

RESEARCH ARTICLE

EFFECTS OF TEACHERS' USE ETHNOMATHEMATICS APPROACH IN TEACHING MATHEMATICS

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ABSTRACT

This study looked at senior high school mathematics teachers' use of ethnomathematics approach in teaching mathematics. The study's theory is based on Lev Vygotsky's notion of social constructivism. The study followed the positivist philosophical paradigm and took a quantitative research approach. The investigation was conducted using a cross-sectional survey design. The study used a sample size of 140 mathematics teachers. Independent sample t-test was used to analyze the data. The study's findings revealed that both male and female mathematics teachers use ethnomathematics approaches in teaching mathematics. Based on the findings, it was advised that the government should provide teachers with professional development opportunities to better their understanding of ethnomathematics and its implications for teaching and learning.

KEYWORDS

Ethnomathematics, Teachers, use, Mathematics Achievement, Cultural Activities.

1. INTRODUCTION

Ethnomathematics explores the intricate relationship between Mathematics and culture d'Ambrosio, 1985. It aims to deepen our understanding of both culture and Mathematics (Bishop, 1991). In recent years, educators have increasingly recognized ethnomathematical techniques as highly effective for teaching Mathematics (Rowlands and Carson, 2002). Numerous theoretical discussions have enriched this philosophical approach (Bishop, 1991). However, despite its potential, the practical application of this mathematical philosophy has not garnered sufficient attention. Integrating Realistic Mathematics Education (RME) with ethnomathematical pedagogies becomes imperative to leverage cultural knowledge and social connections in teaching mathematical concepts (Purwanti et al., 2019; Sumirattana et al., 2017). The traditional curriculum for teaching Mathematics has often been abstract and challenging for students to grasp (Scott, 2018).

This discrepancy has been criticized as it deviates from the curriculum widely accepted in many developing countries (Rowlands and Carson, 2002). In Ghana, for example, a significant portion of Mathematics students struggles with Mathematics due to classroom teaching methods. Western cultural dominance in mathematical constructs and ideas has exacerbated this issue. Consequently, some African educators have turned to ethnomathematics to reshape the discourse (Amit and Qouder, 2017; Davis and Seah, 2016; Mills and Mereku, 2016). Ethnomathematics places the student at the heart of the learning process, engaging them with mathematical ideas drawn from formal and cultural perspectives (Davis and Seah, 2016). Mathematics, often perceived as a comprehensive subject in many schools, lacks connection for students (Amineh and Asl, 2015). Providing cultural context in Mathematics instruction could bridge this gap by aligning formal learning with students' cultural knowledge.

In the classroom, ethnomathematics encourages interactive and candid discussions, fostering a deeper understanding of mathematical concepts (Borba, 1990). By incorporating ethnomathematical concepts, instructors can tap into students' experiences and cultural understanding, thereby enriching the learning process (Borba, 1990). Cultural artifacts, such as those found in Savana communities, offer tangible examples of geometric concepts deeply embedded in culture (Davis and Seah, 2016). Leveraging such artifacts in teaching Mathematics can strengthen students' socio-cultural roots while enhancing their comprehension of mathematical principles.

Adopting ethnomathematics in the curriculum acknowledges the diversity within mathematical practices and promotes meaningful mathematical learning experiences (Bishop, 1991; Rosa and Flores, 2017). Understanding and integrating students' cultural backgrounds into mathematical problem-solving can significantly enhance their learning outcomes (Naresh, 2015). Culturally appropriate mathematics curricula, according to a study, should place an emphasis on how mathematics fits into a sociocultural framework that incorporates the ideas and theories of ethnomathematics as well as how to approach contextualised problems from an ethnomathematical standpoint (Sharma and Orey, 2017). This kind of mathematics curriculum examines the degree to which students' communities and schools may coexist culturally, in order to implement the concept of cultural congruence, instructors need to be conscious of and respectful of the diverse cultural traditions and languages of the students in their classes (D'Ambrosio, 2000; Zeichner, 2013).

Teachers should do this by clearly understanding their own ethnic and cultural identities so that they may understand and cherish those of their students and acknowledge mathematics as a socially and culturally

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constructed field. The aforementioned discussion has led to study in Ghana and data, particularly from the savannah region, that will deepen our comprehension. It is evident from the conversation above how significant ethnomathematics is. In conclusion, embracing ethnomathematics in educational practices offers a promising avenue to enrich Mathematics education, fostering a deeper connection between students' cultural identities and mathematical concepts. This paper advocates for the integration of ethnomathematics pedagogies to enhance Mathematics lessons, particularly in Savana communities, aiming to cultivate a more approachable and culturally relevant teaching strategy.

