



Crossroads in Mathematics Games: Integrating Indigenous and Exotic Games

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ABSTRACT

In numerous countries and higher education institutions, the significance of indigenous games in mathematics education is highly recognized. Nonetheless, the increasing preference for exotic games has placed indigenous mathematics teachers in a challenging position. This research aimed to examine the awareness and understanding of mathematics teachers regarding indigenous games amidst this competition. Initially, the study employed a phenomenological approach, targeting 200 teachers but randomly selecting a sample of 70 for the quantitative phase. Subsequently, the qualitative phase involved in-depth interviews and observation checklists with five teachers to explore the issue further. The collected data was systematically coded and thematically analyzed, focusing on teachers' knowledge, misconceptions, and potential solutions. The findings revealed that some teachers had greater knowledge of indigenous games than exotic ones. Conversely, other teachers believed that exotic games facilitated faster learning outcomes. This divergence created a significant dilemma in choosing indigenous games for mathematics instruction. Despite the popularity of games like draft, playing cards, snake-and-ladder, and Ludo, the teachers ultimately recognized that Indigenous games such as biloo, bilore, gollaa, and mullaa provided superior learning outcomes. Therefore, stakeholders were recommended to revamp mathematics curricula to incorporate indigenous games more effectively.

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INTRODUCTION

Indigenous cultural games are recreational activities that naturally originate from specific cultural groups, communities, or people, completely distinct from metropolitan games and sports [1]. They span from indoors to typical competitive games with prizes based on pride and inner satisfaction. They can be played in and out of school [2]. The following contribute to the need for school learners to accept and use Indigenous games.

Research on indigenous cultural games indicates that incorporating cultural elements into educational systems is highly effective for modern educational development globally ([1], [3], [4], [5], [6], [7], [8], [9], [10], [11]). Consequently, mathematics education should be contextualized within students' cultural and geographical settings. Recently, international organizations have highlighted indigenous knowledge systems as a critical global priority to empower traditional and local communities in their efforts towards sustainable development. The marginalization of the contributions of indigenous communities to the advancement of mathematical and scientific knowledge continues to hinder effective teaching and learning of mathematics. Considering the nature of mathematical knowledge and its origins leads to an ambiguous understanding. This historical oversight stems partly from a narrow definition of what constitutes mathematics and a lack of

comprehension of living indigenous practices [5].

Integrating the cultural knowledge of indigenous communities with contemporary educational practices should be the preferred method for teaching mathematics [7]. Scholars argue that many developing countries possess indigenous resources that can be harnessed for mathematics education ([2], [8]). However, the literature on conceptualizing, concretizing, and indigenizing mathematical concepts remains sparse. Often viewed as entertainment, Indigenous games create meaningful and practical opportunities for applying mathematical skills. Since children generally enjoy playing games, they can develop an intrinsic motivation for learning mathematics through these indigenous games.

Games have the potential to demystify mathematics, making it less abstract and more accessible. They address concerns that mathematics instruction often seems remote and detached from children's experiences. Additionally, games can make learning mathematics enjoyable [9]. To enhance the teaching and learning of mathematics, efforts should be made to reintroduce and incorporate culturally informed mathematics (ethnomathematics). Integrating mathematics instruction with indigenous games, supported by modern technological knowledge, can transform teaching into a more engaging and enjoyable experience ([3], [6], [2]). The introduction of indigenous cultural games in the 1987 education reforms in Ghana aimed to contextualize mathematics instruction within the social realm of the child.

Including indigenous knowledge and artifacts in mathematics education policies is essential [12]. These initiatives aim to contextualize mathematics within the sociocultural domain of students, making it more meaningful and relevant. They underscore the potential of games as alternative instructional tools that position mathematics within the social domain of the child. This approach impacts various socio-economic factors, including cultural diversity, education and training, resource accessibility, international relations, and economic growth [13]. Although many basic mathematics teachers are unfamiliar with using indigenous games to teach mathematics, they should be encouraged to incorporate culturally relevant games to make education more relevant and meaningful.

