THE EFFECT OF ETHNOMATHEMATICS-BASED TEACHING APPROACH ON GRADE 3 LEARNERS' PERFORMANCE IN NUMERACY CONCEPTS: A CASE STUDY IN THE ZAMBEZI REGION, NAMIBIA

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ABSTRACT

The main purpose of this study was to explore the effect of an Ethnomathematics-based teaching approach on Grade 3 learners' performance in numeracy concepts. The study was guided by the following research objectives: 1). To investigate the effects of the Ethnomathematics-based teaching approach on Grades 3 learners' academic performance in numeracy concepts in a selected lower primary school in the Zambezi Region. 2. To establish the perceptions and challenges of Grade 3 teachers in using the Ethnomathematics-based teaching approach to teach numeracy concepts in selected lower primary schools in the Zambezi Region. Furthermore, the following null hypothesis was tested: H_0: There is no significant difference between the performances of Grade 3 learners taught using the Ethnomathematics-based teaching approach and the lecture method respectively. The study employed the mixed-methods research design, in which a sample of 40 Grade 3 learners was selected using stratified random sampling from one Junior Primary school for the experiment. The 40 learners were divided into two groups: the Experimental group and the Control group, each made up of 20 participants. The Experimental group was taught using the Ethnomathematics-based teaching approach while the Control group was taught using the conventional lecture approach. Both groups were given common pre- and post-tests to assess their performances both before and after the treatment. In addition, 30 Grade 3 teachers were purposively selected to complete questionnaires while a subsample of 8 teachers participated in the follow-up one-on-one interview to share their perceptions and challenges of using the Ethnomathematics-based teaching approach. The findings of the study revealed that the Experimental group recorded approximate mean scores of 54% in the pre-test and 79% in the post-test while the Control group recorded 46% and 50% in the pre-and post-tests respectively. The result of the t-test analysis between paired sample means of the Control and Experimental

groups' post-tests was statistically significant ($p < 0.05$). This suggests that the Ethnomathematics-based teaching approach improves the Grade 3 learners' performance in numeracy concepts. The Grade 3 teachers' perceptions of the Ethnomathematics-based teaching approach revealed that the majority of the participants have no knowledge of the Ethnomathematics-based teaching approach. However, the participants perceived that Mathematics can be related to culture. A few participants stated that they sometimes use the Ethnomathematics-based approach and that learners comprehend numeracy concepts better when they are linked to real-life situations. Finally, the study also revealed that the non-inclusion of the Ethnomathematics-based approach in the Grade 3 Mathematics syllabus, lack of time, and lack of specialized training on the usage of Ethnomathematics-based approach constitute the major challenges that Grade 3 teachers face in incorporating Ethnomathematics-based approach in the teaching of numeracy concepts in the study area. Nonetheless, considering that the Ethnomathematics-based teaching approach significantly improved Grade 3 learners' performance in this study, it is important to carry out wider studies on the prospect of using this teaching approach to improve Grade 3 learners' performance in numeracy concepts. Furthermore, the Ministry of Education, Acts and Culture should include an Ethnomathematics-based teaching approach in the Grade 3 Mathematics curriculum and capacitate the teachers to be able to incorporate it in teaching numeracy concepts.

Keywords: Ethnomathematics, teaching approach, Grade 3, numeracy concept

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I want to thank the Zambezi Regional Directorate of Education, Arts and Culture for granting me permission to carry out this study in schools in the region. Special gratitude goes to the lower primary teachers and the Grade 3 learners in the region for participating in this study.

To all my family members and friends, thank you for your understanding when I was unavailable to you for most of the times when I was busy with this study.

God bless!

DEDICATION

This thesis is dedicated to the most important people in my life, my parents, late Mr. Muswalali Christopher Mumeka (May your soul rest in peace) and Mrs Muswalali Reginnah Tumwenipo Maemeko who keep me going every day.

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DECLARATION

I, Karen Feliso Muswalali, hereby declare that this study is a true reflection of my own research and that this work, or part thereof, has not been submitted for a degree in any other institution of higher education.

Karen Feliso Muswalali Date

…22.09.2025…….

CHAPTER ONE: INTRODUCTION

1.1. Orientation of the study

The main aim of this study is to assess the effects of an Ethnomathematics-based teaching approach on Grade 3 learners' performance in numeracy concepts in a selected Primary school in the Zambezi Region of Namibia. D'Ambrosio (2001) defines Ethnomathematics as a branch of mathematics that takes into account the cultural and familial (everyday life) context in which it originated. It has been widely acknowledged that Ethnomathematics helps learners make connections between numeracy ideas and their cultural and home backgrounds, which enhances their understanding of those concepts (Orey & Rosa, 2020).

Additionally, a number of writers stressed how crucial it is to educate using the Ethnomathematics-based method. For instance, a study by Abiam, Okechukwu, Ugama, and Okafor (2016) found that when teaching the numerical concept of geometry, the Ethnomathematics-based teaching technique produced better outcomes than the lecture method. Furthermore, according to Francois (2019), the majority of culturally diverse Western schools employ an Ethnomathethematics-based teaching approach to improve learners' numeracy and mathematical proficiency. Hara-Gaes (2005) found that conventional sewing, home construction, cooking, counting, and gaming were examples of indigenous activities that integrated several numerical ideas, including addition, geometry, and measuring. The study focused on Damara cultural practices in Namibia. Additionally, in the Zambezi region, famous cultural games, for example, the game called Mulabalaba also reflects the concept of number sense development where counting is embedded, as stones are counted and equalled during the game to attain a win. Finally, certain vernacular names also reflect an aspect of the nominal use of numbers. For example, the name Tubonke which means one.These

studies indicate that learners' understanding of mathematics numeracy concepts, such as geometry, measurement, counting, and number ordering development skills, may be promoted if the Ethnomathethematics-based teaching approach is applied appropriately.

Numeracy ideas must be taught in a way that makes sense to learners given their diverse backgrounds and cultures (Orey & Rosa, 2020). By doing so, reality is created, and the cultural diversity present in the classroom is valued. According to Nambira, Kaneda, Tjipueja, and Sichombe (2009), given the state of primary learners' poor performance in mathematics in previous years, it is obvious that changes must be made in order to strengthen the lower primary phase's foundation for learning numeracy concepts by introducing new and pertinent teaching methods.

Because lower primary learners' poor performance in mathematics in the Zambezi Region of Namibia is now attributed to their understanding of mathematics numeracy concepts, it is crucial to investigate the effects of an Ethnomathethematics-based teaching approach. This could serve as an alternate teaching strategy to the present lecture-based approach, which does not appear to improve the Zambezi Region's lower primary kids' performance in mathematics and numeracy concepts.

1.2. Statement of the problem

Learners′ mathematics performance globally and locally has been a major concern (Mabena & Ramapela, 2021). In Namibia, the weak foundation of numeracy concepts at the lower primary phase is one of several reasons that contributed to the poor performance of primary school learners in mathematics (Hamukonda & Luneta, 2023). Since the lower primary phase serves as the starting point for formal education, a weak foundation in numercy concepts could have an impact on all subsequent stages of

learners' education. Of particular concern is the grade 3 which is the transition point from teaching using the mother tongue to teaching using English language in the current Namibia education structure. Document analysis of the grade 3 syllabus revealed that teachers are required to teach the conepts of numeracy by giving learners' everyday life examples, especially when teaching word problem solving. However, the researcher observed that the teacher still relied much on classroom and textbook examples when teaching numeracy concepts. Up to now, mathematics performance in the lower primary phase is a major concern (Mateya, 2016). This is really the current situation in the study area- the Zambezi region of Namibia. This suggests that several interventions are required, especially exploring teaching methods that accommodate the learners' home background. Thus, the purpose of this study is to investigate how an Ethnomathethematics-based teaching approach affects Grade 3 learners' understanding of numeracy concepts. It's interesting to note that the Ethnomathematics-based teaching approach takes pupils' home backgrounds into account. Since Grade 3 learners are instructed in their mother tongue, utilising the Ethnomathematics-based teaching approach, which depends on the learners' comfortable language, may enhance their understanding and performance in numerical concepts. When home background is included in education, learners are better able to contextualise what they are learning since it has a strong connection to their daily lives (Orey & Rosa, 2020). Additionally, Orey and Rosa (2020) believed that rather than merely teaching learners with textbooks and classroom graphics, the subject should be connected with examples from the learners' home environments in order to help them better understand numeracy concepts. Thus, this study investigated the effect of

Ethnomathethematics-based teaching approach on Grade 3 learners' comprehension of numeracy concepts.

1.3. Research objectives

The main objective of the study is to investigate the effects of using an Ethnomathematics-based teaching approach to enhance Grade 3 learners' academic performance in numeracy concepts in the Zambezi Region, Namibia. The specific objectives are as follows:

- To investigate the effects of the Ethnomathematics-based teaching approach on grades 3 learners' academic performance in numerical concepts in a selected lower primary school in the Zambezi region.
- To establish the perceptions and challenges of Grade 3 Mathematics teachers in using the Ethnomathematics-based teaching approach to teach numeracy concepts in selected lower primary schools in the Zambezi region.

The hypothesis of the study:

H_0: There is no significant difference between the academic performances of learners (Grade 3) taught using the Ethnomathematics-based approach and the lecture method respectively.

1.3. Significance of the study

Francois (2019) asserts that adding Ethnomathematics to math classes fosters cultural variety, which broadens the scope of instruction. Therefore, this study shed light on the possibility of utilising an Ethnomathethematics-based teaching approach to raise the academic accomplishment of Grade 3 learners in numeracy concepts in an effort to address the persistently low performance of lower primary learners in the study area. The study also revealed perceptions and difficulties faced by mathematics teachers in

the lower primary phase in the Zambezi region when implementing the Ethnomathematic-based teaching strategy to teach numeracy concepts.