In the dynamic realm of Mathematics education, there is a pressing need for instructional methods that resonate deeply with the diverse tapestry of student experiences. Senior high school Mathematics education, however, grapples with the challenge of bridging the gap between abstract mathematical concepts and the tangible realities of students, especially in culturally rich regions. This gap not only raises concerns about learner disengagement but also contributes to the underachievement in Mathematics. Delving into the intricate dance between mathematical structures and cultural elements, ethnomathematics emerges as a powerful avenue. Ethnomathematics, the fusion of numbers, patterns, and logic within cultural contexts, offers a unique lens to explore mathematical systems. Understanding its historical evolution and cross-cultural applicability becomes paramount (d'Ambrosio, 1985).

While many unknowingly apply mathematical skills in their daily lives, the untapped potential lies in integrating these skills into classrooms. As emphasises, the primary goal of Mathematics instruction is to enhance practical skills (Ascher, 2000). Acknowledging and incorporating the diverse cultural mathematical forms of communities can significantly improve student Achievement in the classroom. The influence of Mathematics teachers, students, and their cultural backgrounds on the teaching of Mathematics cannot be overstated. Embedding personally and culturally relevant experiences into Mathematics education becomes crucial for fostering a deeper understanding of reality, culture, society, and self (Fasheh, 2012). This not only cultivates self-awareness and critical thinking but empowers students to transform mathematical ideas from abstract concepts into practical applicable solutions. Despite the evident importance of ethnomathematics in shaping teaching and learning experiences, there is a notable lack of research on impacts of ethnomathematics approach on students' mathematics achievement. This gap is particularly pronounced in Ghana, where the incorporation of ethnomathematics into classroom delivery remains largely unexplored.

1.1 Research Questions

- i. What is the difference between of Male and Female Mathematics Teachers' use of Ethnomathematics Approaches in Teaching?
- ii. What are the Effects of Teacher's Usage of Ethnomathematics Teaching Approach on Students' Mathematics Achievement?

1.2 Research Hypotheses

The hypothesis below was tested for the research questions:

(H0): H0: There is no significant difference between male and female mathematics teachers' use of ethnomathematics approaches in teaching.

H0: There are no significant effect of the use ethnomathematics teaching approach on students' mathematics achievement.

2. LITERATURE REVIEW

2.1 Male and Female Mathematics Teachers use of Ethnomathematics approach in teaching mathematics

The extent to which teachers use ethnomathematics-based educational methodologies has been a subject of numerous studies. According to a study, both male and female teachers who participated in Asokwa traditional activities agreed that teaching and learning procedures in the classroom should incorporate Asokwa students' traditional mathematics practices and activities (Seth Osei, 2023). They said that this would improve the relationship between the school and the community, as well as students' mathematical achievement.

Understanding the cultural background of the learners and how the teaching and learning process relates to it is one of the fundamental tenets of effective teaching, according to (Gerdes, 1996). According to a study, ethnomathematics is a method that stresses mathematical activities

rooted in culture and portrays learning as an active process of creating knowledge through social practices that are encouraged by the teacher (Verner et al., 2019). Mogari states that learner-centered and activity-oriented, ethnomathematics approaches emphasise the teaching and learning of Mathematics using pertinent examples and activities that the students are already familiar with (Mogari, 2014). According to ethnomathematics is a learner-centered approach that builds on the experiences, values, and culture of its students (Hunter, 2021). Cultural experiences are inextricably linked to Mathematics, which is a fundamental component of both ethnomathematics and culture (Dickenson-Jones, 2008; Gerdes, 2001).

This suggests that Mathematics is a mental construct and a social product that people have developed in communities all around the world. It is a crucial component of the cultural experience of the learners and plays a significant role in many aspects of life (Dickenson-Jones, 2008). According to most of study, there are numerous rich geometric cultural activities around the world, and these activities have a wide spectrum of practical applications, from building to design (Jones, 2002; Stathopoulou et al., 2015).