Utilizing indigenous games in mathematics education not only engages students but also demystifies the perceived difficulty of the subject. The failure to use indigenous games risks perpetuating a disconnect in mathematics education for future generations. This study is grounded in Piaget's constructivist theory, which helps to understand how mathematics teachers guide children in actively constructing new knowledge and making sense of their learning. According to Piaget, knowledge is built through accommodation and assimilation, where new experiences are integrated into existing frameworks or mental representations are adjusted to incorporate new experiences [14]. Additionally, Vygotsky's theory highlights the social learning processes, emphasizing collective interaction and communication as crucial for cognitive development. Applying indigenous games allows students to analyze, think critically, synthesize, and derive meaningful solutions [15].

Despite numerous indigenous games that significantly contribute to children's academic development, it is unclear how many teachers are aware of and use these games in mathematics instruction. This study explores junior high school mathematics teachers' knowledge of indigenous games and their impact on teaching basic mathematics.

This study is based on Piaget's constructivist theory, which focuses on how learners construct new knowledge from their prior experiences [14]. Constructivist scholars advocate for the pedagogical benefits of games, asserting that learning involves accommodating and assimilating new experiences into existing frameworks. When experiences align with internal representations, knowledge is constructed seamlessly. However, when new experiences contradict existing understandings,

individuals must adjust their perceptions ([6], [16], [10]). Constructivism emphasizes the active role of learners in constructing knowledge rather than passively receiving it. Teachers should create environments that encouraging critical thinking and exploration [17]. Indigenous cultural games form the basis of children's prior knowledge, facilitating reflection, practice, and the application of mathematical concepts.

Constructivism also supports reflection and meta-cognition. Teachers should challenge students to think critically about their learning processes. For instance, instructional games played outside the classroom can be discussed and analyzed during class, fostering a constructivist learning environment. Social interactions during games can produce emotions that impact learning outcomes ([3], [9]).

The integration of indigenous games into African education has been discussed since the 1990s [5]. Several countries and universities have recently incorporated indigenous games into their curricula at various levels. However, mathematics teachers face significant challenges integrating these games due to competition with other educational games. Identifying the most suitable games for specific mathematical topics is a major challenge. Although many indigenous games exist and play a crucial role in children's academic development, it remains unclear how many teachers use these games in teaching mathematics. This study explores the use of indigenous games by junior high school teachers and the challenges they encounter in integrating them into mathematics instruction ([1], [12]).

This study aims to identify teachers' challenges in teaching selected mathematical topics and suggest best practices for overcoming these challenges. It also explores teachers' perspectives on integrating indigenous games into mathematics instruction.

The following research questions guide the study: 1) What types of indigenous games do mathematics teachers use to teach selected mathematical concepts? 2) What challenges do teachers face in integrating indigenous games into selected mathematics topics? 3) How can teachers overcome the challenges of integrating indigenous games into mathematics instruction?

METHODS

This study, grounded in Piaget's constructivist theory, employed a qualitative phenomenological approach to meet its objectives and answer the research questions. Teachers could discuss and select exotic and cultural games [18]. They further identified key topics in the curriculum, selecting areas that should be taught using indigenous games better to reflect mathematical concepts [2]. The main challenges of using these games were identified through an observation checklist designed by the researchers.

The study initially involved 70 professionally trained mathematics teachers (65 males, five females) chosen based on their accessibility to the researchers in the first phase. This group was then narrowed down to five teachers (three males and two females) selected for their particularly interesting and engaging responses [10].

The sample selection process was homogenous and purposive only for Indigenous teachers with vast experience playing indigenous games [1]. During their training at the College of Education level, these teachers also had formal education where mathematics activities and games were embedded in the syllabus. Of the 70 teachers, 45 completed the College of Education, and 25 completed the traditional teacher-training Universities for their bachelor or diploma in education degrees. They have also taught mathematics games for two or more years [12].