1.4. Limitations of the study

Some primary school math teachers were reluctant to share important details about their opinions and difficulties when implementing an Ethnomathethematics-based teaching approach to teach numeracy concepts in their classes. The researcher made it apparent to the teachers how important the study was and how it may help them in order to lessen this effect.

1.5. Delimitations of the study

The study focused on investigating the effect of an Ethnomathematics-based teaching approach on Grade 3 learners' academic performance in numeracy concepts in a selected lower primary school in the Zambezi Region only. Thus, this study could not be generalized to other parts of Namibia.

1.6. Definition of terms

1.6.1. *Ethnomathematics-based teaching approach* denotes the method of teaching mathematics in which numerical concepts are presented or taught using familiar analogies from the learners' home environment. This approach helps the reseqarcher to explain numerical concepts with examples from the learner's home and culture.

1.6.2. *Lecture method* denotes the method of teaching mathematics in which numerical concepts are presented or taught using examples from the classroom environment and textbooks. This approach helps the researcher to explain numerical concepts with examples from the classroom and textbook.

1.6.3. *Positive effect: P*ositive effect in the context of this study refers to a scenario in which a teaching strategy would aid learners in understanding numeracy concepts by obtaining a pass mark (50–100%).

1.6.4. *Negative effect*: Negative effect in the context of this study refers to a scenario in which a teaching strategy would not enhance learners' understanding of numeracy concepts and learners would obtain a fail mark (0– 49%).

1.6.5. *Numeracy concepts:* The pre- and lower-primary phases cover these ideas. These ideas include measuring (money, time, and order), computation (addition, subtraction, multiplication, division, and multi-step problems), counting, geometry, data handling, and number concept development (subitizing, regrouping, decomposing, fractions, etc.). One of the numerical concept of measurement was used in this study.

1.6.14. Culture: Culture denotes the everyday home based activities, which the learners are aware of and are exposed, and hence, using every day.

1.7. Summary of chapter one

The study's orientation was provided in the first chapter. The study's orientation provided a concise overview of the study's objectives. The concept of Ethnomathematics was defined in detail, along with its application, effectiveness in helping learners understand numeracy concepts, and necessity of using this approach as an intervention to improve the weak foundation of numeracy concepts laid at the lower primary phase due to the use of conventional and conventional methods like lectures that do not take into account learners' prior knowledge. Second, it addressed the research problem statement, which provided a brief overview of the issue and

explained the rationale behind the study's necessity. Thirdly, this chapter also included an outline of the research objectives. These are only the study's objectives; they are the questions it seeks to address. Additionally, this chapter discussed the study's significance and provided a summary of its potential benefits. Lastly, the study's limits include a description of the variables that hindered its conduct, the steps taken to mitigate these issues, and a delimitation that merely specifies the range of topics the study may address. The next chapter presents a literature review of the study.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

It was discovered during a search for pertinent literature on the research topic that Namibia had not produced much of it. According to Lilemba & Matemba (2009) the reason for this is that despite the rhetoric of reform, African indigeneous cultural education remains marginalized in preference of western ideals and models that continue to dorminate. On the other hand, however, a wealth of research has been conducted globally regarding the function of the Ethnomathethematics-based teaching approachology in the study of mathematics. This chapter's first portion lays forth the study's theoretical basis. The literature was reviewed to determine the role that an Ethnomathematics-based teaching approach plays in mathematics learning, how to teach mathematics using an Ethnomathematics-based approach, including how to incorporate an Ethnomathematics-based teaching approach into the teaching of numeracy concepts, and what obstacles teachers encounter when doing so. The literature review also covers the methods commonly used in Namibia and around the world to teach numeracy skills (measuring, geometry, computation, counting, and categorization).

2.2. Theoretical framework

This research is grounded in the theory of socio-constructivism theory. This approach highlights the ways in which a child's social community supports their learning. As a result of their socialisation with their parents and siblings at home, children bring information from home with them to school (Scott, 2015). The social community of the learner includes their family, friends, neighbors, and other adults. This community becomes the biggest pool of numerical concepts. As a child interacts with their family, friends, neighbors, and other adults, for example, they will partake in home activtiies

which involves fetching water, cooking, sharing of food, baking, etc. these activities reflect embedded numerical concepts such as measurement of capacity, weight, volume, fractions, and problem solving skills. The socio-constructivism theory and Ethnomathematics, therefore interacts within this study, because by acquiring numerical concepts such as measurement of capacity, weight, volume, fractions, and problem solving skills through socialization (which is what the socio-constructivism is all about) is considered ethnomathematics because the learning of these concepts consider the home environment from where they had arisen. therefore This suggests that a child's past knowledge of mathematical concepts can come from their social-cultural surroundings, which include their home. Lev Vygotsky's theory of socio-constructivism serves as the foundation for the study since it teaches learners to recognise their cultural and familial background knowledge, which is critical for comprehending numeracy concepts when teachers utilise an Ethnomathethematics-based teaching approach. Lev Vygotsky placed a strong emphasis on the use of social interaction and scaffolding to help people acquire new information, including notions related to numbers.

The theory also highlights the idea that learners arrive at school with incomplete cultural or familial knowledge of mathematics and that it is the teacher's responsibility to guide, facilitate, scaffold, and assist learners in refining this knowledge by using pertinent examples from their surroundings or culture rather than just teaching content. Thus, it is believed that acquiring Ethnomathematical knowledge at home serves as a crucial basis for additional scaffolding in the classroom.

2.3. The effects of the Lecture-based approach on the performance of Grade 3 learners in numeracy concepts.

The lecture method is a conventional lecture strategy in which the student's job is to listen and respond, and the teacher assumes the role of chief instructor (Varadajan, 2019).

Obeidat (2020) emphasised both the advantages and disadvantages of the lecture-based approach. The benefits of this approach are typically linked to covering a lot of ground in one class session, organising the content logically for oral presentation, and eliminating unnecessary learning materials.

However, the drawbacks of this approach include learners' amnesia, their exclusive attention to the teacher, and their failure to recognise the unique characteristics of each student (Obeidat, 2020).

Elgadir and Nadzir (2023) also argued that the lecture method makes lower primary learners to become accustomed to passive listening and may end up not actively participating or assisting in the topic being presented. Secondly, it does not provide them with the opportunity to contribute and engage in the learning process, resulting in a negative role during education, especially if there is no chance for them to ask questions or Seek clarification. Thirdly, lower primary learners may experience mental distraction during the lecture for various reasons, leading to a lack of comprehension, failure to connect different parts of the lecture, and missing out on the intended benefits. Lastly, It discourages lower primary learners from engaging in research, inquiry, and creativity, as it does not encourage Critical thinking, analysis, and deduction

For learning to be meaningful, learners must be actively involved in the material. This may allow for further investigation into the reasons behind the majority of teachers'

preference for this approach, even though research indicates that it is primarily ineffective at spreading significant amounts of knowledge to a vast student body (Centre for Instructional Development and Distance Education, 2014).

The lecture method has a number of drawbacks, according to CIDDE (2014). These include the inability for the teacher to give learners personalised feedback, the difficulty of adapting to individual learning differences, and the potential failure to foster active learning unless other teaching strategies like questioning and problem-solving exercises are integrated into the lecture. According to CIDDE (2014), it does not support independent learning.

Finally, Abah (2020) contended that scholars and researchers who are committed to advancing the development of alternative instructional approaches have repeatedly denounced the standard teaching style as ineffective, restrictive, and antiquated. Educationists frequently sidestep the straightforward discussion of what constitutes a competent teacher's obligation (Abah, 2020).

Given the aforementioned drawbacks, the researcher believes that the lecture method is inappropriate for use in Grade 3 classrooms because it may not foster meaningful and active learning, especially given the learners' limited exposure to mathematical concepts at that level. Orey & Rosa (2020) support this by arguing that when education includes a cultural background component, it helps learners contextualise what they are learning because it provides a strong basis for their daily lives.

2.4. The effects of the Ethnomathematics-based teaching approach on the performance of lower primary learners in numeracy concepts

The Ethnomathematics approach is an instructional strategy that connects mathematical concepts to learners' cultural backgrounds and daily life experiences.

Unlike traditional teaching methods, the Ethnomathematics approach emphasizes the use of culturally relevant examples to teach numeracy concepts, such as using objects from a learner's environment to illustrate ideas like geometry and measurement. For example, comparing the lengths of a cooking stick and a spoon to teach the concept of length measurement allows learners to relate abstract mathematical ideas to tangible, familiar objects. Additionally, this approach encourages learners to find and draw objects from their homes that illustrate mathematical concepts, promoting active learning and engagement. Studies indicate that incorporating Ethnomathematics helps learners make connections between numeracy concepts and their cultural practices, enhancing their understanding of the subject (Udoniaku & Stanislus, 2013).

2.4.1 Ethnomathematics-based teaching approach improves Learners' Performance in numeracy concepts

Research demonstrates that the Ethnomathematics-based teaching approach has positive effects on learners' academic performance, particularly in numeracy concepts. A study conducted by Udoniaku and Stanislus (2013) in Nigeria showed that the Ethnomathematics achievement test improved learners' performance in areas such as volume calculation, specifically in relation to cylinders and hemispheres. The study suggested incorporating Ethnomathematics resources into the basic curriculum to help teachers effectively teach these concepts. Additionally, Ozofor and Onos (2018) found that the Ethnomathematics approach significantly improved achievement in senior secondary learners, with a substantial interaction between gender and teaching method. These findings emphasize the value of connecting cultural practices to mathematics instruction, enhancing learners' understanding and performance.

The Ethnomathematics approach is a teaching and learning strategy, much like the lecture technique. The only distinction is that when a teacher uses the Ethnomathematics approach to teach a numeracy concept, for example, geometry (2D versus 3D shapes), the teacher will use examples from the student's home or culture to help them understand the subject. For instance, a cooking stick and a spoon can be used as a pair of comparisons to help learners understand the concept of length measurement. Additionally, the teacher will let learners find and draw household objects or materials that depict these forms rather than only imparting knowledge pertaining to examples of mathematics from their culture or environment.

