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Primary school teachers' perceptions of the practicability of ethnomathematics pedagogy and teaching of school Mathematics in Southern Cross River State, Nigeria

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Abstract

This study examines primary school teachers' perceptions of the applicability of ethnomathematics concepts in creating learner-friendly Mathematics instructions in the Southern Senatorial Zone of Cross River State, Nigeria. The research aims to explore teachers' attitudes toward integrating ethnomathematics pedagogy into primary school Mathematics teaching, particularly focusing on the use of culturally relevant mathematical concepts in the classroom. A descriptive field survey design was employed, involving 250 randomly selected primary school teachers from Ejagham-speaking communities across four local government areas. Data was collected using a validated 23-item Likert-type questionnaire on the applicability of ethnomathematics concepts (ATEC). Descriptive and inferential statistical methods, including weighted mean scores, were used to analyze the data. The study found that most teachers agreed that ethnomathematics concepts could be effectively applied to primary school mathematics teaching. Based on these findings, it is recommended that ethnomathematics should be integrated into mathematics instruction to enhance students' learning experiences and promote a culturally relevant and learner-friendly educational environment. This research revealed the significance of incorporating indigenous cultural knowledge in enhancing the quality of mathematics education in Nigeria.

Keywords: Ethnomathematics; Teachers' perception; Applicability; Learning; Mathematics

1. Introduction

Every society engages in mathematics, no matter how primitive they are and this mathematics assist their people to carry out their daily life transactions. This is the reason, even when western education was non-existent, some basic knowledge of mathematics has been used to solve peoples' daily problems in Africa. This buttress the facts why we have adults and even school age children not possessing any form of western education exhibiting some basic mathematical competences in counting, measuring, records keeping amongst others. It is this mathematics as practical among identifiable cultural groups (D'Ambrosio, 1999) that is known as Ethnomathematics. It is a term coined by (D' Ambrosio, 1990 It is in the knowledge that is indigenous to a particular culture that are mathematized. Therefore, ethnomathematics is a term used to express the link between culture and school mathematics.

The universality of mathematical language has been shown to exist in abundant similarities in mathematical practices between various cultural groups in Nigeria and other countries in Africa. We find in every culture a way of counting, adding, subtracting, construction of cultural artifacts and carrying out logical deductive reasoning that could be associated with that culture (Kurumeh, 2004).

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Ethnomathematics of the people of Yakurr like those of the people of other cultural group in Nigeria and Africa countries is very rich in mathematical ideas and concept. For instance, these manifest in cultural artifacts such as native mat, clay pots, clay bed, yam barn, beads, thatch houses, native decoration, native basket and fishing basket. Major mathematics concepts are embedded in these artifacts. The rich ethnomathematics concepts identified in various culture, indicate that teachers of mathematics need to know and apply the mathematics embedded in the learners' culture in classroom instructions.

1.1. Theoretical Framework of the study

The theoretical framework for this study is built on the intersection of two primary constructs: Ethnomathematics and Constructivist Learning Theory. These frameworks provide the basis for understanding how mathematics, embedded in culture, can be effectively integrated into school instruction to enhance students' learning experiences and improve outcomes in mathematics education.

1.1.1. Ethnomathematics Theory:

- Ethnomathematics, coined by (D'Ambrosio 1990), refers to the study of the relationship between mathematics and culture. It is based on the idea that mathematical concepts are not universal and detached from cultural contexts but are deeply embedded in the everyday practices and traditions of particular cultural groups. This theory posits that mathematics is a social activity that arises from the needs of individuals and communities, thus enabling a culturally relevant framework for teaching mathematics. According to (D'Ambrosio 1999), ethnomathematics provides insights into the mathematical knowledge system of various cultural groups, offering opportunities for integrating local knowledge into classroom instruction.
- The relevance of ethnomathematics in this study is in the recognition that the mathematical ideas embedded within the cultural artifacts of the Efik-speaking communities in Cross River State (e.g., counting systems, architectural designs, craftsmanship, etc.) are valuable for informing teaching practices. By connecting mathematics instruction to the learners' indigenous culture, teachers can make learning more relatable, practical, and meaningful, thereby creating a learner-friendly classroom environment. This framework supports the idea that integrating ethnomathematics pedagogy into primary school mathematics can bridge the gap between students' everyday experiences and formal mathematics learning.