The coding was in two parts. The first part of the coding was the frequency counts. All respondents and their frequencies were created to allow for easy analysis. The second part of the

coding used anonymous tags for each of the five teachers. These were denoted as T1, T2, T3, T4, and T5. Consequently, the data analysis data from the first phase, which focused on the types of indigenous games used by mathematics teachers to teach basic concepts, were analyzed using frequency distribution tables. In the second phase, data on the challenges associated with indigenous games were categorized into three themes corresponding to the second research question and the study's purpose [10]. Both phases systematically coded, categorized and interpreted data to clarify the research questions.

Ethical Considerations: The researcher adhered to several ethical guidelines throughout the study. Initially, permission was obtained from the local district where the teachers were the primary participants. Each teacher was subsequently contacted to secure their consent to participate in data collection. Confidentiality and anonymity were ensured, with pseudonyms such as Teacher 1, Teacher 2, etc., used to collect the data. The main ethical considerations included: 1) Voluntary Participation: Participants were informed that their involvement was voluntary and that they could withdraw from the study at any time without any penalties; 2) Informed Consent: Consent was obtained from participants, including the district education director and school principals, after explaining the research and their role in it; 3) Confidentiality and Anonymity: To maintain confidentiality and anonymity, pseudonyms were used in data collection; 4) Providing Feedback: The study's results and findings were shared with the participants once they were validated. The participating teachers were informed of the outcomes after the results were deemed valid [1].

RESULTS AND DISCUSSION

Research Question 1: Types of Games Mathematics Teachers Use

This research question aimed to identify the types of indigenous games teachers incorporate into their mathematics instruction. To address this, a set of questionnaires was created. The initial section included two items to determine if mathematics teachers used games in their teaching and to identify the specific types of games used. The second section asked participants to specify the games they employed for different topics in the mathematics syllabus. The participants' responses were then analyzed descriptively, with the detailed results from the findings in Tables 1, 2, and 3.

Table 1. Teachers Use of Games in Teaching Mathematics

Use of Games	Frequency	Percentage%
Yes	64	91.4
No	6	8.6
Total	70	100

Table 1 reveals that of the 70 participants who completed the questionnaire, a significant majority (64 respondents or 91.4%) reported using games in their mathematics instruction. In contrast, the remaining six respondents (8.6%) did not incorporate games into their teaching methods. These responses suggest that using games in teaching mathematics is prevalent among most respondents.

Table 2. Kinds of Games Teachers Use

Kind of Games	Frequency (F)	Percentage (%)
Indigenous games	15	23.4
Exotic games	1	1.6
Both Indigenous and exotic games	48	75.0
Total	64	100

Table 2 shows that among the 64 respondents who answered "yes," 15 (23.4%) reported using indigenous games in their mathematics teaching. Only one respondent (1.6%) mentioned using exotic games, while 48 respondents (75.0%) stated they used indigenous and exotic games in their classrooms.

Recognizing simple "yes" or "no" answers and multiple-choice questions might not fully capture the actual practices. The researcher asked participants to specify the types of games they used for different topics in the mathematics syllabus. Although 91.4% claimed to use games in teaching mathematics, many could not specify the types of games they used for each topic. To facilitate analysis, the responses were categorized into "indigenous games," "exotic games," and "undecided." The frequency counts were then converted into percentages, as shown in Table 3.

