The Mathematics Teacher at the Crossroads Between Indigenous Cultural and Exotic Games in Teaching Mathematics

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Research Article

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Abstract

The issue of integrating indigenous games in Africa had long been conceived by Mogege David Mosimege in the 1990s. Of late, several countries and universities have introduced indigenous games into their curricula at all levels of education. However, with serious competition with the exotic education games, the mathematics teacher is still at the crossroads of integrating these games. One of the most challenging aspects is determining the games that best suit particular topics. The purpose of this study was to explore teachers’ challenges in some selected topics and suggest ways best practices of resolving the impasses. Deeply rooted in Piaget constructivism, the phenomenological design was harnessed to address the purpose, objectives and research questions carved to guide the study. With a population of over 200 teachers, the researchers sampled 70 teachers (65 males, 5 females) through simple random sampling for the first stage. Five teachers, comprising three males and two females, were purposively sampled for the second stage. The semi-structured interview guide and an observation checklist were the instruments the researchers used to collect data. The data was analyzed thematically to reflect the research questions. The results of both stages showed that even though a good number of teachers cannot decided on any games and substantial number were still being influenced by the other cultural games, some teachers who selected the indigenous games yielded impact on students’ learning of mathematics. The four indigenous games, namely biloo, bilore, gollaa and mullaa were dominant. However, the observation checklist showed that many teachers are at serious crossroads of selecting indigenous games for the teaching of mathematics. It was therefore recommended that stakeholders reinvent teaching and learning through the integration of games and culture.

Introduction

Research works on indigenous cultural games (Akayuure & Ali, 2016; Mpofu, 2016; Mosimege, 2017; Manzari Tavakoli et. al., 2021; Moloi et al., 2021; Pereira & Venâncio, 2021; Bonne & Higgins, 2022; Hadebe-Ndlovu, 2022; Mulaudzi, 2022; Tangkur et al., 2022) have shown that the cultural placement of an educational system is probably the most appropriate way in modern educational development in the undeveloped part of the world. Therefore, mathematics teaching must be related to the cultural and geographical context. Moloi (2015) opines that indigenous cultural games are part of indigenous knowledge systems. International world organizations have recently established these indigenous knowledge systems as a top global priority for empowering traditional and local communities in their quests toward sustainable development. Chahine (2011) opines that the over-marginalization of the contributions of indigenous communities to the development of mathematics and scientific knowledge remains a threat to the teaching and learning of mathematics. When one considers the nature of mathematical knowledge and who produces it, one will enter into an ambiguous realm of doubts. This historical reduction has been partly due to a rather limited view of what counts as mathematics on the one hand and to a lack of understanding of living indigenous practices on the other hand.

Harmonizing indigenous community’s cultural knowledge with contemporary ideas in our formal education should be the best method and technique for teaching mathematics (Machaba, 2013; Moloi et
al., 2021). Ali (2021), and Pereira and Venâncio (2021) contend that many developing countries have indigenous resources that could be explored to teach mathematics. However, little literature has been conceptualized, concretized and indigenized mathematical conceptions. Games as indigenous cultural resources are usually viewed from the narrow perspective of play, enjoyment and recreation. Even Moloi (2015) outlines how indigenous games create meaningful and practical situations for applying mathematical skills. Since most children enjoy playing games, they could unintentionally develop intrinsic motivation for mathematics through these indigenous games.

Generally, games have the potential to demystify mathematics as an abstract and a challenging course of study (Nabie, 2011). Games also addresses Mutema's (2014) concerns of making mathematics classroom activities exclusively abstract, remote and mostly detached from the children's experiences. Again, games make children enjoy mathematics (Bonne & Higgins, 2022). For effective teaching and learning of mathematics, efforts should be made toward reintroducing and reincorporating culturally informed mathematics (ethnomathematics). Thus, adding African mathematics into the educational curricula and boosted by the modern technological knowledge are borne out of the indigenous knowledge systems (indigenous games) (Dewah & Van Wyk, 2014). This technological knowledge has been metamorphosed into digital knowledge in online teaching and learning (Akayuure, 2021). This makes teaching and learning more fun and enjoyable (Kazima, 2013; Moloi, 2013; Mulaudzi, 2022; Tangkur et. al., 2022). The introduction of indigenous cultural games in the 1987 education reforms in Ghana was deliberately intended to help transform and contextualize mathematics teaching and locate mathematics instruction in the social domain of the child.