It has been seen that using an Ethnomathematics-based teaching approach helps learners make connections between numeracy concepts and their cultural backgrounds, which enhances their understanding of those ideas (Udoniaku & Stanislus, 2013). Additionally, a number of writers stressed the significance of employing an Ethnomathethematics-based teaching approachology. Regardless of a student's cultural background, the teaching method aims to engage all learners and try to reach them in the study of mathematics (Matang, 2022). In a study conducted in Nigeria, Udoniaku and Stanislus (2013) noted that the Ethnomathematics achievement test was effective in improving learners' performance in menstruation, with particular reference to volumes of the cylinder and hemisphere. This study demonstrated the positive effects of the Ethnomathematic-based teaching approach. Among other things, it was suggested that teaching resources for Ethnomathematics be included in the basic curriculum so that teachers may utilise them to help learners understand the ideas of hemisphere and cylinder volumes.

From the same perspective, Ozofor & Onos (2018) found that, among other things, the Ethnomathematics approach was more successful in promoting learners' achievement in their study on the impact of the subject on senior secondary education learners. The Ethnographic approach led to considerable achievement gains for both genders (Ozofor & Onos, 2018). The results of the study showed a substantial interaction impact between gender and method. For those involved in mathematics instruction, including teachers, these disclosures had grave ramifications.

An analysis of data from a study by Achor, Imoko, and Uloko (2009) examined the impact of an Ethnomathematics teaching approach on the achievement and retention of senior secondary learners in locus. The findings showed that learners exposed to ETA outperformed those taught using a conventional approach in terms of both achievement and retention. As a result, there were notable differences in the achievement and retention mean scores (F1, 248 = 241.317, p = 0.000) between the learners taught Locus with ETA and those taught the conventional method (Achor et al, 2009).

2.4.2 Ethnomathematics-based teaching approach encourages Learners' Interest and Engagement in Mathematics

The Ethnomathematics-based teaching approach has also been found to increase learners' interest and engagement in mathematics. A study by Oranito and Onile (2021) revealed that learners exposed to the Ethnomathematics Instructional Approach (EIA) demonstrated superior achievement and greater enthusiasm for mathematics compared to those taught through conventional lecture methods (CLM). The connection between mathematics and real-life cultural experiences seems to make the subject more relevant and accessible, thus fostering a deeper interest in learning.

Masingila (quoted by Matang, 2002) further emphasized that learners who have prior experience with culturally relevant mathematical activities, such as floor laying, outperform those encountering the concept for the first time. This suggests that real-world experiences related to mathematics help reinforce learners' understanding of abstract mathematical concepts.

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Furthermore, the application of cultural contexts in teaching mathematics fosters a sense of belonging and validation for learners from diverse backgrounds. By incorporating elements from the learners' own culture into the learning process, the Ethnomathematics approach not only makes mathematics more engaging but also empowers learners to see the value of their cultural knowledge. When mathematical concepts are tied to familiar cultural practices, learners are more likely to engage actively in lessons, as they see a direct link between their everyday experiences and

what they are learning. This fosters a positive attitude towards the subject, as learners feel that their cultural perspectives are being recognized and respected, thus promoting an inclusive learning environment.

Research also indicates that learners' engagement and motivation can be sustained over time when cultural elements are consistently integrated into the curriculum. When mathematics is presented through culturally meaningful examples, learners are more likely to persist in their studies and show a long-term interest in the subject. Sunzuma et al. (2021) argue that learners who relate mathematical concepts to their personal and cultural experiences develop a deeper understanding of the subject, which enhances both their cognitive and emotional connection to mathematics. This increased motivation often leads to improved academic performance, as learners are more invested in their learning and are likely to demonstrate greater effort in mastering mathematical skills.

According to the researcher perspective, the Ethnomathematics approach offers a valuable opportunity to bridge the gap between formal mathematical education and learners' everyday lives. By incorporating cultural contexts into the teaching of mathematics, we not only make the subject more engaging but also foster a sense of ownership and connection to the material. This approach is particularly important for learners who may otherwise struggle to see the relevance of mathematics in their lives. I believe that the positive impact of Ethnomathematics on learners' engagement and motivation is significant and can lead to a more inclusive, meaningful, and effective learning experience. However, for this approach to be fully realized, teachers need

proper training and support to integrate cultural elements in a way that enhances learning without compromising academic rigor.

2.4.3 Benefits of Ethnomathematics-based teaching approach Across All Grade Levels

While studies like that of Ozofor and Onos (2018) focused on senior secondary learners, the benefits of the Ethnomathematics-based teaching approach are not limited to higher grade levels. Oraneto (2021) argues that learners in lower primary grades can lay a solid foundation of numeracy concepts through the use of culturally meaningful connections. This foundation can benefit them as they progress to higher grades, where they will build on these concepts. The approach enables learners to grasp mathematical ideas in a way that is grounded in their own experiences, promoting better retention and understanding that can be built upon in later years.

The Ethnomathematics-based teaching approach has also been found to increase learners' interest and engagement in mathematics. A study by Oranito and Onile (2021) revealed that learners exposed to the Ethnomathematics Instructional Approach (EIA) demonstrated superior achievement and greater enthusiasm for mathematics compared to those taught through conventional lecture methods (CLM). The connection between mathematics and real-life cultural experiences seems to make the subject more relevant and accessible, thus fostering a deeper interest in learning. Masingila (quoted by Matang, 2002) further emphasized that learners who have prior experience with culturally relevant mathematical activities, such as floor laying, outperform those encountering the concept for the first time. This suggests that real-world experiences related to mathematics help reinforce learners' understanding of abstract mathematical concepts.

Furthermore, the application of cultural contexts in teaching mathematics fosters a sense of belonging and validation for learners from diverse backgrounds. By incorporating elements from the learners' own culture into the learning process, the Ethnomathematics approach not only makes mathematics more engaging but also empowers learners to see the value of their cultural knowledge. When mathematical concepts are tied to familiar cultural practices, learners are more likely to engage actively in lessons, as they see a direct link between their everyday experiences and what they are learning. This fosters a positive attitude towards the subject, as learners feel that their cultural perspectives are being recognized and respected, thus promoting an inclusive learning environment.

Research also indicates that learners' engagement and motivation can be sustained over time when cultural elements are consistently integrated into the curriculum. When mathematics is presented through culturally meaningful examples, learners are more likely to persist in their studies and show a long-term interest in the subject. Sunzuma et al. (2021) argue that learners who relate mathematical concepts to their personal and cultural experiences develop a deeper understanding of the subject, which enhances both their cognitive and emotional connection to mathematics. This increased motivation often leads to improved academic performance, as learners are more invested in their learning and are likely to demonstrate greater effort in mastering mathematical skills.

From my perspective, the Ethnomathematics approach offers a valuable opportunity to bridge the gap between formal mathematical education and learners' everyday lives. By incorporating cultural contexts into the teaching of mathematics, we not only make the subject more engaging but also foster a sense of ownership and connection to the

material. This approach is particularly important for learners who may otherwise struggle to see the relevance of mathematics in their lives. I believe that the positive impact of Ethnomathematics on learners' engagement and motivation is significant and can lead to a more inclusive, meaningful, and effective learning experience. However, for this approach to be fully realized, teachers need proper training and support to integrate cultural elements in a way that enhances learning without compromising academic rigor.

2.4.4 Ethnomathematics-based teaching approach Enhances Real-World Application of Mathematics

In addition to improving academic performance and interest in mathematics, the Ethnomathematics approach promotes the application of mathematical concepts to real-world situations. Sunzuma et al. (2021) cite Rosa and Orey (2011), noting that Ethnomathematics helps learners apply mathematics outside the classroom, making the subject more practical and relevant. By using real-life examples, such as analyzing bank statements or calculating interest rates, learners can see the direct connection between mathematics and everyday life. This approach also helps learners develop life skills that will be useful in their communities and personal lives. Activities like purchasing goods, weighing products, and making proportional calculations for recipes are all opportunities for applying mathematical concepts in daily activities, as highlighted by Rosa and Orey (2020).

In addition to improving academic performance and interest in mathematics, the Ethnomathematics approach promotes the application of mathematical concepts to real-world situations. Sunzuma et al. (2021) cite Rosa and Orey (2011), noting that Ethnomathematics helps learners apply mathematics outside the classroom, making

the subject more practical and relevant. By using real-life examples, such as analyzing bank statements or calculating interest rates, learners can see the direct connection between mathematics and everyday life. This approach also helps learners develop life skills that will be useful in their communities and personal lives. Activities like purchasing goods, weighing products, and making proportional calculations for recipes are all opportunities for applying mathematical concepts in daily activities, as highlighted by Rosa and Orey (2020). Such examples not only improve mathematical understanding but also build skills that have immediate utility in day-to-day tasks, fostering practical problem-solving abilities.

Moreover, integrating real-world applications into the mathematics curriculum can bridge the gap between theoretical knowledge and practical use, empowering learners to use mathematics beyond the classroom environment. This is particularly valuable in fostering critical thinking and decision-making skills. For instance, learners might engage in projects where they calculate the area needed for construction projects using cultural building methods or analyze the cost-effectiveness of local goods based on market prices. These activities provide opportunities for students to apply mathematical concepts in meaningful ways, reinforcing their understanding and increasing their confidence in using mathematics to solve real-world problems. By connecting mathematical knowledge with everyday experiences, Ethnomathematics creates a more engaging and relevant learning experience for students, motivating them to see mathematics as a tool that can be used to navigate and improve their lives.

2.4.5 Empirical Evidence Supporting the Effectiveness of Ethnomathematics-based teaching approach

Empirical studies consistently support the effectiveness of the Ethnomathematics approach in improving learners' performance. For example, in a semi-experimental study BY Adam (2020) found that learners taught using the Ethnomathematics approach performed better in intermediate algebra compared to those who were taught using traditional methods. Similarly, a study in Nigeria by Anchor et al. (2009) on the teaching of loci showed that learners taught with Ethnomathematics had higher achievement and retention rates compared to those who received conventional instruction. These studies demonstrate that the Ethnomathematics approach can lead to better academic outcomes by making mathematics more accessible and relatable to learners' cultural contexts.