Table 3. Kinds of Topics and Games Teachers Use

Topic	Types of Games Used by Teachers	F	Number/percentage (N/%)
Number and Numeral	Indigenous Game Gollaa	7	17(24.3%)
	Bibore	10	
	Exotic Game Playing Cards	3	3(4.3%)
Set	Undecided	50	50(71.4%)
	Indigenous Game Bibore	8	17(24.3%)
	Biloo/Bize	9	
	Exotic Game Draft	7	11(15.7%)
	Playing Cards	4	
Fraction	Undecided	42	42(60.0%)
	Indigenous game Gollaa	17	23(32.9%)
	Mullaa	6	
	Exotic Game Ludo	9	9(12.9%)
Shapes & Space	Undecided	38	38(54.3%)
	Indigenous Game Gollaa	8	15(21.4%)
	Bibore	5	
	Mullaa	2	
Length and Area	Exotic Game Playing cards	13	13(18.6%)
	Undecided	42	42(60.0%)
	Indigenous Game Bibore	6	18(25.7%)
	Gollaa	12	
	Exotic Game Playing Cards	10	10(14.3%)
Power of Numbers	Undecided	42	42(60.0%)
	Indigenous Game Biloo/bize	12	14(20.0%)
	Bibore	2	
	Exotic Game Ludo	10	10(14.3%)
Capacity, time, money, and mass	Undecided	46	46(65.7%)
	Undecided	70	70(100%)
Angles	Undecided	70	70(100%)
	Indigenous Game Bibore	6	16(22.9%)
	Gollaa	10	
	Exotic Game Draft	11	11(15.7%)
Properties of quadrilateral	Undecided	43	43(61.4%)
	Indigenous Game Gollaa	11	15(21.4%)
	Bibore	4	
	Exotic Game Playing cards	7	7(10.0%)
	Undecided	46	46(65.7%)

Probability	Indigenous Game Mullaa	8	20(28.6%)
	Gollaa	12	
	Exotic Game Ludo	7	7(10.0%)
Vectors	Undecided	43	43(61.4%)
	Indigenous Game <i>Gollaa</i>	10	10(14.3%)
Properties of Polygons	Undecided	60	60(85.7%)
	Indigenous Game Gollaa	12	17(24.3%)
	Bibore	5	
	Exotic Game Ludo	10	10(14.3%)
Rigid Motion	Undecided	43	43(61.4%)
	Indigenous Game Baa	18	18(25.7%)
	Undecided	52	52(74.3%)

Table 3 demonstrates that 17 respondents (24.3%) utilized indigenous games like Gollaa and Bibore for teaching Numbers and Numerals, while a smaller number (3 respondents, 4.3%) opted for playing cards for the same topic. Notably, 50 respondents (71.4%) were unsure which game to teach Numbers and Numerals. Similarly, 17 respondents (24.3%) indicated using indigenous games such as Bibore or Biloo/Bize for teaching Sets, whereas 11 respondents (15.7%) used exotic games like playing cards and drafts. The majority (42 respondents, 60.0%) were undecided.

Furthermore, 23 respondents (32.9%) used indigenous games like Gollaa and Mullaa to teach Fractions, while nine (12.9%) used Ludo. However, 38 respondents (54.3%) were uncertain which game to use. For Shapes and Space, 15 respondents (21.4%) utilized indigenous games such as Gollaa, Bibore, and Mullaa, while 13 respondents (18.6%) used playing cards, and 42 respondents (60.0%) were undecided.

In addition, 18 respondents (25.7%) used Bibore and Gollaa for teaching Length and Area, while 10 (14.3%) used playing cards. The majority (42 respondents, 60.0%) remained uncertain. Similarly, 14 respondents (20.0%) indicated using Biloo/Bize and Bibore for teaching Power and Numbers, whereas 10 respondents (14.3%) used Ludo, and 46 respondents (65.7%) were undecided. All 70 respondents were undecided about which games to teach Capacity, Time, Money, and Mass.

For teaching Angles, 16 respondents (22.9%) used Bibore and Gollaa, while 11 respondents (15.7%) used draft, and 43 respondents (61.4%) were undecided. For Properties of Quadrilaterals, 15 respondents (21.4%) used indigenous games like Gollaa and Bibore, seven respondents (10.0%) used playing cards, and 46 respondents (65.7%) were undecided. In teaching Probability, 20 respondents (28.6%) used Mullaa and Gollaa, seven respondents (10.0%) used Ludo, and 43 respondents (61.4%) were uncertain.

For Vectors, only ten respondents (14.3%) used Gollaa as an indigenous game, while the remaining 60 respondents (85.7%) were uncertain about which game to use. Similarly, for teaching Properties of Polygons, 17 respondents (24.3%) used indigenous games like Gollaa and Bibore, 10 respondents (14.3%) used Ludo, and 43 respondents (61.4%) were undecided. Lastly, for Rigid Motion, 18 respondents (25.7%) used Baa, while 52 (74.3%) were undecided.