The 2020 educational reform policy of Ghana document repeated the inclusion of indigenous knowledge and artefacts in the teaching and learning of Mathematics (Ministry of Education, 2020). These moves aimed at contextualizing mathematics within students’ socio-cultural domain seek to make mathematics more meaningful and relevant. These have underscored the potential of games and located mathematics within the social domain of the child as alternative instructional tools for classroom interactions (Nabie, 2011). These eventually impact several socio-economic issues, such as African identity, cultural diversity, education and training, accessibility to resources, international relations and economic growth (Tachie & Galawe, 2021). Moloi (2015) opines that although the idea of using indigenous games to teach mathematics is not familiar to most basic mathematics teachers, they need to be encouraged to utilize learners' culturally related games as a vehicle for learning to make education relevant and meaningful.

So, using indigenous games to teach mathematics would not only arouse the child's interest but also demystify the perceived difficulty of learning mathematics. This devastating effect of not using indigenous games has the potential of always resurfacing its ugly heads on generations yet unborn. The study was anchored on Piaget's constructivist theory to help understand how mathematics teachers teach children to actively construct new knowledge and make meaning from their co-constructed knowledge. Knowledge is constructed through accommodation and assimilation. When individuals assimilate, they incorporate the new experience into an existing framework without necessarily changing it, and accommodation is the process of reframing one's mental representation of the external world to fit
new experiences (Piaget, 1983). In particular, the study was situated on Vygotsky’s (1978) social processes between people (inner psychological) and then inside the child (intra-psychological). In this Vygotsky’s perspective, learning as a social activity is the collectivity, communication and social rationality (Amr, 2012). As applied to indigenous games, students may seize the opportunity to analyze, think critically, synthesize, and arrive at a meaningful solution.

Even though there exist quite several indigenous games and the fact that many of these indigenous games play a significant role in the academic development of the child (Nabie, 2011), it is not too clear how many teachers know the use of these games and how the games impact on the teaching and learning of mathematics. The study aimed to explore how junior high school mathematics teachers know the indigenous games and how the games impact teaching basic mathematics. This purpose activated the following thought-provoking research questions:

**Theoretical Framework**

The study was anchored on Piaget constructivist theory because the aim of the researcher was to understand how mathematics teachers teach children to actively construct new knowledge and make meaning from them. Piaget (1983) argues that in constructivism, learners construct new knowledge based on their prior knowledge or otherwise their experience. Scholars who believe in the pedagogical benefits of games take their theoretical underpinnings from the constructivists’ perspective of the learning process (Amr, 2012). Piaget (1983) holds the view that through accommodation and assimilation, individuals construct new knowledge from their experiences. When individuals assimilate, they incorporate the new experience into an already existing framework without necessarily changing that framework. This may occur when individuals’ experiences are aligned with their internal representations of the world. In contrast, when individuals’ experiences contradict their internal representations, they may change their perceptions of the experiences to fit their internal representations (Tachie & Molepo, 2019; Manzari Tavakoli et. al., 2021; Hadebe-Ndlovu, 2022). According to Piaget (1983), accommodation is the process of reframing one’s mental representation of the external world to fit new experiences. Accommodation can be understood as the mechanism by which failure leads to learning. It is important to emphasis that constructivism is a theory describing how learning happens.

In the constructivist view of learning, the role of the teacher is to create enabling environment that encourages students to think (reason) and explore knowledge themselves (Sansome, 2016). Teachers do not besiege the centre of the learning process in constructivism. Machaba (2013) posits that individuals are responsible for acquisition of their own knowledge. That is knowledge is not passed on from the instructor to the student rather students construct it. The word “to construct” is a Latin word *construere*, which means to arrange or give structure. Donald, Lazarus and Lolwana (2010) contend that constructivism is viewed as knowledge that is actively constructed by individuals and not simply transferred.
Constructivism sees learners as active participants in their own learning environment. The idea is that knowledge is not passively received rather it is actively constructed. Through active engagement, learners can be challenged to make meaning of their social and or physical environment. Maychaba (2013) opines that within constructivism we see what we understand rather than understand what we see. Man's drawings of reality and interpretations of situations reflect is knowledge is not passed on from the instructor to the student rather students construct it. The word “to construct” is a Latin word *construere*, which means to arrange or give structure.