Empirical studies consistently support the effectiveness of the Ethnomathematics approach in improving learners' performance. For example, in a semi-experimental study by Abah (2020) found that learners taught using the Ethnomathematics approach performed better in intermediate algebra compared to those who were taught using traditional methods. This finding highlights the significant potential of incorporating cultural contexts into mathematics instruction, which not only makes learning more engaging but also leads to better retention and understanding of abstract mathematical concepts. The study demonstrated that when learners connect mathematical ideas to their own lived experiences, they are more likely to grasp complex topics with greater ease, as they can relate them to familiar, real-world contexts.

Similarly, a study in Nigeria by Anchor et al. (2009) on the teaching of loci showed that learners taught with Ethnomathematics had higher achievement and retention rates compared to those who received conventional instruction. These learners engaged in hands-on activities such as pegging agricultural land and roofing round huts, which

connected geometric concepts like loci to everyday practices within their cultural environment. This study supports the idea that embedding cultural practices into mathematics instruction not only enhances conceptual understanding but also improves long-term retention, as students can see the relevance of what they are learning in their daily lives. Such evidence underscores the value of using Ethnomathematics as an effective teaching method that can foster deeper understanding and better academic performance.

The consistent positive outcomes from these empirical studies reinforce the notion that Ethnomathematics holds significant promise for improving mathematics education. By contextualizing mathematical concepts within learners' cultural and practical experiences, this approach creates a more meaningful and engaging learning environment. The findings from studies like those of Forbes (2018) and Anchor et al. (2009) suggest that Ethnomathematics can be an effective tool for not only improving students' academic performance but also enhancing their motivation, interest, and ability to retain mathematical knowledge over time. However, these positive results also highlight the importance of training educators to effectively implement the approach, ensuring it is aligned with students' cultural contexts and academic needs.

2.4.6 Challenges and Limitations of the Ethnomathematics-based teaching Approach

Despite the positive outcomes associated with the Ethnomathematics approach, there are some challenges and limitations to its widespread implementation. One major difficulty is the lack of standardized teaching resources and assessment tools. Teachers may struggle to find materials that effectively integrate cultural knowledge with

mathematical concepts, and the absence of clear assessment guidelines can make it difficult to measure learners' progress. Furthermore, integrating cultural perspectives into mathematics instruction requires teachers to have a deep understanding of both the subject matter and the cultural contexts of their learners. This requires extensive training and support, which may not always be available. As such, while the Ethnomathematics approach has many benefits, its successful implementation depends on addressing these challenges.

Despite the positive outcomes associated with the Ethnomathematics approach, there are several challenges and limitations to its widespread implementation (Adam, 2020). One major difficulty is the lack of standardized teaching resources and assessment tools. Teachers often struggle to find materials that effectively integrate cultural knowledge with mathematical concepts. This lack of resources makes it difficult to create a consistent and effective curriculum that can be easily adopted across different educational settings (Dawadi, 2021). Furthermore, the absence of clear assessment guidelines creates challenges in evaluating learners' progress and ensuring that the application of Ethnomathematics aligns with established academic standards (Francois, 2019). Without reliable and standardized tools to assess students' understanding, it becomes challenging to gauge the success of the Ethnomathematics approach and its impact on learners' academic performance.

Moreover, integrating cultural perspectives into mathematics instruction requires teachers to have a deep understanding of both the subject matter and the cultural contexts of their learners (Adam, 2020). This dual requirement necessitates extensive training and ongoing professional development, which may not always be accessible

or affordable for educators. In many regions, teachers may not receive adequate support or resources to successfully implement this approach, leading to inconsistencies in its application. The effectiveness of the Ethnomathematics approach depends on teachers' ability to strike a balance between mathematical rigor and cultural relevance, which can be difficult to achieve without proper training and resources (Geert, 2020). As such, while the Ethnomathematics approach offers many benefits, its successful implementation requires systemic support, including curriculum development, professional development for teachers, and the creation of culturally relevant teaching materials.

2.4.7 Conclusion: The Promise of Ethnomathematics-based teaching approach for Improving Learners' Performance

Overall, the Ethnomathematics-based teaching approach has proven to be effective in enhancing learners' performance in numeracy concepts by connecting mathematical knowledge to their cultural experiences. The approach not only improves academic achievement but also fosters greater interest and engagement in mathematics by making the subject more relevant and meaningful. However, for Ethnomathematics to reach its full potential, it is crucial that educators receive proper training, and that teaching resources and assessment tools are developed to support its integration into the curriculum. By addressing these challenges, the Ethnomathematics approach can play a pivotal role in improving the quality of mathematics education and making it more inclusive and culturally relevant for all learners.

2.5. Lower primary teachers' perception and challenges in teaching mathematics using Ethnomathematics-based teaching approach.

2.5.1 Perceptions of Ethnomathematics-based teaching approach as a Discipline

Mathematics is often perceived as an abstract subject devoid of cultural significance. D'Ambrosio (2001) and Favilli (2016) argue that many educators view mathematics as a purely theoretical discipline, disconnected from cultural contexts. Historically, Ethnomathematics was considered relevant only for so-called illiterate groups, but Francois (2019) highlights its evolution to embrace cultural diversity in mathematics education. Despite this, the belief that Western mathematics is superior and universally applicable continues to create resistance to the Ethnomathematics approach, as noted by Pais (2011) and Forbes (2018). This perception perpetuates the dominance of traditional mathematics over culturally integrated approaches.

Mathematics has long been perceived as an abstract and universal discipline, often detached from cultural or contextual influences. This perception stems from the traditional view that mathematics is purely theoretical, emphasizing logical reasoning and universal principles without regard for the cultural or social experiences of learners. D'Ambrosio (2001) and Favilli (2016) argue that this perspective is deeply ingrained among many educators, leading them to treat mathematics as a culturally neutral subject. As a result, the potential for mathematics to be connected to learners' lived experiences and cultural contexts is often overlooked or dismissed.

Historically, Ethnomathematics was regarded as relevant only for "illiterate" or marginalized groups, reinforcing its limited acceptance within mainstream education. However, Francois (2019) highlights a shift in this perception, noting that Ethnomathematics now emphasizes the cultural diversity inherent in mathematical practices and education. By linking mathematics to the cultural knowledge and practices of different communities, Ethnomathematics seeks to make the subject more inclusive and accessible. Despite these advances, resistance to this approach persists,

largely due to the dominance of Western mathematical paradigms that prioritize abstract and universal principles over culturally specific applications.

This resistance is rooted in the belief that Western mathematics represents a superior and universally applicable framework. Pais (2011) and Forbes (2018) observe that this perspective perpetuates the dominance of traditional mathematics, marginalizing culturally integrated approaches like Ethnomathematics. Many educators and policymakers fear that incorporating cultural contexts into mathematics education might dilute the rigor and universality of the subject. Consequently, efforts to integrate Ethnomathematics into mainstream education often face skepticism and challenges, further entrenching the traditional view of mathematics as an abstract and culturally neutral discipline.

The researcher views the perception of mathematics as an abstract and culturally neutral discipline as a significant barrier to the adoption of Ethnomathematics. This perspective, deeply rooted in traditional Western paradigms, limits the recognition of mathematics as a culturally diverse and contextually relevant subject. While Ethnomathematics seeks to bridge this gap by integrating learners' cultural knowledge and experiences into mathematical education, the dominance of universal and theoretical frameworks continues to marginalize these efforts. The researcher aligns with the argument that this resistance perpetuates inequities in education, as it dismisses the potential for culturally integrated approaches to enhance inclusivity and engagement in mathematics.

2.5.2. Mathematics teachers' perceptions of Ethnomathematics-based teaching approach

According to Mania and Alam (2021), using the Ethnomathematics-based approach in teaching math in schools is more acceptable and enjoyable in the teaching and learning process. Recently media used in teaching math and learning process focus on the concept and fail to contextualize based on the students' cultures and backgrounds

Furthermore, according to the revelation of the findings of Maulina et al. (2023), teachers responded that ethnomathematics is a valuable approach to teaching mathematics. Through ethnomathematics, students can see the value of mathematics in their lives. Previously, students deemed that doing mathematics meant doing a calculation, which always relates to numbers. Using this approach, students can connect mathematics and culture to make learning interesting. This notion can be seen in the interview excerpts.

Finally, It apparent enough to draw that, most lower primary teachers according to the above revealed literature have a positive perception about Ethnomathematics-based teaching approach as it offers learners to see the value of mathematics in their personal lives.

2.5.2 Challenges Faced by Teachers in Implementing Ethnomathematics-Based Teaching Approach

Teachers face numerous challenges in implementing Ethnomathematics-based approaches, particularly in culturally diverse classrooms. D'Ambrosio (2021) emphasizes that educators often struggle to understand and address the varied cultural backgrounds of their learners. This lack of cultural competence limits their ability to

connect mathematical concepts to learners' experiences, as highlighted by Mosimege (2012) and Sunzuma and Maharaj (2019). Additionally, curriculum constraints pose significant challenges. Teachers frequently feel that Ethnomathematics deviates from prescribed curricula, making it difficult to balance cultural approaches with standard academic requirements (Dawadi, 2021). Furthermore, many educators lack the necessary pedagogical training and content knowledge to effectively integrate Ethnomathematics into their teaching. Madusise (2015) and Naresh (2015) argue that these gaps, particularly in areas like geometry, undermine teachers' confidence and effectiveness in implementing this approach. Adam (2020) similarly points out that teachers' limited understanding of geometry prevents them from effectively incorporating cultural contexts into their lessons.