The results from Table 3 indicate that although most respondents agreed that they use games in teaching mathematics, most could not specify the games they used for different topics as outlined in the mathematics syllabus. This observation aligns with the findings of [7] and [1], which suggest that despite cultural games' significant role in education, few teachers incorporate them effectively due to a lack of knowledge about indigenous games.

Research Question 2: Challenges of Using Indigenous Games

The second research question explored teachers' challenges when integrating indigenous games into mathematics teaching. Table 4 and the following transcripts provide a comprehensive overview of these challenges.

Table 4. Knowledge of using Indigenous games

Challenges in Using Indigenous games	Agree	Disagree	Uncertain	Totals
I lack sufficient knowledge to utilize indigenous games effectively.	43 (61.4%)	18 (25.7%)	9 (12.9%)	70 (100%)
The diversity within the class makes it challenging to implement indigenous games.	16 (22.9%)	49 (70.0%)	5 (7.1%)	70 (100%)
Africa's colonial history impacts the integration of indigenous games in mathematics education.	28 (40.0%)	33 (47.1%)	9 (12.9%)	70 (100%)
The large class size hinders the use of indigenous games in teaching mathematics.	52 (74.3%)	10 (14.3%)	8 (11.4%)	70 (100%)
There is no ongoing professional development to keep teachers updated on using indigenous games.	41 (58.6%)	19 (27.1%)	10 (14.3%)	70 (100%)
Incorporating indigenous games in mathematics lessons would lead to excessive play among students.	45 (64.3%)	17 (24.3%)	8 (11.4%)	70 (100%)
The time allocated for mathematics lessons is too limited to include indigenous games.	56 (80.0%)	3 (4.3%)	11 (15.7%)	70 (100%)
The scarcity of indigenous game materials prevents their use in classrooms.	20 (28.6%)	46 (65.7%)	4 (5.7%)	70 (100%)
The training I received in college was insufficient to integrate indigenous games into my teaching effectively.	53 (75.7%)	6 (8.6%)	11 (15.7%)	70 (100%)

The findings presented in Table 4 highlight several issues contributing to teachers' inability to incorporate indigenous games into mathematics instruction. Most respondents (43), representing 61.4%, agreed that teachers' inadequate knowledge of Indigenous games prevents many mathematics teachers from utilizing them in the classroom. Conversely, 18 respondents (25.7%) disagreed with this assertion, and nine (12.9%) were uncertain. These findings indicate that mathematics teachers have limited knowledge of using indigenous games. Additionally, 16 respondents (22.9%) agreed that the heterogeneous nature of the class makes it difficult to use indigenous games in teaching mathematics, although 49 respondents (70%) disagreed, and five respondents (7.1%) were uncertain. This finding contrasts with the views of [6] and [8], who posited that the diverse cultural backgrounds of students in many African classrooms make integrating Indigenous games into mathematics instruction challenging, if not impossible.

Furthermore, while 28 respondents (40.0%) believed that colonization affects the use of indigenous games in the mathematics classroom, a majority of 33 respondents (47.1%) disagreed, and nine respondents (12.9%) were uncertain. This claim contradicts [7], who noted colonization as a significant barrier to effectively using Indigenous games in mathematics instruction. Additionally, a majority of respondents (52), representing 74.3%, thought that large class sizes impede the use of Indigenous games in teaching mathematics, whereas ten respondents (14.3%) disagreed, and eight respondents (11.4%) were uncertain. Regarding the continuous professional training of mathematics teachers in using indigenous games, 41 respondents (58.6%) agreed, while 17 respondents (27.1%) disagreed, and ten respondents (14.3%) were uncertain. Similarly, 45 respondents (64.3%) believed that using indigenous games in mathematics instruction would lead to excessive play among pupils, although 17 respondents (24.3%) disagreed, and eight respondents (11.4%) were uncertain. This

finding supports the notion that some teachers view games narrowly as activities for play, enjoyment, and recreation.