Learners construct their own knowledge in the classroom when the knowledge can be transferred to the world out-side the school environment (Tachie & Molepo, 2019). Tachie and Molepo (2019) explain constructivism as a way of helping children to construct their own ideas by using what they already know. It can be assumed that constructivism is still considered as an epistemology rather than a learning theory (Amr, 2012). Tangkur (2022) is of the view that indigenous cultural games form the bases of children prior knowledge. As one of the core aspects of constructivism, indigenous games are capable of capturing and allowing players to practice, reflect and relate the ideas gathered in the teaching and learning of mathematics.

Another important feature of constructivism is that it supports reflection and meta-cognition. Teachers should create opportunities in their classrooms that challenged student to critically think in their learning process. Akayuure (2021) espouse that students can be allowed to play an instructional game outside the classroom and teachers can bring in meaningful discussions and analyses during class time and make conclusions about the topic being taught. Since the teachers’ role is to facilitate the discussion, a constructivist learning environment is established during such an analysis. Bonne and Higgins (2022) believe that social interactions produce emotional. This can readily impact on learning outcomes.

**Statement of the Problem**

The issue of integrating indigeous games in Africa had long been conceived by Mogege David Mosimege in the 1990s. Of late, several countries and universities have introduced indigenous games into their curricula at all levels of education (Mosimege, 2017). However, with serious competition with the other education games, the mathematics teacher is still at the crossroads of integrating these games. One of the most challenging aspects is determining the games that best suit particular topics.

Secondly, in spite of the fact that there exist quite a number of indigenous games in the communities, and the fact that many of these indigenous cultural games play significance role in the academic development of the child (Nabie, 2011), it is not too clear as to how many teachers use these games in the teaching and learning of mathematics even though the Ministry of Education [MOE] (2012), underscores the importance of connecting new learning experiences in school to the knowledge and skills that children develop in the community. In view of this, the study sought to find out Junior High Schools Teachers use of indigenous games in their classrooms as well as the challenges they encounter in trying to integrate indigenous games in the teaching and learning of mathematics (Tangkur, et al., 2022).
Purpose of the Study

The purpose of this study was to explore teachers' challenges in some selected topics and suggest ways best practices of resolving the impasses. It was also to explore from teacher’s perspectives, the challenges encounter in integrating indigenous games in the teaching and learning of mathematics.

Research Questions

The following research questions guided the study:

1. What kinds of indigenous games do mathematics teachers use in teaching selected mathematical concepts?
2. What challenges do teachers encounter in integrating indigenous games into the selected mathematics topics?
3. How do should teachers resolve the challenges of integrating indigenous games into teacher mathematics?

Methodology

Research design

Deeply rooted in Piaget constructivism, the researchers employed the qualitative phenomenological design to address the purpose, objectives and research questions carved to guide the study. In this design, the teachers were allowed to articulate and select both the exotic and cultural games (Ali, 2022). They went further to select the dominant topics in the curriculum. The selection of the topics was based on their own conception of areas should be taught and learned with indigenous games to reflect on the reality of mathematics (Ali, 2021). They then expressed the main challenges of using the games through the researchers’ own design of an observation checklist.

Participants and Context

The participants consisted of 70 teachers (65 males, five females) professionally trained mathematics teachers who were selected based on their access to the researchers in phase one. After that, the number was scaled down to 5 (three males, two females) teachers who were purposively selected based on their own interesting and captivating responses (Hadebe-Ndlovu, 2022).

Data Analysis

The phase one data based on the kinds of indigenous games mathematics teachers use in teaching basic mathematical concepts were presented on frequency count distribution tables. Phase two data based on the challenges of indigenous games were categorized according to three themes to reflect on research question two and the purpose of the study (Ormston, Spencer, Barnard and Snape, 2013;
Hadebe-Ndlovu, 2022). In both analyses, the researchers ensured a systematic process of coding, categorizing and interpreting data to provide clarifications about the research questions.