1.1.2. Constructivist Learning Theory:

- Constructivism, primarily associated with (Piaget, 1973) and (Vygotsky, 1978), emphasizes the active role of learners in constructing their own understanding of the world. According to this theory, learning occurs when individuals are actively involved in making sense of new information by connecting it to their prior knowledge and experiences. In the context of mathematics education, constructivism encourages teachers to design lessons that allow students to explore mathematical concepts in authentic, contextual settings that mirror their lived experiences.
- (Vygotsky's 1978) Zone of Proximal Development (ZPD) is particularly relevant in understanding how ethnomathematics can be utilized to enhance the teaching of mathematics. According to Vygotsky, students learn most effectively when they are provided with tasks that are slightly beyond their current capabilities but within their reach with support from a teacher or peer. By incorporating elements of students' cultural contexts into the lesson, teachers can scaffold students' learning more effectively, facilitating the development of mathematical understanding in a manner that is culturally relevant and accessible.

1.1.3. Culturally Relevant Pedagogy:

- Culturally relevant pedagogy, as discussed by (Ladson-Billings, 1994), is an educational approach that seeks to incorporate students' cultural backgrounds into the teaching and learning process. This approach is premised on the belief that students are more likely to engage with and excel in their learning when they can see themselves reflected in the content and teaching methods. In the context of this study, culturally relevant pedagogy is an essential component of integrating ethnomathematics into primary school mathematics teaching. By utilizing the students' indigenous knowledge and practices, teachers can create more inclusive, effective, and motivating learning environments that foster both academic achievement and cultural pride.

1.2. Application to the Study

- This theoretical framework supports the exploration of how primary school teachers in the Southern Senatorial Zone of Cross River State perceive the applicability of ethnomathematics concepts to mathematics instruction. It suggests that by integrating culturally relevant mathematical concepts from the Efik culture into the

curriculum, teachers can enhance students' engagement, learning outcomes, and appreciation for mathematics as it is applied in their daily lives. The study draws on these frameworks to investigate the relationship between teachers' perceptions of ethnomathematics pedagogy and its practical integration into the classroom.

- In line with this, the research questions aim to determine whether teachers believe that incorporating ethnomathematics concepts could improve the accessibility and effectiveness of mathematics education for primary school students. Teachers' perceptions of the practical applicability of ethnomathematics will likely be influenced by their understanding of how cultural context can shape students' engagement with mathematical content.

1.3. Problem Statement

In recent times the performance of pupils in mathematics at the primary school level has been abysmally poor. This is serious source of worry in view of the biting concern of successive governments for qualitative science education. Qualitative science education is impossible in a setting where teachers' perception on the practicability of ethnomathematics pedagogy is poor and as a result pupil consistently perform miserably in internal and placement examinations. If science and technology are critical requirements for national development then the poverty of mathematics education will not only stunt but retard development. Children first mathematical experiences come from their interaction with their immediate environment which is been ignored by the classroom mathematics teaching and learning situation. Learner-friendly classroom environment, and indeed, good achievement in mathematics may depend, to a large extent, on the techniques of teaching. To teach with good results mean not only to teach with good knowledge of the learner but also to teach with good perception that is learner friendly.

The non-didactical structure is a starting point for learning mathematics as one of the reasons responsible for low achievement in the subject. The researcher now thinks that pupil's low achievement in mathematics is because the concepts taught to them and the method of teaching and learning do not have meaning and link to the cultural environment of the learners. This is why the widespread apparent failure in school mathematics is a cultural problem being played out through the filtering of mechanism of western mathematics education. But what is most disturbing about innovations in mathematics education is the strong believe that mathematics can be taught effectively and meaningfully without linking it to the culture of the learners. Hence the problem of the study is: to what extent will teacher with positive perception of ethnomathematics pedagogy differ from those with negative perception of ethnomathematics pedagogy in primary school mathematics. Finally, the study is designed to find out primary schools' teachers' perception on the practicability of ethnomathematics pedagogy and teaching primary school mathematics.