Moreover, 56 respondents (80.0%) agreed that the instructional time allocated for mathematics is too short to incorporate indigenous games effectively, although three respondents (4.3%) disagreed, and 11 respondents (15.7%) were uncertain. The study also revealed that while 20 respondents (28.6%) agreed that insufficient indigenous game materials hinder their integration into mathematics instruction, a majority of 46 respondents (65.7%) disagreed, and four respondents (5.7%) were uncertain. Additionally, 53 respondents (75.7%) agreed that their training in teacher training colleges was inadequate for effectively incorporating Indigenous games into mathematics lessons. However, six respondents (8.6%) disagreed, and nine (15.7%) were uncertain. Consequently, institutions responsible for training school mathematics teachers must include the use of indigenous games as a strategy to enhance pupils' understanding of mathematics. The results from Table 1.4 suggest that respondents are fairly knowledgeable about the challenges of integrating indigenous games into mathematics instruction.

Table 5. Teachers Use of Indigenous Games in the Mathematics Classroom

No.	Questions	T1	T2	T3	T4	T5	Total (√)	Total (×)
1	Did the teacher incorporate an indigenous game?	√	√	×	√	√	4	1
2	Did the teacher progress from familiar concepts to new ones?	√	√	√	√	×	4	1
3	Was the classroom environment supportive of learning?	√	√	√	√	√	5	0
4	Was the indigenous game used effectively?	×	×	√	√	×	2	3
5	Did the game provide benefits to the students?	×	×	×	√	×	1	4
6	Were any difficulties experienced?	√	√	√	×	√	4	1
7	Did the use of indigenous games cater to the diverse learning needs of the students?	×	×	×	×	×	0	0

The results presented in Table 5 from the observation checklist indicate that although 4 out of 5 teachers included indigenous games in their lessons, only two effectively applied these games as specified in item 4. It was noted that even though many teachers understand the numerous benefits of incorporating indigenous games in mathematics teaching, only a few put this knowledge into practice due to a lack of understanding of the mathematical content and language embedded in these games ([7], [1]). Additionally, the study found that while most classrooms were conducive and teachers introduced new concepts by building on familiar ones, little consideration was given to the diverse learning needs of individual students.

The first research question is: 'What types of indigenous games do mathematics teachers use to teach selected mathematical concepts?' The questionnaire survey results indicated that teachers possess a reasonable awareness of the difficulties encountered when incorporating Indigenous games into mathematics teaching. Nevertheless, the responses to the Likert scale items might be speculative and not necessarily indicative of their true knowledge. To delve deeper into the teachers' comprehension of the obstacles they face in using indigenous games for mathematics instruction, five participants were interviewed following an interview guide designed to validate the questionnaire findings. The thematic analysis of the interview responses revealed that most teachers understood the

challenges involved in using indigenous games to teach mathematics. This insight from the interview partly confirmed the results of the questionnaire survey. Respondents were able to substantiate their claims made in the questionnaire survey, reinforcing the survey's findings ([1], [10]).

Question: What primary challenges do you encounter when using indigenous games in teaching mathematics? The following responses were transcribed from the teachers.

Teacher 4: [Ammm] I cannot utilize indigenous games in my mathematics lessons due to inadequate knowledge about these games. Furthermore, the diverse backgrounds of my students make it difficult to select the appropriate indigenous games for effective teaching (source: Teacher 4).

Teacher 3: [Errrr] In my perspective, games are primarily for leisure and have no significant role in the educational process of mathematics (source: Teacher 3).

Teacher 5: I refrain from using indigenous games in my mathematics teaching because many are played on the ground, which can soil the students' uniforms. Additionally, these games might expose children to various health risks, something I believe many parents would not find acceptable (source: Teacher 5).

Teacher 2: [Hmmm] Considering that many indigenous games are designed for just two players, managing them in a large classroom setting would be difficult, if not impossible, without taking up much instructional time (source: Teacher 2).

