87**		**HE**

Low Extent (LE = 1.50 – 2.49), High Extent (HE = 2.50 – 3.49)

Table 2 reveals the respondents' perceptions on the extent to which teachers' pedagogical content knowledge influences the integration of ethnomathematics into geometry teaching in secondary schools within the Port Harcourt metropolis. The grand mean score of 2.50 for public school teachers and 2.87 for private school teachers both falls within the High Extent (2.50–3.49) range, indicating that pedagogical content knowledge plays an important role in the integration process and suggests stronger conceptual awareness among private school teachers.

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However, despite this familiarity, teachers reported inadequate professional preparation. The mean scores for adequate training were 2.34 (SD = 1.29) for public schools and 2.47 (SD = 1.23) for private schools, both within the Low Extent range. Similarly, the ability to design geometry lessons incorporating local cultural practices recorded 2.37 (SD = 1.26) for public schools and 2.14 (SD = 1.18) for private schools, also indicating Low Extent. These figures reveal a noticeable gap between theoretical awareness and practical instructional skills. On the positive side, teachers indicated that their pedagogical knowledge enables them to explain abstract geometric concepts using cultural examples, with mean scores of 2.65 (SD = 1.19) for public schools and 2.59 (SD = 1.13) for private schools, both within High Extent. Furthermore, lack of pedagogical training was perceived as a major barrier, particularly among private school teachers who recorded 3.53 (SD = 0.58), interpreted as Very High Extent, compared to 2.62 (SD = 1.23) for public school teachers (High Extent).Overall, teachers' pedagogical content knowledge in the integration of ethnomathematics into geometry teaching was influence to a High Extent.

Research Question 3: To what extent can policy and governance strategies address the challenges of integrating ethnomathematics into geometry?

Table 3: The extent policy and governance strategies address the challenges of integrating ethnomathematics into geometry**.**

		Public N(129)			Private N(88)		
S/N	**Questionnaire Statement**	**Mean**	**Std**	**Remark**	**Mean**	**Std**	**Remark**
11	Government policies can support the inclusion of ethnomathematics in the school curriculum.	3.50	0.80	**VHE**	3.52	0.82	**VHE**
12	The Ministry of Education should provide training and workshops for teachers on ethnomathematics.	3.38	0.50	**VHE**	3.64	0.94	**HE**
13	School authorities encourage the integration of cultural practices in teaching geometry.	3.63	0.79	**VHE**	3.60	0.69	**VHE**
14	Funding and resources are not available to support ethnomathematics integration.	3.80	0.81	**VHE**	3.70	0.48	**VHE**
15	Policy gaps are a major obstacle to the integration of ethnomathematics in teaching.	3.68	0.91	**VHE**	3.50	0.97	**VHE**
	Grand mean	**3.87**		**VHE**	**3.59**		**VHE**

Very High Extent (VHE = 3.5 – 4.00)

Table 3 reveals the respondents' views on the extent to which policy and governance strategies address the challenges of integrating ethnomathematics into geometry. The analysis was based on five questionnaire items, with responses measured on a four-point Likert scale ranging from Very High Extent (VHE) to Very Low Extent (VLE). The decision rule classified mean scores within the range of 1.50–2.49 as Low Extent (LE) and 2.50–3.49 as High Extent (HE). All responds on this category fall within the mean range of Very High Extent (VHE). In general the computed grand mean of 3.87 and 3.59 falls within the Very High extent (HE) category. This implies that, policy and governance strategies address the challenges of integrating ethnomathematics into geometry to a Very High extent.

Discussion

From Table 1, based on the result of the data analyzed on Curriculum support for integration of ethnomathematics into geometry, the grand mean for public school teachers showed 2.40 and 2.44 for private school teachers. This indicates that, the curriculum support for integrating ethnomathematics into geometry in Port Harcourt schools was low to an extent. Although item 1 and 3 individually crossed the cut-off of 2.50 to 2.57 and 2.53 respectively for public teachers and item 5 crossed the cutoff for private teachers, however, the grand mean was found to be on a low extent range. The table 1 also showed that items 2, 4, 5 were perceived as curriculum lacking opportunities for teachers to adapt local cultural practice into geometry, inadequately connecting students to real life cultural mathematics, and poses barriers in the integration of teaching mathematics cultural. A closer examination of table 1 further shows that, both public and private school teachers shared similar perceptions

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regarding limited curriculum support. However, private school teachers consistently reported slightly higher mean scores than public school teachers, particularly on items relating to curriculum integration as a barrier. This suggests that private school teachers may be more critically aware of curriculum limitations due to stricter instructional demands and accountability structures within private schools. The mixed finding reflects prior literature of the study. The study of Kyeremeh et al. (2025) revealed that male mathematics teacher reported lack of cultural examples in the geometry curriculum, whereas female mathematics teachers identified gender discrimination as a challenge to their effort to integrate ethnomathematical perspectives into geometry teaching. The study of Sunzuma and Maharaj (2019) revealed that, the major challenges included lack of knowledge on ethnomathematics approaches and how to integrate these approaches into the teaching of geometry. Similarly, Khalil (2023) study revealed that mathematics teachers' have only an average level of knowledge of ethnomathematics.