Teachers face significant challenges when implementing Ethnomathematics-based approaches, particularly in classrooms with culturally diverse learners. One of the primary issues is the lack of cultural competence among educators. D'Ambrosio (2021) highlights that many teachers struggle to understand and address the varied cultural backgrounds of their students, which hinders their ability to connect mathematical concepts to learners' lived experiences. Studies such as those by Mosimege (2012) and Sunzuma and Maharaj (2019) reinforce this view, emphasizing that teachers often possess only a superficial understanding of indigenous knowledge systems. This lack of depth restricts their ability to incorporate culturally relevant examples and teaching methods into their lessons, further alienating learners from the subject matter.

Another major challenge stems from the constraints imposed by standardized curricula. Teachers frequently perceive Ethnomathematics as deviating from prescribed academic guidelines, making it difficult to balance cultural approaches with the need to cover required content. Fantinanto (2018) and Orey and Rosa (2020) observe that this tension discourages educators from using Ethnomathematics, as they fear falling behind on mandated lesson plans or failing to adequately prepare learners for standardized assessments. The rigidity of traditional curricula thus creates a barrier to adopting more inclusive and culturally responsive teaching methods, leaving little room for the integration of Ethnomathematical principles.

Furthermore, a lack of pedagogical training and content knowledge significantly undermines teachers' ability to implement Ethnomathematics effectively. According to Madusise (2015) and Naresh (2015), many educators lack the confidence and expertise to connect mathematical concepts to cultural contexts, particularly in complex areas like geometry. Adam (2020) also notes that teachers' limited understanding of geometry prevents them from recognizing opportunities to incorporate cultural knowledge into their lessons. Without sufficient training and support, teachers may struggle to develop the skills needed to bridge the gap between academic mathematics and the cultural practices of their learners. These gaps not only affect the quality of instruction but also discourage educators from fully embracing Ethnomathematics in their teaching.

The researcher views the challenges faced by teachers in implementing Ethnomathematics as multifaceted, deeply rooted in systemic and individual factors. They emphasize that a lack of cultural competence among educators significantly

limits the effective application of Ethnomathematics, as many teachers struggle to connect mathematical concepts to the diverse cultural contexts of their learners. This lack of understanding, as highlighted by D'Ambrosio (2021) and other scholars, restricts teachers' ability to create culturally relevant and engaging lessons.

Additionally, the researcher points to the rigidity of standardized curricula as a major obstacle, noting that the perceived misalignment between Ethnomathematics and mandated academic content creates tension for teachers. Educators often feel constrained by time and curricular demands, making them hesitant to adopt culturally responsive teaching methods. This systemic issue, coupled with insufficient pedagogical training and gaps in content knowledge, particularly in areas like geometry, further compounds the problem.

Ultimately, the researcher views these challenges as significant barriers to the integration of Ethnomathematics in classrooms, underscoring the need for targeted training, curriculum reform, and support systems to help teachers bridge the gap between academic mathematics and learners' cultural experiences. Without addressing these issues, the potential of Ethnomathematics to enhance inclusivity and engagement in mathematics education remains underutilized.

2.5.3 Impact of Ethnomathematics on Learners

The impact of Ethnomathematics on learners has been a topic of mixed findings. While some studies suggest that Ethnomathematics approaches positively influence learners' academic performance, others show no significant improvement. For instance, Kara and Togrol (2010) found no notable difference in achievement between learners taught using Ethnomathematics and those taught using traditional methods. However, the

same study revealed a positive effect on learners' attitudes toward mathematics. Similarly, Sunzuma et al. (2021) report that while the academic benefits of Ethnomathematics approaches are inconsistent, they often enhance learners' engagement and motivation.

The impact of Ethnomathematics on learners has been a subject of varied findings in academic research. Some studies suggest that using Ethnomathematics approaches in the classroom positively influences learners' attitudes and engagement with mathematics. For instance, Kara and Togrol (2010) observed that while there was no significant difference in academic achievement between learners taught using Ethnomathematics and those taught through traditional methods, learners exposed to Ethnomathematics displayed a more positive attitude towards mathematics. This suggests that integrating cultural contexts into mathematical instruction can make the subject more relatable and enjoyable for learners, even if it does not immediately translate into higher academic performance.

Furthermore, Ethnomathematics approaches have been shown to enhance learners' motivation and engagement with mathematics. Sunzuma et al. (2021) report that learners often find Ethnomathematics-based lessons more engaging because they connect mathematical concepts to real-life contexts and cultural practices. By using culturally relevant examples, these approaches help learners see the practical applications of mathematics in their own lives, fostering a deeper interest in the subject. This increased engagement can lead to improved participation and persistence in learning mathematical concepts, which are essential for long-term success.

However, the inconsistency in academic outcomes remains a concern. While some studies highlight the potential of Ethnomathematics to improve learners'

understanding of mathematical concepts, others suggest that the benefits are limited or context-dependent. Factors such as the quality of implementation, the teacher's familiarity with the Ethnomathematics approach, and the alignment of the curriculum with learners' cultural experiences play a significant role in determining its effectiveness (Fantinanto, 2018). Despite these challenges, the overall impact of Ethnomathematics on learners suggests that it can play a valuable role in making mathematics education more inclusive and meaningful, particularly for learners from diverse cultural backgrounds.

The researcher views the impact of Ethnomathematics on learners as complex and multifaceted. While some studies report positive outcomes in terms of learners' attitudes and engagement with mathematics, these benefits do not always translate into measurable academic improvement. The researcher acknowledges that Ethnomathematics approaches, by connecting mathematical concepts to culturally relevant contexts, can make the subject more engaging and relatable, which fosters motivation and participation among learners. However, the researcher also recognizes that the effectiveness of Ethnomathematics is not guaranteed and is heavily influenced by factors such as the quality of implementation, teacher expertise, and the alignment of the curriculum with learners' cultural backgrounds. Despite the mixed findings, the researcher believes that Ethnomathematics has the potential to make mathematics education more inclusive and meaningful, particularly for learners from diverse cultural backgrounds, but it requires careful consideration of these factors to fully realize its benefits.

2.5.4 Pedagogical Limitations of Ethnomathematics

The implementation of Ethnomathematics faces several pedagogical limitations. Orey and Rosa (2020) note that Ethnomathematics lacks a standardized syllabus and clear assessment guidelines, leading to inconsistencies in its application. Domite (2009) highlights that the integration of local cultural contexts can be too diverse for a universal curriculum, making it challenging for teachers to balance cultural relevance with academic rigor. Furthermore, Forbes (2018) criticizes the bottom-up approach of Ethnomathematics, arguing that it undermines the abstract and universal nature of mathematics, which is essential for fostering broader problem-solving skills.

The implementation of Ethnomathematics in the classroom is hindered by several pedagogical limitations, one of the most significant being the absence of a standardized syllabus and clear assessment guidelines. Orey and Rosa (2020) point out that the lack of a cohesive framework for teaching Ethnomathematics leads to variations in how it is applied across different classrooms. Without a consistent curriculum or reliable methods for evaluating students' progress, teachers may struggle to maintain uniformity in instruction. This lack of structure can result in inconsistent learning outcomes, making it difficult to measure the effectiveness of Ethnomathematics-based approaches.

Additionally, the integration of local cultural contexts into mathematics teaching poses challenges for creating a universal curriculum. Domite (2009) explains that cultural diversity can be a double-edged sword: while it makes the subject more relatable to learners, it also complicates the development of a standardized curriculum. With each culture bringing its own distinct mathematical knowledge and practices, teachers may find it difficult to balance the cultural relevance of lessons with the need to cover the standardized academic content. This diversity can lead to a fragmented approach to

teaching, where some learners may benefit more than others depending on their cultural background.

Moreover, Forbes (2018) critiques the bottom-up approach of Ethnomathematics, which focuses on teaching mathematics through local cultural practices and experiences. While this approach seeks to make mathematics more accessible by connecting it to real-life contexts, Forbes argues that it undermines the abstract and universal nature of mathematics. According to this view, the emphasis on culturally specific mathematical knowledge could detract from the development of essential problem-solving skills that are applicable across a wide range of situations. By prioritizing local cultural contexts, Ethnomathematics may risk limiting learners' ability to tackle broader mathematical challenges that require abstract thinking and generalized solutions (Adam, 2020).

The researcher views these pedagogical limitations as significant obstacles to the successful integration of Ethnomathematics into mainstream education. While the cultural relevance of Ethnomathematics offers valuable insights, the lack of a standardized curriculum and assessment methods makes it difficult to assess its overall effectiveness. Additionally, the diversity of local cultural contexts poses challenges in balancing cultural integration with academic rigor. The researcher believes that, while Ethnomathematics has great potential, its implementation must be carefully managed to ensure that it does not undermine the universal principles of mathematics that are necessary for broader problem-solving skills. A more structured approach to its integration, along with clearer guidelines for assessment, would help mitigate some of these limitations.

2.5.4 Criticisms of Ethnomathematics

Critics of Ethnomathematics argue that its focus on cultural diversity could inadvertently reinforce marginalization and inequality rather than promoting equity. Rowlands and Carson (2002) and Pais (2011) caution that emphasizing cultural perspectives in mathematics might uphold the status quo instead of challenging systemic inequalities. Additionally, Rowlands and Carson (2002), referenced in Forbes (2018), contend that if mathematics is applied and understood according to cultural perception as suggested by Ethnomathematicst then, paradoxically, this approach would uphold the status quo rather than advancing equity, as suggested by the field's proponents. Pais (2011), referenced by Forbes (2018), goes on to say that a multicultural approach turns into racism if the theoretical framework of a diverging educational model 27 of equity and diversity does not sufficiently represent individual culture. In other words, there is a willingness "to accept the other as long as it is deprived of all the vicissitudes that characterise the otherness" and the "other is squeezed from its otherness." Similarly, Horsthemke and Schäfer (2007), cited by Forbes (2018), contend that although the application of mathematical concepts may uniquely identify a certain culture, the idea that mathematics is the exclusive domain of one particular culture is incorrect and only serves to exacerbate marginalisation and division.