1.4. Significant of the study

It is envisaged that pupils' teachers, local government education authority, state ministry of education and all those who have a stake in our system will benefit. The findings of the study will also be significant to pupils as the will see the relationship with the mathematics taught in school and mathematics practical at homes. The mathematics teachers will see that there is a link between school mathematics and ethnomathematics concept.

1.5. Objectives of the Study

The main objective is to determine primary school teachers' perceptions of the practicability of ethnomathematics pedagogy and teaching of school Mathematics in the research area.

- To determine teacher's perception towards integrating ethnomathematics pedagogy in teaching primary school mathematics.

1.6. Research question;

To what extent will teachers agree that ethnomathematics concepts could be applicable to the teaching of primary school Mathematics?

2. Literature Review

Ethnomathematics, as defined by (D'Ambrosio, 1990), refers to the mathematical practices of various cultural groups that reflect their way of life, belief systems, and cultural expressions. This concept links mathematics with culture and provides a framework to understand how indigenous knowledge systems can inform contemporary mathematical instruction. It emphasizes the value of integrating cultural experiences into learning, allowing students to relate mathematical concepts to their everyday lives. This cultural foundation could be especially beneficial for primary school

education in diverse settings such as those in Southern Cross River State, Nigeria, where local culture can serve as a resource for mathematics teaching.

2.1. Ethnomathematics and Its Role in Mathematics Education

Ethnomathematics offers an alternative pedagogical framework for teaching mathematics that is grounded in the lived experiences of learners. As noted by (D'Ambrosio, 1999), the practices of various cultural groups, including counting systems, geometric construction, and mathematical reasoning, are not only useful but often more relatable to learners. For example, the Efik people, along with many other African groups, have developed their own systems of counting, measurement, and symbolic representations (Kurumeh, 2004). These cultural artifacts and practices—such as weaving, basket making, and architectural designs—are inherently mathematical, encompassing concepts of symmetry, geometry, measurement, and estimation.

Integrating ethnomathematics into the primary school curriculum offers an opportunity to make learning more relevant and engaging for students. Teachers who understand and value the role of cultural knowledge in mathematics can build connections between the abstract concepts typically taught in classrooms and the concrete experiences students encounter in their communities. Such an approach not only makes mathematics more meaningful but also promotes respect for cultural diversity, which is a crucial aspect of education in multicultural societies (D'Ambrosio, 1990).

2.2. Teacher Perceptions of Ethnomathematics

Teacher perceptions play a critical role in the implementation of any pedagogical strategy. In the case of ethnomathematics, research suggests that teachers' perceptions of its applicability and effectiveness can significantly impact whether they integrate cultural knowledge into their teaching. In several studies, teachers have expressed positive perceptions of ethnomathematics, recognizing its potential to make learning more contextual and meaningful. For instance, (Nasir and Cobb, 2007) found that when teachers incorporated students' cultural knowledge into mathematics instruction, it led to increased student engagement and a deeper understanding of mathematical concepts.

However, despite the promising outcomes of ethnomathematics integration, challenges exist. Some teachers may perceive ethnomathematics as incompatible with the established curriculum or as an additional burden that requires specialized knowledge and training (Nicol, 2010). Others may have negative perceptions due to a lack of exposure to ethnomathematics and its benefits. In a study conducted by (Moses and Ganong, 2015), teachers noted that while they understood the cultural value of incorporating local knowledge into mathematics teaching, they often lacked the tools or resources to do so effectively.

In Nigeria, teachers' perception of integrating ethnomathematics concepts into primary school mathematics has been a subject of concern. In a study by (Adedayo and Kolawole, 2016), primary school teachers in Nigeria expressed the need for more training and professional development to incorporate cultural mathematics into their teaching practices effectively. This aligns with the findings of the present study, which aims to determine whether teachers in Southern Cross River State perceive the application of ethnomathematics as feasible and beneficial.