In this research study on mathematical practices in traditional Igboland conducted by the aforementioned individual (Meremikwu and Erukoha, 2011). He found that, even before the arrival of the white man, Igbo people generally had their own unique mathematical techniques and logical, systematic systems for classifying objects. He continued by saying that in order to ensure a strong basis for the successful study of mathematics as a discipline, the mathematics curriculum in Igboland should be changed to incorporate some traditional mathematical techniques. Using survey techniques, Erukoha also looked at the "mathematical heritage of the Igbo," despite the fact that just two states were sufficiently sampled (Erukoha, 2000). Additionally, he looked at two significant issues that arise when Igbo language is used by teachers to teach mathematics.

3. MEHODOLOGY

3.1 Research Design

The study design is a cross sectional survey base research design. A group researchers defined a research design as a structure by which a researcher carries out his study, giving a systematic order and direction to the study (Mwende et al., 2019). According to a survey design is one that employs common questionnaires to gather data from participants (Eckel, 2018). This strategy will be suitable for the study since it permitted the quantitative data collection from Mathematics teachers using standardised questionnaires and the quantitative analyses of that data using both descriptive and inferential statistics (Saunders, 2016). while the hypotheses were tested at a 0.05 level of significance using correlation statistics.

3.2 Sampling of Teachers

The study looked six (6) districts in Savannah region. The researcher reached out to eighteen secondary schools in the six districts in the region; all the two hundred and fifteen Mathematics teachers agreed to participate in the study. Following that, stratified sampling, proportional sampling, and Simple random sampling methods were used to select 140 Mathematics teachers from the two hundred and fifteen (215) Mathematics teachers in the Savannah Region who gave their consent.

3.3 Research Instruments

A questionnaire was used as the tool for teacher assessment. questionnaires were distributed to one hundred and forty (140) senior high school Mathematics teachers in the Savannah Region in order to collect primary data. The questionnaire asks about the demographics of the respondents, Mathematics teachers' use of ethnomathematics teaching approaches, Teacher's Ethnomathematics Knowledge in Teaching Mathematics and the Effects of Ethnomathematics Teaching Approach on Students' Mathematics Achievement. The level of agreement with the questionnaires were measured using a five-point Likert scale (1=strongly disagree, 2=disagree, 3 = neutral, 4 = agree, and 5=strongly agree). Table 3 presents a distribution of teachers that responded to the questionnaires.

4. RESULTS

4.1 Demographic Characteristics of Teacher Respondents

This section presents the background profiles of teachers who

participated in the data collection. This background profile includes gender, age, qualifications, religion, and years of experience. The analyze was Presented in tables. The sample of mathematics teachers' respondents at each district is presented in Tables below.

Table 1: Gender Distribution of Respondents (Teachers).		
Gender	Frequency (N)	Percentage (%)
Male	97	69.3
Female	43	30.7
Total	140	100.0

Source: Field Survey (2024)

The gender of respondents who were teachers used in the study is displayed in Table1. One Hundred and Forty (140) respondents responded to the questionnaires and out of them, 97 representing 69.3% were male mathematics teachers while 43 representing 30.7% were female mathematics teachers. The distribution of responders age is presented in the section that follows. Table 3 represents the distribution of respondent's age.

Table 2: Distribution of respondent's age		
Age	Frequency (N)	Percentage (%)
18 – 25 years	19	13.6
26 – 33 years	81	57.9
Above 33 years	40	28.6
Total	140	100.0

Source: Field Survey (2024)

From table 3, out of one hundred and forty (140) teachers, 13.6% represent the age range of teachers from eighteen (18) to twenty-five (25) years. 57.9% represent the age range of teachers, from twenty-six (26) to thirty-three (33) years. 28.6% represent the age range of teachers above thirty-three (33) years.

Table 3: Distribution of Teacher Qualification.		
Qualification	Frequency (N)	Percentage (%)
Bachelor Degree	117	83.6
Master's Degree	23	16.4
Total	140	100.0

Source: Field Survey (2024)

The distribution of respondents' educational backgrounds is seen in Table 4. Of the 45 respondents who completed the questionnaires, 117 (83.6%) had a first degree in mathematics, while 23 (16.4%) had a master's degree in the subject. None of the other respondents had any other degrees than those listed in Table 4. This indicates that every respondent to the questionnaire was literate. However, the distribution of the respondent years of experience is shown in the next section. The distribution of the response years of experience is shown in Table 5.