Moreover, Horsthemke and Schäfer (2007) contend that Ethnomathematics may only be meaningful in localized contexts, limiting its relevance as a broad pedagogical or epistemological framework. They further argue that while Ethnomathematics can

deepen cultural and historical understanding, it lacks the scope to serve as a universal approach to mathematics education.

Critics of Ethnomathematics often highlight its potential to unintentionally reinforce marginalization and perpetuate inequality, despite its aim to promote cultural inclusivity. Rowlands and Carson (2002) as well as Pais (2011) argue that focusing too heavily on cultural perspectives in mathematics might inadvertently sustain the existing power structures rather than challenging them. They warn that by framing mathematical practices through a cultural lens, Ethnomathematics might inadvertently serve the interests of dominant groups, further marginalizing those it aims to empower. This paradox arises because, in emphasizing cultural differences, Ethnomathematics risks affirming the marginalization of minority groups by framing them as "other," thus reinforcing existing power dynamics rather than addressing systemic inequalities. This concern is encapsulated by Pais' (2011) notion that a multicultural approach can turn into a form of racism if it fails to represent diverse cultures sufficiently or if it excludes the complexities that define these cultures.

Further criticisms focus on the perceived limitation of Ethnomathematics in its application as a broad educational or epistemological framework. Horsthemke and Schäfer (2007) argue that while Ethnomathematics is meaningful within specific cultural contexts, it lacks the universal applicability required to serve as a comprehensive model for mathematics education. By anchoring mathematics education too deeply in localized cultural contexts, critics argue that Ethnomathematics may fail to provide students with the universal mathematical principles needed for broader academic and professional success. They contend that although exploring the cultural significance of mathematical concepts can enhance

cultural and historical understanding, it cannot replace the necessity for abstract reasoning and universal mathematical skills, which are essential for addressing global challenges. Thus, Ethnomathematics may have limited scope in bridging the gap between localized cultural knowledge and the global, abstract nature of mathematics.

The researcher views these criticisms as reflective of a key tension in the implementation of Ethnomathematics balancing the celebration of cultural diversity with the need for universal standards and problem-solving skills. While acknowledging the potential for Ethnomathematics to marginalize certain groups, the researcher suggests that these concerns arise from the challenge of integrating cultural relevance into a subject traditionally viewed as universal and abstract. Ethnomathematics should aim to foster both cultural understanding and global mathematical competencies, avoiding the trap of perpetuating the status quo or narrowing the scope of mathematics education. A more inclusive and balanced approach, which recognizes both cultural diversity and the universal aspects of mathematics, could address these criticisms and help ensure that Ethnomathematics contributes to a more equitable and effective education system.

2.5.5 Broader Implications for Educational Change

The successful adoption of Ethnomathematics depends heavily on teachers' attitudes and beliefs. Fullan (2007) and Sunzuma and Maharaj (2019) emphasize that educators' core beliefs significantly influence their willingness to adopt new teaching approaches. Resistance to change often stems from entrenched views of mathematics as a culturally neutral discipline and the challenges of reconciling diverse educational perspectives.

Forbes (2018) adds that resistance is further fueled by the perception that Ethnomathematics compromises the integrity of mathematics as a universal discipline. The adoption of Ethnomathematics in education also involves addressing the broader implications for educational change, especially in terms of how mathematics is taught and understood. According to Fullan (2007) and Sunzuma and Maharaj (2019), the attitudes and beliefs of educators are pivotal in the success of any new teaching approach. Teachers who perceive mathematics as a purely abstract and universal subject may be resistant to integrating cultural perspectives into their lessons. This resistance is often rooted in deeply ingrained views that mathematics should be objective and culturally neutral. Such educators may struggle with the idea that mathematics can be connected to the cultural contexts of their students without compromising its rigor or objectivity. Overcoming this resistance requires a fundamental shift in how educators view the relationship between mathematics and culture, moving towards a more inclusive understanding of the subject (Obeidat, 2020).

Furthermore, the successful implementation of Ethnomathematics calls for systemic changes in teacher training and curriculum design. Forbes (2018) notes that the perception of Ethnomathematics as a threat to the universality of mathematics often leads to hesitation among educators and policymakers. This perception is compounded by concerns that incorporating cultural diversity into mathematics education might undermine the discipline's intellectual integrity. To address these concerns, it is essential to develop clear guidelines and frameworks that demonstrate how cultural relevance can coexist with universal mathematical principles. Educators need to be equipped with the knowledge, skills, and resources to effectively integrate cultural

contexts into their teaching without sacrificing the core mathematical concepts that are essential for academic and professional success (Francois, 2019). A reimagined curriculum that embraces both cultural diversity and universal mathematics could facilitate the broader acceptance of Ethnomathematics.

The researcher views these broader implications as critical to the future of mathematics education. While resistance to Ethnomathematics is understandable given the traditional view of mathematics as universal and objective, the shift towards a more inclusive approach can enhance the relevance and accessibility of the subject for diverse learners. Teachers' attitudes and beliefs about the cultural nature of mathematics must evolve to recognize the value of integrating local knowledge systems without undermining the global applicability of mathematical concepts. A more inclusive curriculum that blends cultural perspectives with universal mathematical principles could lead to a more equitable and effective educational system, one that fosters both cultural understanding and intellectual rigor.

2.6. Ethnomathematics-based teaching approach as an intervention strategy in teaching numeracy concepts

Numerous academic studies have demonstrated that the Ethnomathematics-based teaching technique is used to teach numeracy concepts by providing examples of these ideas from culture and the home to help learners understand them.

Ferreira (as cited by Orey & Rosa, 2020) states that educators, curriculum developers and supervisors, principals, administrators, and parents should all be involved in incorporating Ethnomathematics into teaching practices. Ferreira goes on to say that one way to implement this approach in the classroom is to use it to introduce a lesson, discuss the topic's cultural and/or historical background, or demonstrate how the topic

is used in real-world situations. For instance, a lesson on triangles could start with a display of a Hawaiian petroglyph or a discussion of how the ancient Egyptians used right triangles to survey their territory following the Nile River's yearly flooding. Additionally, one may demonstrate certain triangle-shaped tools and discuss their use and significance. Secondly, a lesson can be developed using a multicultural approach. It is recommended that educators provide samples of multicultural art and literature, such as baskets, masks, books, music, etc. For example, family structure or kinship may be used as an example in a discussion on patterns, relations, or even algebraic functions. A story or folktale (any of the several tales about crossing the river) may be used to demonstrate logic or tactics, or an African mask may be displayed to assess symmetry, line, or rotation (Orey & Rosa, 2020). Teachers in Namibia may use examples of cultural practices that include mathematical concepts in their lessons. -#Gaes (2005) found that many numerical concepts like addition, geometry, and measuring were embodied in the conventional sewing, home building, cooking, counting, and games performed by the Damara tribe in Namibia. Additionally, household items can serve as excellent models for comprehending measurement principles. Rather than relying just on lecture notes and theoretical examples to teach, the teacher can assign learners to rank and contrast the items' length, height, mass, and volume.

The goal of using Ethno-mathematical techniques in mathematics curricula is to improve learners' overall educational experience by making mathematics more interesting and relevant to them. By employing learners' own distinctive cultural references to teach knowledge, skills, and attitudes, the application of an Ethno-mathematical perspective in the school mathematics curriculum aids in the

development of learners' intellectual, social, emotional, and political learning (Presmeg, 2005). According to Orey and Rosa (2020), this type of curriculum offers strategies for learners to thrive academically while retaining their individuality. Orey and Rosa (2006) also mentioned that the programme addresses professional development, classroom management, teacher expectations, relationships between teachers, administrators, learners, and the community, as well as the content and process of the curriculum when using Ethnomathematics as a teaching methodology. With this method, learners are able to draw connections between the ideas, practices, and historical developments of mathematics as well as the contributions of other cultural groups and individuals. Important qualities allow Ethnomathematics to contribute to the conceptual development of mathematics. To put it another way, because it changes the true nature of mathematics, Ethnomathematics can be viewed as a transformative undertaking (Amit & Abu,2017). Tracing the evolution or changes in mathematical concepts and practices throughout time could therefore be one goal of the analysis of an Ethnomathematical approach in addition to the curriculum in schools. In light of this, Orey and Rosa (2020) suggested that implementing a methodology that addresses Ethnomathematical viewpoints in the mathematics curriculum is one aspect of the difficulty. It is conceivable to think that using mathematical modelling techniques is an approach appropriate for this viewpoint. The choice of mathematical material can be tailored to address particular subjects, benchmarks, or requirements in the mandatory mathematics curriculum.

There is a limited chance of an Ethnomathematical perspective entering classrooms because many teachers are neither trusted or permitted to deviate from prescribed books and curriculum, nor are they well trained or supported to be able to connect

mathematical modelling with Ethnomathematics. In order to overcome this obstacle, a community and school must adopt an open curriculum, in which the amount of mathematics taught is determined by how well the class is doing and how engaged the learners are (Powell, 2002).

In this sense, the Ethnomathematics programme makes mathematical modelling an essential methodology. Mathematical modelling is the foundation from which most of modern mathematics has grown, frequently through an abstraction process that depicts the real world, according to a thorough examination of mathematics history (D'Ambrosio, 2021).

Ethnomathematics tends to link mathematics with its settings and places an emphasis on the collective approach. Ethnomathematics can be perceived as an all-encompassing curriculum element if these two elements are combined, as mathematics can be humanised. This means that Ethnomathematics can be perceived as a philosophical, contextual, affective, and attitudinal approach to teaching (Powell, 2002). Teaching is much more than the transfer of knowledge when looking at it through the lens of utilising mathematical modelling towards pedagogical action for the Ethnomathematics programme. This is because teaching becomes an activity that introduces the creation of knowledge (Abah, 2020).

From the same perspective, the researcher agrees with the authors mentioned above. But local teachers' implementation of this strategy in their mathematics and numeracy concepts lessons won't be made public until after they have shared their opinions.