**Ethical Considerations**

The researcher abided by numerous ethical considerations in carrying out this research. First and foremost, permission was sought from the Lawra Educational Directorate, where the teachers were the primary respondents. Afterwards, each teacher was contacted to consent to participate in the data collection. The researcher assured the teachers of non-disclosure of information on their data. The following important ethical considerations were considered:

1. Voluntary Participation: Voluntary participation on the part of those requested to be part of the data gathering process was sought. Participants were informed that they could voluntarily leave the project whenever they chose to, which was without penalty.
2. Informed Consent: The researcher sought for the participants’ consent. This included the district education director and school heads. In this case, they were informed of the research and how they could participate.
3. Confidentiality and Anonymity: To ensure confidentiality and anonymity in this study, pseudo names such as; Teacher 1, Teacher 2 and so on were used in gathering the data.
4. Providing Feedback: Feedback regarding the results and findings of the research was given to the study participants. For this study, as soon as the results were certified as valid, the participating teachers were informed of the study’s outcomes (Tangkur et al., 2022).

**Results And Discussion**

**Research Question 1: Types of Games Mathematics Teachers Use**

This research question sought to find out the type of indigenous games teachers use in teaching mathematics. In addressing this, various questionnaires were designed. In the first part, two separate items were designed to find out whether or not JHS mathematics teachers use games in teaching mathematics as well as the kind of game used in teaching, while the second part demanded participants to indicate the particular kind/type of game(s) they each use in teaching the various topics in the JHS mathematics syllabus. The responses of the participants were subjected to descriptive analysis and the results were presented in Table 1, 2. and 3 respectively.

**Table 1. Teachers Use of Games in Teaching Mathematics**
Table 1 shows that out of the 70 participants who responded to the questionnaire, majority (64) of the respondents representing 91.4% indicated that they use games in teaching mathematics while the remaining (6) of the respondents representing 8.6% stated “NO” which means that they do not use games in the delivery of their mathematics lessons. The responses suggested that majority of the respondents use games in teaching mathematics.

**Table 2. Kinds of Games Teachers Use**

<table>
<thead>
<tr>
<th>If yes, what kind of games</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indigenous games</td>
<td>15</td>
<td>23.4%</td>
</tr>
<tr>
<td>Exotic games</td>
<td>1</td>
<td>1.6%</td>
</tr>
<tr>
<td>Both indigenous and exotic games</td>
<td>48</td>
<td>75.0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>64</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Table 2 reveals that out of the 64 respondents who responded yes, 15 of them representing 23.4% indicated that they use indigenous games in teaching mathematics while 1 (1.6%) of the respondents admitted using exotic games in teaching mathematics and as many as 48 respondents representing 75.0% indicated that they use both indigenous and exotic games in the teaching and learning of mathematics in their classrooms.

The researcher knowing that participants’ responses to the ‘Yes’ or ‘No’ and the multiple-choice type questions could just be a mere guess and may not necessarily or adequately reflect the reality on the ground, further subjected the respondents to indicate the kind of games they use in teaching the various topics as outlined in the JHS mathematics syllabus. Even though 91.4% of the respondents agreed in the first part that they use games in teaching mathematics, they could not justify what they said they do as it was evident from the survey that majority of the respondents remained undecided as to the kind of game use in teaching the various topics in the JHS mathematics syllabus. For easy analysis of the data, the researcher categorized the various games indicated by the respondents into “indigenous games”, “exotic games” and “undecided”. Participants’ responses were aggregated using frequency counts which were converted into percentages as presented in Table 3.