2.3. Importance of Culturally Relevant Mathematics Education

One of the key benefits of incorporating ethnomathematics into the mathematics curriculum is the promotion of a learner-friendly environment. This concept is particularly important for students in rural or marginalized communities, where the standardization of mathematics teaching often overlooks the cultural context of learners. According to (Aguirre, 2009), culturally relevant pedagogy fosters better student performance by connecting the curriculum with students' identities, experiences, and social realities. When students can relate their learning to their culture, it enhances their sense of ownership of knowledge, increasing their motivation to engage with and excel in the subject matter.

2.4. Summary of Literature Review

The literature underscores the potential of ethnomathematics to improve mathematics instruction and student performance by making it more relevant and engaging. Teacher perceptions, however, remain a crucial factor in determining the extent to which ethnomathematics can be successfully integrated into the classroom. Given that the current study focuses on teachers in Southern Cross River State, Nigeria, understanding their perceptions and attitudes toward the applicability of ethnomathematics is essential for promoting effective teaching practices that are both culturally relevant and pedagogically sound. As the study aims to explore the practical application of ethnomathematics in primary school classrooms, it is important to recognize the growing body of literature that highlights the intersection of culture and mathematics education.

3. Methodology

3.1. Research Design

This research design used was a descriptive field survey design that will focused on data acquisition through field exploration survey using the questionnaire instrument procedure.

3.2. Research Area

The study was conducted in the Southern Senatorial district, being one of the three districts in Cross River State. The district is made up of seven (7) Local Government Areas out of the eighteen (18) Local Government Areas in the State (CRSG, 2007). These seven (7) local governments areas are; Akamkpa, Akpabuyo, Bakassi, Biase, Calabar Municipality, Calabar South and Odukpani.

The area has a land mass of seven thousand three **hundred (7, 300)** square kilometers and is bounded in the North by **Yakurr Local** Government Area, in the South by the Atlantic Ocean, in the East the Republic of Cameroun and in the West by Akwa Ibom, Abia and Ebonyi States. It has the largest forest area in the state and the land is fertile. It also has many rivers, streams and springs. The major occupation of the people includes fishing, farming and mining of stone and gravels.

The National Population Census (NPC, 2006) showed that the Southern senatorial district of Cross River State has an estimated population of Six Hundred and Twenty-one thousand (621, 000) people with the Efik speaking tribe forming the majority and common play of Southern senatorial district is Ekpe which is common to all the seven (7) local government areas. The major tourist attraction in Southern senatorial district are National Wildlife park which is located at Akamkpa and TINAPA Business Resort which is located at Calabar municipality, it has also Export Processing Zone (EPZ) and the Free Trade. Notable Educational institution in Cross River South are; Cross River University of Technology, Calabar located at Calabar South and University of Calabar located at Calabar. Municipality and Cross River State College of Education Akamkpa. Calabar is the state's capital of Cross River State which constitutes two Local Government Area, namely Calabar Municipality and Calabar South. The researcher chooses this area because he resides and works within the area.

3.3. Population

The population of the study comprises of primary school teacher in southern senatorial district of Cross River State.

3.4. Sample and sampling techniques

The sample comprised of primary school teachers that will be randomly selected using hat-and-draw method from the population of the four Efik speaking Local Government Area in Cross River State of Nigeria respectively, teachers' perception on ethnomathematics applicability questionnaire TPEAQ will be used for collection of data. TPEAQ is comprised of 23 statements on applicability scales with a 4-point Likert type response of strongly agree (SA), Agree (A), Disagree (D) and strongly disagree (SD). This instrument is design to determine the extent to which to teachers perceive (agree or disagree) on the applicability of basic ethnomathematics concepts of Efik culture in classroom instruction.

3.5. Data Analysis

Data collected in this study was analyzed using inferential and descriptive statistic. The responses of subjects were be categorized and scored for all positive statements as follows: strongly agree (SA) = 4 points, agree (A) = 3 points, disagree (D) = 2 points and strongly disagree (SD) = 1 point.