2.7. Summary of chapter two

The pertinent literature for this investigation was presented in this chapter. The lecture method is a classic teaching strategy in which the teacher assumes the role of the head of instruction and the learners' roles are to listen and respond. This was discovered through a comparison between the lecture-based instruction technique and the Ethnomathematics-based teaching approach. Because the element of reality is not incorporated into the teaching and learning of numeracy concepts, this method is less engaging and learning does not appear natural. The Ethnomathematics-based teaching approach, on the other hand, is a teaching strategy that takes learners' cultural backgrounds into account. In other words, teachers teach learners by connecting topics related to their cultural background. This infuses reality into the classroom and enables learners to draw parallels between what they are learning and their own cultures. It also enables them to value their respective cultures. Although the literature study revealed that the Ethnomathematics approach presents certain problems for teachers, it may appear to be the perfect way to address learners' poor performance in numeracy concepts. For instance, managing learners from different cultural backgrounds on a daily basis in math classes can be difficult, and educators and school administrators sometimes have unfavourable opinions about using an Ethnomathethematics-based teaching approach in math classes. The study's methodology is presented in the following chapter.

CHAPTER THREE: RESEARCH METHODS

3.1. Introduction

The research design, study population, sample and sampling techniques, research equipment, and data collection methods are all covered in this chapter. It also goes into the data analysis methodology and the study's ethical application.

3.2. Research design

This study employed the exploratory mixed-methods research design to collect data. Exploratory mixed methods research design is a research method that combines qualitative and quantitative data collection and analysis in a sequence of phases (Dawadi, 2021). This design is in alignment with the interpretivist paradigm which argues that reality is socially constructed and constructive (Kivunja, 2017). This method is considered appropriate as the current study focused on determining the effect of Ethnomathematics-based teaching approach on Grade 3 learners' performance in numeracy concepts as well as the perceptions and challenges of Mathematics teachers in using the Ethnomathematics-based teaching approach to teach numeracy concepts in Grade 3. To determine the effects of Ethnomathematics-based teaching approach on Grade 3 learners' performance in numeracy concepts, learners' scores need to collected and then analysed, and this is called qualitative. In addition, in order to determine the perceptions and challenges of Mathematics teachers in using Ethnomathematics-based teaching approach to teach numeracy concepts in Grade 3, teachers' text responses have to be collected, and this called qualitative. In a

mixed-methods research design, both quantitative and qualitative data are gathered, analysed, and interpreted within the same study (Norris, 2017). Data on the impacts of an Ethnomathematics-based teaching approach on Grade 3 learners' academic achievement in numerical concepts in the chosen lower primary school were gathered using a quasi-experimental methodology in this quantitative study.The qualitative method used employed a mixed questionnaire and follow-up face-to-face interviews to collect data on the perceptions and challenges of Mathematics teachers in using the Ethnomathematics-based teaching approach to teach numeracy concepts in Grade 3.

3.3. Population of the study

There are two sets of population of this study. The first set of the study population consisted of 68 Grade 3 learners at the selected primary school in the Zambezi. The learners were all selected from one school to avoid factors of different school environments influencing the results of the study. Grade 3 was selected because it is the grade where numeracy concepts are mostly emphasized, and it forms the transition point from numeracy to primary mathematics.

The second set of the population consisted of all the lower primary Mathematics teachers teaching from Grades 1 to 3 in the Zambezi Region. According to the Zambezi Regional Education Directorate teachers' enrolment data, there are a total of 100 lower primary teachers teaching Mathematics in the Zambezi Region (MOEAC, 2017). Additionally, there are 1,083 lower primary schools in Zambezi region. This is inclusive of both private and public (MOEAC, 2022)

3.4. Sample and sampling

Forty (40) Grade 3 learners were chosen at random from each of the three Grade 3 classrooms (3A, 3B, and 3C) in the chosen school to serve as the learners' sample. The

school was randomly selected as a representative of the population of 1,083 primary schools in the region. The 40 learners were then given serial numbers 1 through 40. Following this, they were split into two groups of 20 participants each using systematic random sampling. As a result, every student with an even number was assigned to the Experimental group (n = 20) and every student with an odd number was assigned to the Control group (n = 20). The figure below illustrates the systematic random sampling used to divide the 40 learners into two groups. All the numbers highlighted in red colour are even numbers and represent the learners in Experimental group. On the other hand, all the numbers highlighted in blue colour are odd numbers and represent the learners in Control group.

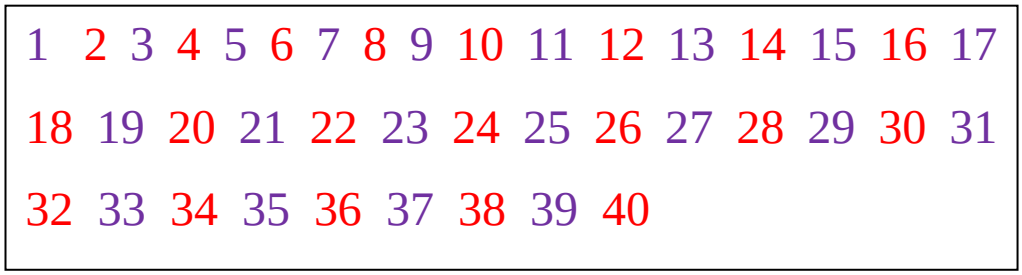

Figure 1

Diagram illustrating systematic random sampling used to divide 40 learners into two groups.

Thirty lower primary mathematics teachers in the Zambezi Region (Grade 3), chosen through the purposive sampling approach, answered the survey questions. A teacher had to have taught lower primary mathematics in the research region for at least two years in order to be eligible to be included in the sample. Additionally, eight of the thirty teachers who made up the subsample were chosen to take part in the follow-up

interview. The teacher's availability and willingness to take part in the follow-up interview determined the subsample.

3.5. Research instruments

The study used the following instruments to collect data on the research questions:

1) PRE- AND POST-TESTS: These instruments were used to determine the learners' entry level knowledge and post experiment knowledge with a view to assessing the effect of Ethnomathematics-based teaching approach on the Grade 3 learners' performance in numeracy concepts.

2) MIXED QUESTIONNAIRE: This tool was used to investigate into the attitudes and difficulties that Grade 3 Maths teachers had when attempting to teach numerical concepts in the research area using an Ethno-mathematics-based teaching style.

3) INTERVIEW GUIDE: This instrument was used to gather follow-up data on the perceptions and challenges of Grade 3 Mathematics teachers in using Ethno-Mathematics based teaching approach to teach numeracy concepts in the study area.

3.6. Data collection procedure

3.6.1. Pre-tests

In order to ascertain their prior knowledge before to the experiment, learners in the Control and Experimental groups (n = 40) completed the same general knowledge test on numeracy concepts: length, height, volume, and mass during the pre-tests. The exit learning objectives for Grade 3 mathematics were used to guide the assessments given to the learners. In order to investigate the learners' comprehension of arranging and comparing the length, height, mass, and volume of common items in their

environment, a total of 20 pre-test questions (Appendix A) were collected. The learners were given instructions on how to complete the worksheet test questions. Five marks were given to each question, for a total of 100 possible points across the 20 questions expressed as a percentage. If a test taker receives a score of 49% or less, they are considered to have a low level of numeracy concept knowledge and have failed the test. The Grade 3 grading scale states that a percentage of 50 and above is regarded to be passed, whereas a percentage of 49% is below average and is classified as poor or fail (NIED, 2005). The pre-test was given and scored by the researcher in person.

3.6.2. The experimental (teaching) process

The teaching approaches used during the experiment were:

1. Ethnomathematics-based teaching approach, and
2. Lecture-based method (the conventional lecture method used by the teachers)

The Experimental group (n = 20) was taught using an Ethnomathematics-based approach, whereas the Control group (n = 20) was taught using a conventional lecture-based manner. The researcher personally instructed both groups for three weeks, from September 6, 2021, to September 24, 2021 (15 working days), utilising the same lesson plans based on the three numerical concept components of mass, volume, and length (Appendix B). Based on the prearranged school schedule, each lecture lasted forty minutes, and during the experiment, both groups received instruction in succession on the same day.

3.6.3. Post-tests

After the teaching, both the Experimental and Control groups were given the same post-test in the same venue on Tuesday, the 17th working day (26 September 2021) of the experiment to assess the performance of the two groups and hence, the effect of

Ethnomathematics-based teaching approach on the learners' understanding of numerical concepts. The same questions given in the pre-test were used for the post-test, and the researcher also personally administered and graded the post-test. Just, as in the pre-test, the instructions on how to answer the post-test questions were explained to the learners.

3.6.4. Mixed questionnaires

The research area's lower primary teachers' perspectives and challenges about the use of an Ethnomathematics-based teaching approach to teach numeracy concepts to Grade 3 learners were investigated through a mixed questionnaire with both closed-ended and open-ended questions. Before the surveys were sent out, the researcher scheduled appointments with the lower primary teachers. The researcher personally gave the questionnaire to the participants and asked to pick them up three days later after thoroughly outlining the goals of the study and answering any questions they had. To reduce losses, participants were urged to finish the questionnaires while they were at the office.

3.6.5. Interview guide

The purpose of the interview guide was to gather additional information on the difficulties lower primary teachers encounter when implementing an Ethnomathethematics-based teaching approach to teach Grade 3 learners the numeracy concepts included in the study. Eight lower primary maths teachers that made up the subsample were interviewed face-to-face to check for consistency and reliability of the questionnaire responses of the 30 teachers . Every interview took place at a scheduled time and lasted roughly fifteen minutes. An audio recorder was used to capture every interview session.

3.7. Data analysis

The mean, standard deviation, median, mode, and range of descriptive statistics were used to examine the quantitative data obtained from the pre- and post-tests. Additionally, the significance difference between the learners' performance in the Control and Experimental groups was ascertained using the t-test ($p < 0.05$).