**Table 3. Kinds of Topics and Games Teachers Use**
<table>
<thead>
<tr>
<th>Topic</th>
<th>Types of games used by Teachers</th>
<th>F</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number and numeral</td>
<td>Indigenous Game</td>
<td>7</td>
<td>17(24.3%)</td>
</tr>
<tr>
<td></td>
<td><em>Gollaa</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Bibore</em></td>
<td>10</td>
<td>3(4.3%)</td>
</tr>
<tr>
<td></td>
<td>exotic game</td>
<td>3</td>
<td>50(71.4%)</td>
</tr>
<tr>
<td></td>
<td>playing cards</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Undecided</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Set</td>
<td>Indigenous game</td>
<td>8</td>
<td>17(24.3%)</td>
</tr>
<tr>
<td></td>
<td><em>Bibore</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Biloo/bize</em></td>
<td>9</td>
<td>11(15.7%)</td>
</tr>
<tr>
<td></td>
<td>exotic game</td>
<td>7</td>
<td>42(60.0%)</td>
</tr>
<tr>
<td></td>
<td>Draft</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>playing cards</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Undecided</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Fraction</td>
<td>Indigenous game</td>
<td>17</td>
<td>23(32.9%)</td>
</tr>
<tr>
<td></td>
<td><em>Gollaa</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Mullaa</em></td>
<td>6</td>
<td>9(12.9%)</td>
</tr>
<tr>
<td></td>
<td>exotic game</td>
<td>9</td>
<td>38(54.3%)</td>
</tr>
<tr>
<td></td>
<td>Ludo</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Undecided</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Shapes &amp; Space</td>
<td>Indigenous game</td>
<td>8</td>
<td>15(21.4%)</td>
</tr>
<tr>
<td></td>
<td><em>Gollaa</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Bibore</em></td>
<td>5</td>
<td>13(18.6%)</td>
</tr>
<tr>
<td></td>
<td><em>Mullaa</em></td>
<td>2</td>
<td>42(60.0%)</td>
</tr>
<tr>
<td></td>
<td>exotic game</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Playing cards</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Undecided</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Length and Area</td>
<td>Indigenous game</td>
<td>6</td>
<td>18(25.7%)</td>
</tr>
<tr>
<td></td>
<td><em>Bibore</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Gollaa</em></td>
<td>12</td>
<td>10(14.3%)</td>
</tr>
<tr>
<td></td>
<td>exotic game</td>
<td>10</td>
<td>42(60.0%)</td>
</tr>
<tr>
<td></td>
<td>Playing cards</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Undecided</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Power of Numbers</td>
<td>Indigenous game</td>
<td>12</td>
<td>14(20.0%)</td>
</tr>
<tr>
<td></td>
<td><em>Biloo/bize</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Bibore</em></td>
<td>2</td>
<td>10(14.3%)</td>
</tr>
<tr>
<td></td>
<td>exotic game</td>
<td>10</td>
<td>46(65.7%)</td>
</tr>
<tr>
<td></td>
<td>Ludo</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Undecided</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>Capacity, time, money and mass</td>
<td>Undecided</td>
<td>70</td>
<td>70(100%)</td>
</tr>
<tr>
<td>Angles</td>
<td>Indigenous game</td>
<td>6</td>
<td>16(22.9%)</td>
</tr>
<tr>
<td></td>
<td><em>Bibore</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Gollaa</em></td>
<td>10</td>
<td>11(15.7%)</td>
</tr>
</tbody>
</table>
It was obvious from Table 3, that 17 of the respondents representing 24.3% used *gollaa* and *bibore* to teach Number and Numerals even though few of the respondents (3) representing 4.3% used playing card in teaching the same topic and as many as 50 of the respondents representing 71.4% were however undecided as to what game to use in teaching Number and Numerals. Similarly, while 17(24.3%) of the respondents indicated that indigenous games such as *bibore and or biloo/bize* are used to teach the topic “Set”, 11(15.7%) of the respondents used exotic games such as playing cards and draft for treating set and as usual, majority (42) of the respondents representing 60.0% remained undecided.