4. Result

Table 1 Statistical analysis of Ejagham teacher's responses on the practicability **of** Ethnomathematical concepts to teaching as perceived by primary school Mathematics teachers

S/N0.:	Statement items	Person's total Scores	Weighted Mean
1	I can teach counting to 1000 in Ejagham number words?	845	3.38
2	10,15 and 20 are the main counting bases in Ejagham numeration system?	814	3.26

3	1 can explain the term infinity in Ejagham Numeration system?	505	*2.02
4	Gesture counting in the two cultures can effectively be used to teach counting from 1 to 10 and 15?	835	3.34
5	Addition and multiplication operations are Involved in Ejagharn counting system?	825	3.30
6	1 can get pupils to add objects in Ejagham?	859	3.44
7	1 can teach pupils to perform subtraction in Ejagham?	891	3.56
8	multiplication is possible in Ejagham cultures?	891	3.56
9	Division can be carried out in Ejagham Cultures?	790	*3.16
10	1 can use the local terms to introduce the concept of fraction in class?	499	*2.00
11	An orange can be used to explain the concept of half (1/2) in the two cultures?	840	3.36
12	It is feasible to teach the concept of the number zero in Ejagham?	882	5.53
13	1 can explain the concept of equality of two objects in Ejagham?	399	*1.60
14	The concept of inequality (> and <) can be taught In Primary school?	851	3.40
15	local means can be used to teach pupil's data Collection?	773	*3.09
16	The ordering of. the day by nature can be used to Introduce time telling?	865	3.46
17	Indigenous methods of measuring distances/heights Can be taught in the classroom?	884	3.54
18	The concept of weight can be better taught Through local means of lifting the object?	890	3.56
19	The "Chaka-Chaka ariku game" helps in the introduction of probability?	826	3.30
20	The 'Egan' and 'obankang' game can be used to teach counting and subtraction?	840	3.36
21	The 'aafu' game can be used to teach subtraction in the two cultures?	841	3.36
22	The finger counting rhyme can be used as introductory lesson in counting?	828	3.31
23	Cultural artifacts can be used to teach concepts in practical geometry?	836	3.34
	Average Weighted Mean		3.25

N=250, not Applicable.

4.1. Interpretation of result

The result in table 1 Statistical analysis of Ejagham teacher's responses on the practicability of Ethnomathematical concepts to teaching as perceived by primary school Mathematics teachers. The Average Weighted Mean obtained was (3.25) which serves as the cut off score of the study. Any responses to a statement that received a weighted mean score rating above (3.25) is accepted as favourable. In this case, statement items with serial number 1, 2, 4, 5, 6,7, 8, 11, 12, 14, 16, 17, 18, 19, 20, 21, 22, and 23 were within the accepted region of the statement item strongly agreed and agreed on the practicability of Ethnomathematical concepts to teaching as perceived by primary school Mathematics teachers in the research area. In the other hand, any average weighted mean score below (3.25) is unfavourable. In this case 3, 9,10,13 and 15 were in the rejection region since the teachers strongly disagreed and disagreed on those statement items.

5. Discussion of Findings

The research explored primary school teachers' perceptions of the applicability of ethnomathematics in teaching mathematics in the Southern Senatorial Zone of Cross River State, Nigeria. It was designed to address the critical concern

of integrating culturally relevant mathematical concepts into the classroom to improve mathematics instruction and enhance learning outcomes. Below, we discuss the findings based on the data analysis and relate them to prior research.

5.1. Teachers' Perceptions of Ethnomathematics Applicability

The study's results indicated that most of the 250 teachers surveyed agreed that ethnomathematics concepts could be effectively applied in primary school mathematics instruction. The average weighted mean score of 3.15 was used as the cutoff point, and responses with scores above this threshold were considered favorable. This result aligns with the idea that teachers acknowledge the value of integrating cultural knowledge into educational practices, which supports more learner-centered and culturally inclusive teaching methods.