Table 4: Respondent years of experience		
Year Of Experience	Frequency (N)	Percentage (%)
1 – 3 years	37	26.4
4 – 6 years	54	38.6
7 – 10 years	41	29.3
Above 10 years	8	5.7
Total	140	100.0

Source: Field Survey (2024)

Table 7: Descriptive Statistics for Teachers' use of Ethnomathematics (TUE)						
Item No.	Statement (TUE)	N	Mean	Std. Dev.	Mean Rank	Interpretation
TUE 1	I use concepts of ethnomathematics in teaching	140	4.3357	.94153	5	Highest
TUE 2	I am conversant with ethnomathematics examples from various cultural contexts	140	3.9500	1.19547	4	High

From table 4 out of one hundred and forty (140) teachers, 26.4% had one (1) to three (3) years' experience in teaching, 38.6% had four (4) to six (6) years' experience in teaching, 29.3% have seven (7) to ten (10) years' experience in teaching, and 5.7% have above ten (10) years' experience in teaching.

Table 5: Respondent Religion		
Religion	Frequency (N)	Percentage (%)
Christianity	22	15.7
Muslim	117	83.6
Traditional	1	.7
Total	140	100.0

Source: Field Survey (2024)

From table 5, out of one hundred and forty (140) teachers, 22(15.7%) were Christians, 117(83.6%) were Muslims, and 1(0.7%) was traditionalists.

4.2 Descriptive Analysis

The statistical package for social sciences, or SPSS version 23.0, was used to analysed the data from the cross-sectional survey. The programme was used to calculate the means (M), standard deviations (SD), frequencies (N), percentages (%), and means (%) of both questionnaire items for the 140 mathematics teachers in the study. Salkind states that descriptive statistics are an analyze kind that generates numerical values pertaining to respondents (Salkind, 2017). According to a study, the mean is the average of a set of numbers, but the standard deviation illustrates or evaluates the variability of a group score (Ofori and Dampson, 2012). The study employed a five-point Likert scale questionnaire. The researcher interpreted the mean (M) on a five-point Likert-type scale using the Ofori and Dampson technique, where a response of 0.00-1.00 is deemed lowest, a response of 1.10-2.00 is considered low, and a response of 2.10-3.00 is considered moderate (Ofori and Dampson, 2012). Responses between 3.10 and 4.00 are regarded as high, and those between 4.10 and 5.00 as highest. Each questionnaire's question items were ranked using their means in descending order. Teachers' questionnaire data were paired and examined in subsections. Table 8 presents Scale of Interpretation for a Five-point Likert Scale Questionnaire.

Table 6: Scale of Interpretation for a Five-point Likert Scale Questionnaire			
point	Scale Range	Level of Agreement	Interpretation
5	4.10 – 5.00	Strongly Agree	Highest
4	3.10 - 4.00	Agree	High
3	2.10 - 3.00	Neutral	Moderate
2	1.10- 2.00	Disagree	Low
1	0.00-1.00	Strongly Disagree	Lowest

Source: Field Survey (2024)

4.3 Descriptive Analysis for Mathematics teachers' Use of Ethnomathematics approach teaching mathematics

This research questionnaire sought to determine the level of Mathematics Teachers Use of ethnomathematics in the Savannah region. Using Brown's scale of interpreting Likert scale questionnaire, descriptive statistics of scores from Mathematics Teachers' use of Ethnomathematics-Based Instructional Approaches in Teaching mathematics (TUE).

Questionnaires were used to measures the level of Mathematics Teachers Use of ethnomathematics teaching approach in Savannah region, the results revealed that Mathematics Teachers in the region possess a high level of the use of ethnomathematics teaching approach, with an overall mean score of 4.1418 and a standard deviation of .72873.

Table 7: Descriptive Statistics for Teachers' use of Ethnomathematics (TUE)

TUE 3	I modify my lesson plans to include ideas of ethnomathematics.	140	3.9786	1.10894	4	High
TUE 4	I included Activities based on ethnomathematics in my mathematics classes	140	4.2214	1.03234	5	Highest
TUE 5	I have encountered instances of ethnomathematics in mathematics textbooks or other materials	140	3.8786	1.06931	4	High
TUE 6	I specifically include ethnomathematics into my lesson preparations.	140	3.9500	1.04106	4	High
TUE 7	I am aware that various cultural backgrounds may have different methods for solving mathematics puzzles	140	4.2643	.81894	5	Highest
TUE 8	I will be excited to teach ethnomathematics in further detail in my mathematics class.	140	4.0571	1.072873	5	Highest
Overall Mean Score		140	4.1418	0.72873		Highest

4.4 Male and Female Mathematics Teachers' Use of Ethnomathematics Approach Teaching Mathematics.

H0: There is no significant difference between male and female mathematics teachers' use of ethnomathematics approaches in teaching.