Additionally, 23(32.9%) of the respondents indicated that indigenous games such as *gollaa* and *mullaa* are used to teach the topic “Fraction”, though 9(12.9%) of the respondents used ludo and 38 of the respondents representing 54.3% were uncertain as to the game to use in teaching the said topic. In the same vein, 15(21.4%) of the respondents used *gollaa, bibore* and *mullaa* which are all indigenous games to teach Shapes and space, while 13(18.6%) of the respondents rather used playing cards in treating the same topic and 42(60.0%) of the respondents have no idea as to which game to use in teaching Shapes and Space. In addition, it was noted that 18(25.7%) of the respondents used *bibore* and *gollaa* in treating
Length and Area, even though 10 (14.3%) of the respondents used playing cards in teaching the topic (Length and Area) and as usual, majority (42) of the respondents representing 60.0% were not certain. Similarly, 14 (20.0%) of the respondents indicated that *biloo/bize* and *bibore* are used to teach Power and Numbers, while 10 (14.3%) of the respondents used ludo to treat the same topic and 46 (65.7%) of the respondents remained undecided. Furthermore, all the 70 (100%) of the respondents who took part in the study were undecided and therefore prefer to use the direct method in teaching Capacity, time, money and mass. Moreover, 16 of the respondents representing 22.9% used *bibore* and *gollaa* as indigenous games to teach Angles, while 11 of the respondents representing 15.7% used draft in teaching the same topic and as many as 43 of the respondents representing 61.4% were however undecided as to which game to use in teaching the said topic.

In addition, 15 of the respondents representing 21.4% used indigenous games such as *gollaa* and *bibore* to teach the topic “Properties of quadrilaterals”, while 7 of the respondents representing 10.0% used playing cards to treat properties of quadrilaterals and majority (46) of the respondents representing 65.7% were undecided. Similarly, 20 (28.6%) of the respondents used *mullaa* and *gollaa* to teach Probability, even though 7 (10.0%) of the respondents indicated they used ludo to teach the same topic and 43 (61.4%) of the respondents could not be sure as to which game is appropriate in teaching probability. It was also abundantly clear that only 10 (14.3%) of the respondents used *gollaa* as an indigenous game to teach the topic “Vectors” while the rest of the respondents 60 (85.7%) were uncertain regarding which game is appropriate for teaching the topic (Vectors).

It was also noted in Table 1.2 that 17 of the respondents representing 24.3% used indigenous games such as *gollaa* and *bibore* to teach properties of Polygons while 10 of the respondents representing 14.3% used ludo which is a exotic game in teaching the same topic and majority (43) of the respondents representing 61.4% remained uncertain as to which game is appropriate for teaching Properties of Polygons. Last but not least, it was realised that 18 of the respondents representing 25.7% used *baa* as an indigenous game to teach Rigid Motion while the rest of the respondents 52 representing 74.3% remained undecided. The results from Table 1.2 suggest that even though majority of the respondents agreed that they used games in teaching mathematics, majority of them were unable to mention the games they use in teaching the various topics as stipulated in the JHS mathematics syllabus. This assertion is in line with Moloi et al. (2021) and Tangku et al. (2022) proposition that despite the important role cultural games play in the pedagogical arena, very few teachers translate their experience with games into practice for lack of knowledge in indigenous games.

**Research question 2: Challenges of using indigenous games**

The second research question was “What challenges do teachers encounter in integrating indigenous games into the selected mathematics topics?” Table 4 and the transcripts that follow adequately addressed this research question.

**Table 4. Challenges of using indigenous games**
The results on Table 4 shows several issues accounted for teachers’ inability to use indigenous games in teaching mathematics. It was agreed by majority (43) of the respondents representing 61.4% that teachers’ inadequate knowledge in indigenous games prevents a lot of mathematics teachers from using them to teach mathematics in their classroom, even though few (18) of the respondents representing 25.7% disagreed on this assertion and 9 (12.9%) of the respondents were uncertain. The findings from the instrument agreed with Nabie (2011) as his study revealed that mathematics teachers have limited knowledge in the use of indigenous games in teaching mathematics. Additionally, it was agreed by 16 (22.9%) of the respondents that the heterogonous nature of the class made it difficult to use indigenous games in teaching mathematics, though 49 (70%) of the respondents disagreed and the remaining 5 (7.1%) of the respondents were uncertain. This finding was contrary to Tatira, Mutambara and Chagwiza (2012), Manzari Tavakoli et. al. (2021) and Pereira & Venâncio (2021) posit that most African classes are full of children from different cultural background making it difficult if not impossible to integrate indigenous games into the teaching and learning of mathematics in our classroom.