From table 2 on teachers' pedagogical content knowledge and ethnomathematics integration, the grand mean of 2.50 indicates respondents regards on teachers' pedagogical content knowedge as meaningfully for integrating ethnomathematics into geometry. The table also showed that, the item on familiarity with ethnomathematics, ability to explain abstract concepts culturally, and lack of pedagogical training as a barrier were reported to be on a High Extent, while item responses about adequate training and ability to design geometry culturally embedded lessons were reported to be on a Low Extent. This implies that, table 2 suggests a pedagogical content knowledge gap that explains why curricular references may not translate into classroom enactments. Furthermore, the analysis of table 2 reveals the differences in perception between public and private school teachers. Private school teachers reported higher mean scores on familiarity with ethnomathematics and perceived lack of pedagogical training as a barrier at a Very High Extent, while public school teachers reported these items at a High Extent. This indicates that private school teachers demonstrate greater awareness of ethnomathematics concepts and more strongly recognize training deficiencies. Conversely, both public and private school teachers reported low mean scores on adequate training and lesson design skills, suggesting that pedagogical skill gaps cut across school types. This pattern corresponds with prior literature findings of Mania and Alam (2021) who showcases that, teachers positively perceived pedagogical content knowledge in the teaching of ethnomathematics concepts. Similarly, the research findings of Danoebroto. (2024) showed that, different ethnomathematics approaches with the use of different local culture will lead to different types of mathematical thinking skills. From the table 2, based on the result of the data analysed, it implies that public schools teachers has a grand mean of 2.50 and private schools teachers has a grand mean of 2.87 with both range agreement of High extend. This indicates that teachers' pedagogical content knowledge influence the integration of ethnomathematics into geometry teaching to a high extent. Lastly, for policy and governance strategies addressing the challenges of integrating ethnomathematics into geometry the grand mean of 3.87 indicates a Very High Extents. The analysis of Table 3 indicates that both public and private school teachers strongly agreed on the importance of policy and governance strategies in addressing the integration challenges. Public school teachers reported very high mean scores on government policy support, school authority encouragement, funding availability, and policy gaps similarly with the public school teachers. Also, private school teachers rated these items at a Very High Extent with the public school teachers suggesting a shared perception that policy clarity and institutional support are essential regardless of school ownership.

The aim of ethnomathematics is to recognize many ways of culturally solving mathematics by adopting formal processes in schools (Putra & Prasetyo, 2022). While geometry represents a core area of school mathematics that lends itself naturally to cultural and environmental applications. This study examined teachers' perceptions of the challenges associated with integrating ethnomathematics into geometry secondary schools within the Port Harcourt metropolis. The study adopted a descriptive survey research design that involved mathematics teachers in public and private secondary schools. Data were collected using a validated questionnaire and analyzed using mean and standard deviation.

Conclusion

The findings revealed that the current geometry curriculum provides limited support for the effective integration of ethnomathematics, as cultural examples are insufficiently embedded and opportunities for classroom adaptation are constrained. This curriculum limitation was identified as a major challenge to the meaningful integration of ethnomathematics into geometry teaching. The findings also showed that teachers' pedagogical content knowledge plays a significant role based on respondents' perceptions in the integration process. While many

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teachers demonstrated familiarity with the concept of ethnomathematics and recognized its value, gaps were identified in professional training, lesson design skills, and the ability to systematically incorporate cultural practices into geometry instruction. The results further showed that policy and governance strategies were found to have a very high potential to address the challenges of integration. Respondents agreed to a high extent that supportive government policies, adequate funding, teacher training programmes, and curriculum reforms could enhance the integration of ethnomathematics into geometry teaching. Overall, the study underscores the need for coordinated efforts involving curriculum reform, teacher capacity development, and policy support to overcome the challenges associated with integrating ethnomathematics into geometry instruction and to promote culturally responsive mathematics education. Overall, the finding has it that the perceptions of both public and private school teachers converge on the view that while curriculum and pedagogical challenges exist, strong policy and governance frameworks are critical for overcoming these challenges and ensuring sustainable integration of ethnomathematics into geometry teaching.

Recommendations

Based on the findings of the study, the study therefore recommendation as follows:

1. Curriculum planners should explicitly integrate the cultural examples into secondary school geometry curricula.
2. Regular professional development programmes focus on lesson design, contextualization of geometric concepts using local cultural practices, and effective classroom implementation strategies should be encouraged to improve teachers' pedagogical content knowledge in ethnomathematics-based geometry instruction.
3. Policy makers and government agencies in education should develop and implement clear policies that support the integration of ethnomathematics into geometry teaching. This should include the provision of instructional resources, funding for teacher training, and monitoring mechanisms to ensure sustained implementation.

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