Teacher 1: [Ammm] From my standpoint, using indigenous games would be time-consuming. Specifically, the mathematics curriculum does not advocate using indigenous games in teaching and learning (source: Teacher 1).

The responses from these teachers highlight their indecision and challenges. However, some respondents demonstrated a reasonable awareness of the factors that hinder the integration of indigenous games into mathematics instruction. These findings align with existing studies that suggest most mathematics teachers refrain from using indigenous games due to their limited understanding of them [5].

The researcher created a checklist to investigate this issue (see Table 3) and evaluate the participants' use of indigenous games in their mathematics lessons. This evaluation aimed to confirm or challenge the responses in the questionnaire and the interview guide [7]. The presence of an observed practice was marked with a check (√), while the absence was noted with a cross (×). The frequency of these practices was then recorded, with the results presented in Table 4.

The third research question was, "What strategies should teachers employ to overcome the challenges of integrating indigenous games into mathematics instruction?" Table 5 was utilized to address this question. Each of the five teachers was denoted as T1, T2, T3, T4, and T5. Solutions to the practice were indicated with a check (√), while the absence of practice to resolve the challenges was marked with a cross (×).

Key takeaways from the findings include:

1. The mathematics curriculum should integrate indigenous games, particularly in Basic Schools and Teacher Training Colleges.
2. Mathematics teachers not originally from the communities where they teach should undergo refresher training to enhance their knowledge of local indigenous games.
3. Students skilled in Indigenous games related to mathematics can be invited to demonstrate these games to their peers, using practical examples such as gollaa, bibore, and biloo/bize [1].
4. Indigenous games often employ local languages, which can help children grasp certain mathematical concepts and skills more quickly.

Using indigenous games helps to break down the myths surrounding mathematics, thereby reducing mathematics anxiety [16].

CONCLUSIONS AND SUGGESTIONS

The findings indicated that some teachers better understood indigenous games than exotic ones. Conversely, other teachers believed exotic games led to quicker learning outcomes than indigenous games. This disagreement created significant indecision in selecting indigenous games for teaching mathematics. Despite competition from games like draughts, playing cards, snakes-and-ladders, and Ludo, teachers found that Indigenous games such as biloo, bilore, gollaa, and mullaa produced better learning outcomes.

Indigenous games, deeply embedded in the cultural fabric, provide a valuable form of informal education. It is advisable for teachers new to the communities assigned to undergo refresher courses to familiarise themselves with local indigenous games. This training would enable them to effectively incorporate games such as Baa, mullaa, gollaa, bibore, and biloo/bize into their mathematics instruction, utilizing discovery and trial-and-error methods.

Moreover, indigenous games have been recognized as a viable alternative teaching strategy to improve mathematical understanding. Despite having different names in various regions, the core principles of these games remain consistent.

Employing Indigenous games like Baa, mullaa, gollaa, bibore, and biloo/bize engages and maintains students' interest in the classroom, reducing mathematics's abstract nature. However, it is crucial to address the numerous challenges and uncertainties that teachers encounter to enhance the effectiveness of mathematics education.

Teachers should deepen their understanding and skills in indigenous cultural games by participating in workshops, seminars, and conferences. Once familiar with these games, teachers can leverage them to improve students' mathematical learning outcomes. These workshops, seminars, and meetings should innovate and respond to multidisciplinary, transdisciplinary, intercultural, and transcultural games to build stronger synergies between indigenous and exotic games. The findings showed that many indigenous games are similar to the exotic ones.

The significance of understanding indigenous cultural games is immense. Cultural games have now been permeated into indigenous games. Teachers should categorize different areas of mathematics within the context of these games so that students can easily connect specific games with specific mathematical domains instead of over-concentrating the origin of the games.

Moreover, it is crucial to identify and address the factors that hinder the effective use of indigenous cultural games in mathematics education. The wrong notion of interference of the exotic should be dispelled. Properly looking for the sources of the challenges rather than the effects of exotic games will help enhance teachers' knowledge and application of indigenous games in their instruction.

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