Furthermore, while 28(40.0%) of the respondents thought that colonization of African as a people affects the use of indigenous games in the mathematics classroom, majority 33(47.1%) of the respondents disagreed with this assertion and the rest of the respondents 9(12.9%) remained uncertain. This claim
however contradicts Moloi (2013) assertion, as the author noted colonization to be one of the major challenges that affect the effective use of indigenous games in the teaching and learning of mathematics. Again, majority (52) of the respondents representing 74.3% thought that large size of the class affects the use of indigenous games in teaching of mathematics while few 10 (14.3%) of the respondents disagreed with this assertion, and 8 (11.4%) of the respondents remained uncertain. On the issue regarding mathematics teachers’ continuous professional training in the use of indigenous games, 41 (58.6%) of the respondents agreed while 17 (27.1%) of the respondents disagreed with the proposition and 10 (14.3%) of the respondents were not certain. Similarly, 45 (64.3%) of the respondents were of the view that using indigenous games in teaching mathematics will make the pupils over play in the classroom, though 17 (24.3%) of the respondents disagreed and 8 (11.4%) of the respondents remained uncertain. This confirmed Dewah and Van Wyk (2014) notion that games are viewed from the narrow perspective of play, enjoyment and recreation by some teachers.

In addition, as many as 56 (80.0%) of the respondents agreed that the instructional period allocated for mathematics is too short to effectively incorporate indigenous games into the teaching and learning of the subject, though 3 (4.3%) of the respondents disagreed and 11 (15.7%) of the respondents were uncertain. The study also found out that though 20 (28.6%) of the respondents agreed that inadequate indigenous games materials prevent them from integrating in indigenous games into the teaching and learning of mathematics, majority (46) of the respondents representing 65.7% disagreed with this assertion and 4 (5.7%) of the respondents were uncertain.

Finally, 53 (75.7%) of the respondents agreed that the training that they received from the teacher training colleges is not enough for them to effectively and fully incorporate indigenous games into their mathematics lesson, even though 6 (8.6%) of the respondents disagreed and 15 (17.7%) of the respondents were however uncertain. It is therefore imperative from the finding that institutions uncharged in training pre-school mathematics teachers should take trainees through the use of indigenous games as a one of the strategies which can harness pupils understanding in the teaching and learning of mathematics. The results from Table 1.4 suggest that respondents have fair knowledge on the challenges one is likely to face in integrating indigenous games in teaching mathematics.

Findings from the questionnaire survey revealed that teachers have adequate knowledge on the challenges affecting the use of indigenous games in teaching mathematics. However, participants’ responses to the Likert scale items could be a mere guess that may not necessarily reflect their knowledge. To gain more insight into teachers’ knowledge on the challenges they faced in using indigenous games to teach mathematics, five participants were interviewed using the interview guide to validate the results from the questionnaire survey. Thematic analysis of the interview data revealed that majority of the teachers exhibited fair knowledge on the challenges faced in using indigenous games to teach mathematics as information gathered from the interview guide partly agreed with the questionnaire survey. Respondents were able to justify what they said they know as noted in the questionnaire survey (Hadebe-Ndlovu, 2022; Tangkur et. al., 2022).
Question: What main challenges do you face in using indigenous games in teaching mathematics?

Teacher 4:

[Ammm] I do not use indigenous games to teach mathematics because I do not have adequate knowledge on these indigenous games...as such, the heterogeneous nature of the pupils will even make the teacher confuse as to which indigenous games to use in the teaching(source: Teacher 4).

Teacher 3:

[Errrr] you see, games are merely for play and recreational purposes and has nothing to do with teaching mathematics (source: Teacher 3).

Teachers 5:

For me I do not use indigenous games to teach mathematics because many of these games are played on the ground which will make their uniforms dirty and apart from making their uniforms dirty, the children will be exposed to a lot of health ricks which am sure many of their parents will not take it kind with the teacher (source: Teacher 5).

Teacher 2:

[Hmmm] you see, many of these indigenous games are played by two individuals and considering the large size of the class I teach, it will practically be difficult if not impossible to successfully integrate them into the teaching and learning of mathematics without wasting much time (source: Teacher 2).

Teacher 1:

[Ammm] for me, the use of indigenous games will waste the time and to be specific, the JHSs mathematics curriculum does not even recommend the use of indigenous games in the teaching and learning of mathematics.