5.2. Educational Significance of Ethnomathematics

Ethnomathematics, which refers to the mathematical practices embedded in specific cultural contexts, plays an essential role in bridging the gap between formal mathematics education and students' everyday experiences. As the study suggests, teachers who perceived ethnomathematics as relevant to their classroom instruction could potentially create a more engaging and accessible learning environment. The research highlights that teaching students about the mathematics inherent in their cultural practices, such as in the production of cultural artifacts (e.g., native mats, clay pots, and baskets), not only validates their lived experiences but also deepens their understanding of mathematical concepts.

This is consistent with previous studies, such as those by (D'Ambrosio, 1990), who emphasized the importance of ethnomathematics in education, advocating for a recognition of cultural contributions to mathematical knowledge. Moreover, (Kurumeh, 2004) discussed the rich mathematical knowledge embedded in various African cultures, asserting that acknowledging these practices in education enhances students' connection to the subject matter.

5.3. Addressing Low Mathematics Achievement

The study also aimed to investigate the relationship between teachers' perceptions of ethnomathematics and students' performance in mathematics. The poor performance of pupils in mathematics, particularly in the primary school sector, has been a significant concern, as highlighted by the study. The findings suggest that when teachers integrate culturally relevant mathematical knowledge, students are likely to find mathematics more meaningful and relatable. This could, in turn, improve learning outcomes and reduce the widespread failure seen in standardized mathematics tests.

The connection between culturally grounded teaching methods and improved student performance aligns with the findings of other researchers, such as (Nicol, 2010). who argued that when mathematics instruction incorporates real-world cultural experiences, it becomes more accessible and impactful for students, especially in contexts where traditional teaching methods are disconnected from students' everyday lives.

5.4. The Role of Teacher Perception

The study underscores the critical role of teachers' perceptions in the implementation of ethnomathematics in the classroom. Teachers with positive perceptions of ethnomathematics pedagogy are more likely to incorporate these concepts into their teaching practices. This finding is consistent with the work of (Guevara et al., 2003), who found that teachers' positive attitudes towards the integration of cultural elements in mathematics instruction were crucial in shaping student experiences and outcomes.

Conversely, teachers with negative perceptions or skepticism about the applicability of ethnomathematics concepts may be less likely to embrace these ideas in their practice. The study emphasizes the need for teacher training and professional development programs that focus on the value and application of ethnomathematics in enhancing mathematics instruction.

Recommendations

Based on the study's findings, it is recommended that;

Ethnomathematics concepts be incorporated into mathematics curricula at the primary school level.

Teachers should be encouraged to explore the rich cultural practices of their communities and incorporate them into their teaching methods. This approach not only enriches students' mathematical knowledge but also fosters a deeper connection to their cultural heritage.

Additionally, teacher education programs should provide opportunities for educators to learn about ethnomathematics and its potential benefits in the classroom. Through workshops, seminars, and collaborative learning experiences, teachers can be better equipped to implement culturally relevant pedagogy in their classrooms.

6. Conclusion

In conclusion, the study's findings provide compelling evidence that primary school teachers in the Southern Senatorial Zone of Cross River State perceive ethnomathematics as a valuable tool for improving mathematics instruction. By integrating culturally relevant mathematical concepts into teaching practices, educators can create more engaging, meaningful, and learner-friendly mathematics classrooms. This, in turn, can lead to improved student outcomes and a stronger connection between students' everyday lives and the mathematics they learn in school. These findings align with existing research on the importance of culturally responsive teaching and the role of teachers' perceptions in shaping educational practices

Compliance with ethical standards

The study adhered strictly to confidentiality and privacy of respondents/participants information. Consents of the participants that participated in the research were duly obtained and they willingly participated without being forced to do so neither did they take the decision to do on duress. Furthermore, participants rights and dignity were respected and the study was conducted utmost integrity and honesty.

Disclosure of conflict of interest

We sincerely declare that all the authors have participated in carrying out the research, evaluation and analysis of the research article and the final version have been approved. Also, there is no form of conflict of interest in connection with this research article and the material is not under consideration for publication elsewhere other than in WJARR.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study

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