Independent sample t-test analyze was selected to compare the gender-based data means from the teachers' questionnaires. This was done to the test statistics for the hypothesis being selected. Table 8, displayed the results of the t-test.

Table 8: Independent Sample t - test was used to Analyze Gender use of Ethnomathematics Approach Teaching Mathematics

Gender (TUE)	N	Mean	Sd	p-value	D f	t-cal	Sig (2tailed)	F
Male	97	4.1661	.67760	.188	138	1.363	.175	1.753
Female	43	3.9871	.79984		69.881	1.278	.205	

The computed p-value (.188) is greater than the alpha level (0.05), as Table 4.13 demonstrates. We fail to reject the null hypothesis since the p-value (.188) is greater than the alpha level (0.05), meaning that, there is no significant difference between male and female mathematics teachers' use of ethnomathematics approaches in teaching mathematics.

5. DISCUSSION OF RESULTS

The level of Male and Female Mathematics Teachers' use of Ethnomathematics Teaching Approaches was examined, and it was discovered that both male and female Mathematics Teachers use ethnomathematics approach in teaching mathematics. Furthermore, male and female teachers revealed that, they use ethnomathematics approach in teaching mathematics, they also advise their fellow teachers to incorporate Ethnomathematics into mathematic instruction to enriches Mathematics teaching experience. Similarly, the study findings agreed with previous findings, both male and female teachers who participated in Asokwa traditional activities agreed that teaching and learning procedures in the classroom should incorporate Asokwa students' traditional mathematics practices and activities (Seth, 2023). They said that this would improve the relationship between the school and the community, as well as students' mathematical achievement.

Also, a researcher understanding the cultural background of the learners and how the teaching and learning process relates to it is one of the fundamental tenets of effective teaching (Gerdes, 2001). Moreover, the study findings also aligned with who states that learner-centered and activity-oriented, ethnomathematics approaches emphasize the teaching and learning of Mathematics using pertinent examples and activities that the students are already familiar with (Fatade et al., 2014). According to ethnomathematics is a learner-centered approach that builds on the experiences, values, and culture of its students, which agreed with the study's findings (Hunter, 2021). The study findings were also in line with the outcomes of Gerdes, 2008 and Jones, 2002, who discovered that cultural experiences are inextricably linked to Mathematics, which is a fundamental component of both ethnomathematics and culture.

This suggests that Mathematics is a mental construct and a social product that people have developed in communities all around the world. It is a crucial component of the cultural experience of the learners and plays a significant role in many aspects of life (Jones, 2002). According to most of researcher, they discovered that there are numerous rich mathematical cultural activities around the world, and these activities have a wide spectrum of practical applications, from building to design, which is similar to the study (Dickenson-Jones, 2008; Stathopoulou et al., 2015).

6. CONCLUSIONS

The findings of the study showed that majority of respondents Strongly

agreed that mathematics teachers use ethnomathematics approach in teaching. The study furthermore revealed that, both male and female teachers agreed that teaching and learning procedures in the classroom required to incorporate students' traditional mathematics practices and activities. This would develop a better interaction between the school and out of school, as well as boost students' performance in mathematics. The study also showed that ethnomathematics teaching approach in the Savannah region is known and use by both male and female mathematics teachers.

RECOMMENDATIONS

The research provided the following recommendations to increase Mathematics achievement through ethnomathematics approach in the Savannah Region.

The government should give teachers professional development opportunities to improve their knowledge of ethnomathematics and its implications for teaching and learning. Based on the study's findings, teachers should be equipped with the knowledge and skills necessary to successfully incorporate ethnomathematical approaches into their instructional practices.

When creating curricula, educators should make sure that examples, exercises, and problems are appropriate for the students' culture. To establish links between mathematical ideas and students' real-world experiences, draw on the mathematical customs and practices of many cultural groups.

Teachers should use continuous assessment and feedback systems to analyse and consider the efficacy of teaching ethnomathematics on a regular basis. To better address the varied needs of children and encourage equitable mathematics accomplishment for all learners, modify instructional tactics as necessary.

Teachers should encourage cooperative learning settings where students can use ethnomathematical approaches to investigate and solve mathematical problems as a group. Promote peer-to-peer instruction and learning exchanges to take advantage of the variety of perspectives and backgrounds present in the classroom.

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