The transcripts from the five teachers above showed that the teacher really came to crossroads. However, some of the respondents exhibited fair knowledge on the factors that prevent them from integrating indigenous games in teaching mathematics. The findings agreed with that of Nabie (2011; 2015) who noted in his studies that majority of mathematics teachers’ do not use indigenous games in teaching mathematics because they have limited knowledge in them.

The researcher also designed a checklist (see Table 3) to access participants’ use of indigenous games in teaching mathematics in the Lawra Municipality. This was done to further validate or refute respondents’ responses in both the questionnaire and interview guide (Manzari Tavakoli et. al., 2021). A check (√) on the checklist denotes the use or presents of a practice observed, and a cross (×) signifies the absence of a practice. The observed practices were subjected to frequency counts and the results presented in Table 4.
The third research question was “How do should teachers resolve the challenges of integrating indigenous games into teacher mathematics?”. Table 5 was used to address this research question. The five teachers were represented by T1, T2, T3, T4 and T5. The key (√) represented the solution to the practice and (×) represented the absence of a practice to resolve the challenges.

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

<table>
<thead>
<tr>
<th>No.</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>Total (√)</th>
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</tbody>
</table>

Source: Field Survey, 2021

The results on Table 5 was generated from the observation checklist indicated that even though 4 out of the 5 teachers observed used indigenous games in delivering their lessons, only 2 of them effectively made good use of the games as in item 4. It was noted that even though many teachers are aware of the numerous benefits of using indigenous games in the mathematics, very few of them translate this into actual practice for lack of knowledge of the mathematical content and grammar of indigenous games (Moloi et al., 2021; Tangkur et al., 2022). The study also revealed that though majority of the classrooms were conducive and teachers presented their lessons from known to unknown, while little attention was given to the varied learning needs of the individual learners by all the teachers.

Findings

The following key findings emerged from the results:

1. Mathematics curriculum should include indigenous games particularly in the Basic Schools and the Teacher Training Colleges.
2. Mathematics teachers who do not heal from the communities where they posted should be given refresher training to update their knowledge on the use of some indigenous games within the locality.
3. Children who are good at mathematical-related indigenous games can be called upon to demonstrate to their peers using practical examples of indigenous games such as gollaa, bibore and
The indigenous games in all forms use indigenous languages, which enables quick understanding of some mathematical concepts and skills among children.

Using indigenous games demystifies the myths associated with mathematics, which helps eliminate mathematics phobia (Sansome, 2016).

Conclusion

Indigenous games are part of the culture and provide a kind of informal education. It was therefore recommended that teachers who do not healed from the communities where they posted should be given refresher training to update their knowledge on the use of some indigenous games within the locality since teachers could use indigenous games such as; baa, mullaa, gollaa, bibore and biloo/bize to teach mathematics through discovery and trial and error methods. And Mathematics is the foundation of all other indigenous subjects. More so, these indigenous games have been seen as an alternative teaching strategy that can be used to harness mathematics understanding. Even though these indigenous games may have different names across the country, it was evident that they the same. The impact of indigenous games like baa, mullaa, gollaa, bibore, and biloo/bize intrinsically motivated and sustained the learners’ interest in the classroom throughout the lesson delivery and thereby demystified the abstract nature of the subject. However, the numerous challenges and the crossroads of teachers must be resolved to enforce mathematics teachers and learning.

Recommendations

It was recommended that teachers explore more knowledge and skills in indigenous cultural games through workshops, seminars and conferences. Once teachers get acquainted with the indigenous games, they can use them to enhance the learning outcomes of mathematics and help salvage the ever-souring performance of students in mathematics.

Again, the impact of the knowledge of indigenous cultural games cannot be over-emphasized. It was recommended that teachers partition each of the domains of mathematics, and baa, mullaa, gollaa, bibore, and biloo/bize best suit particular domains of mathematics. In doing so, students can easily associate particular indigenous games with particular domains of mathematics.

In addition, factors that impede the effective use of indigenous cultural games in the teaching and learning of mathematics can be identified by local authorities. This would help improve teachers' knowledge of indigenous games and transcend to teaching and learning mathematics at the Basic Levels.

References

Biloo/bize (Tangkur, 2022).

4. The indigenous games in all forms use indigenous languages, which enables quick understanding of some mathematical concepts and skills among children.