Thematic analysis was used to examine the qualitative information obtained from the questionnaires. A data analysis technique called thematic analysis is used to find, classify, and present patterns in qualitative data (Clarke & Braun, 2013). The audio-recorded interview with the teachers' comments was meticulously transcribed, and the responses were then categorised to produce significant themes and recurring patterns. With pertinent participant quotes serving as support, the themes that surfaced were examined in relation to the research topics.

3.8. Research ethics

First, the Centre for Research and Publications at the University of Namibia provided ethical permission (Appendix E) to conduct the study. The Ministry of Education, Arts, and Culture granted additional authorization to conduct the study through the Zambezi Region's Education Director and school principals. The study required participants to sign a consent form indicating their voluntary participation. They were also informed of their right to withdraw from the study at any time if they felt uncomfortable with the research process continuing. Parents were requested for their consent when it came to learners.

3.9. Pilot study

Pilot testing was done at one school in the Zambezi region using the quasi-experiment (Pre and Post-test), mixed question questionnaire, and interview guide instruments.

The primary study did not include the school that took part in the pilot project. A pilot study is a brief feasibility study intended to evaluate several components of the procedures intended for a more extensive, thorough, or confirmatory research (Lowe, 2019). The pilot study was conducted to prevent the occurrence of a fatal flaw in a study that is costly in time and money.

3.10. Validity and reliability of instruments

The degree to which a notion is precisely measured in a study is known as validity (Hiele & Twycross, 2015). They went on to describe consistency of a metric as another aspect of reliability. Henning, Van Rensburg, and Smit (2004) claim that the foundation of a study's validity and reliability is its credibility. According to Lincoln & Guba in Johnson & Turner (2003), "trustworthiness" describes the researcher's ability to persuade the audience that the research is of high quality and that the study's conclusions are important enough to consider.

As a result, the supervisors reviewed and approved the study instruments once the researcher submitted them to them. Subsequently, the researcher sent the research instruments to a University of Namibia subject matter expert for content validity checking.

The study's reliability was attained by using the test-retest approach, in which participants from a school not included in the main study answered the questionnaire, took part in the follow-up interview, and participated in the pilot study. After a week, the process was carried out again at the same school. The two pilot investigations yielded consistent data, indicating that participants had a clear understanding of the items on the instruments. Therefore, the instruments were not adjusted further before being employed in the primary investigation.

3.11. Summary of chapter three

The research design, study population, sample and sampling processes, research instrument, data collection methods, data analysis, and ethical concerns made during the study were all covered in this chapter. It was also detailed how the pilot study was conducted. The study's findings and the debate will be presented in the upcoming chapter.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1. Introduction

This chapter presents the results and discussion of the study. The results include the performance of Grade 3 learners taught using the conventional lecture method (Control

group, n = 20) and the Ethnomathematics-based teaching approach (Experimental group, n = 20). Under each group, Pre-test (used to determine the entry knowledge of the 40 Grade 3 learners before the intervention), and Post-test (used to determine the significant differences in the performance between the conventional lecture and the Ethnomathematics-based teaching approach) performance scores were analysed and presented. In addition, the results also include teachers' perceptions and challenges in incorporating the Ethnomathematics-based approach in teaching numeracy concepts to Grade 3 learners.

4.2. Investigating the performance of Grade 3 learners in numeracy concepts using the Ethnomathematics-based teaching approach

4.2.1. Performance of Grade 3 learners taught using the conventional lecture method (Control group)

In order to investigate the effect of Ethnomathematics-based teaching approach on Grade 3 learners' performance in numeracy concept, it is compared to the conventional lecture method of teaching. The performance of learners exposed to the latter method is first investigated.

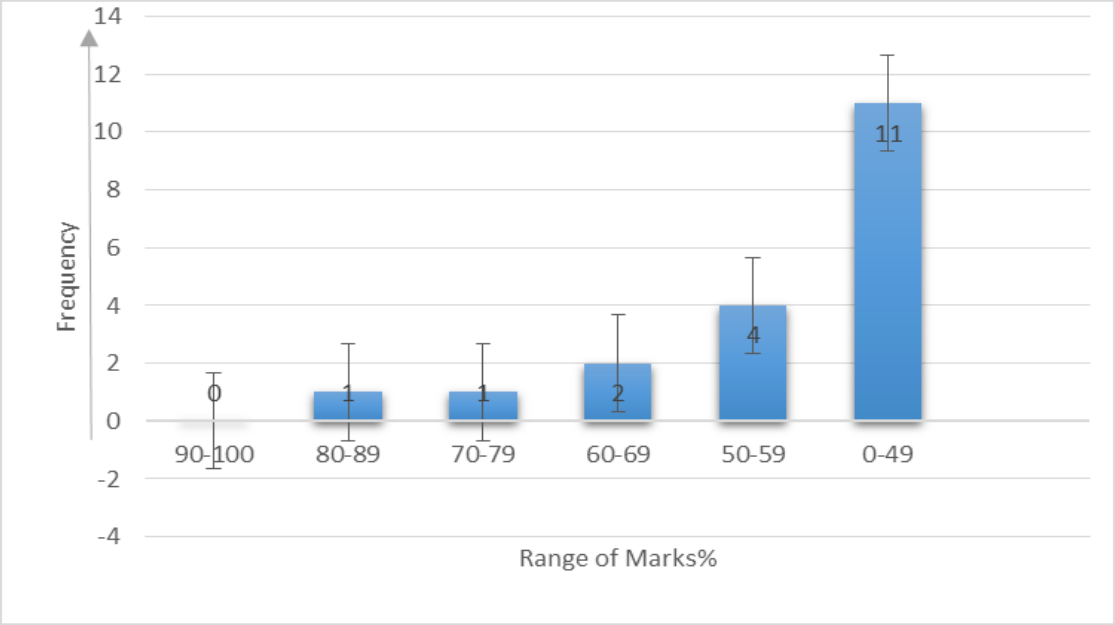

Figure 2

Pre-test range of marks versus frequency of the control group

Figure 2 above shows the frequency distribution of the marks obtained by the Control group in the pre-test as related to the range presented in the descriptive statistics table below (Table 1). The marks were distributed following Namibia's Ministry of Education, Arts and Culture (MoEAC) grading criteria for Junior Primary School (JPS). These include marks between 90 -100 graded as A+, 80 - 89 A, 70 -79 B, 60 - 69 C, 50-59 D and 0 - 49 U/E. According to the MoEAC's grade descriptors for JPS, A+ is a pass with distinction, A is an excellent pass, B is a very good pass, C is a good pass, D is a satisfactory pass, while U/E is a fail or ungraded.

The graph above (Figure 2), shows that no learners (0) scored within the range of 90 - 100 in the pre-test of the Control group. There is however, one learner who scored between 80 - 89, another learner scored 70 -79, two learners scored 60 - 69, four

learners scored 50-59, and eleven learners completely failed the pre-test and scored between the ranges 0 - 49.

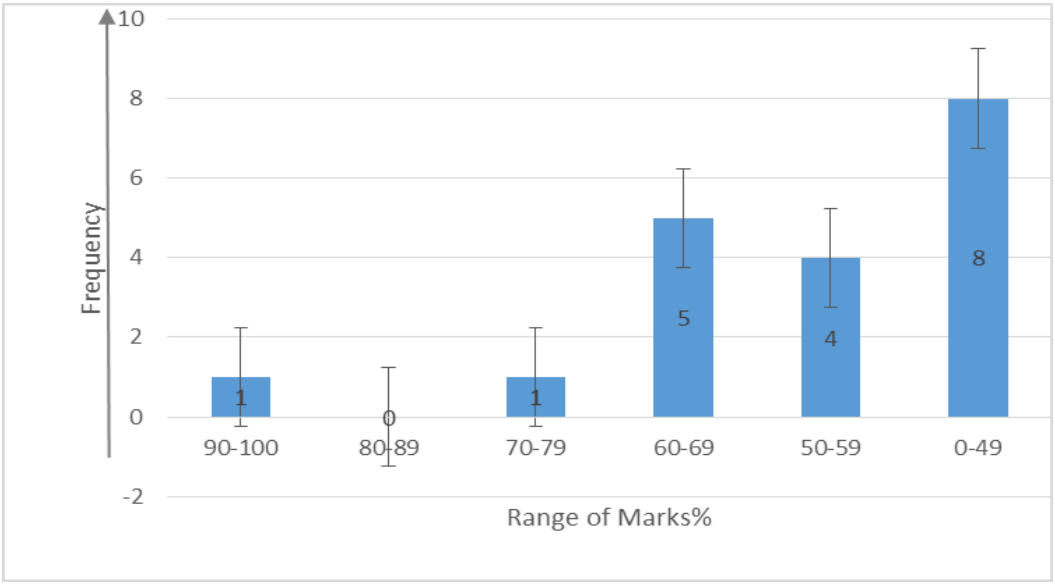

Figure 3

Post-test range of marks versus frequency of the Control group

Figure 3 above shows the post-test marks obtained by the Control group against their frequencies as related to the range presented in the descriptive statistics table below (Table 1). The graph above (figure 2) showed that one learner scored between 90 -100, no learner scored within 80 - 89, one learner scored 70 -79, five learners scored 60 - 69, four learners scored within the range of 50 - 59, and eight learners scored within of 0 - 49.

Table 1

Descriptive statistics of the performance of Grade 3 learners in the Control group (n = 20)

Descriptive statistics	***Pre-test***	***Post-test***
Mean	46	50.25
Median	45	50
Mode	55	60
Standard Deviation	15.94	16.18
Skewness	0.45	0.36
Range	55	65
Minimum	25	25
Maximum	80	90
Counts	20	20

Table 1 above presents the descriptive statistics of the performance of Grade 3 learners in the Control group (n = 20) taught using the Conventional Lecture method. The Control group learners recorded a higher mean score (50%) in the post-tests compared to the mean score of 46% recorded by the same learners in the pre-test. The median marks of the learners were 45% (pre-test) and 50% (post-test), while the modal marks

were 55% (pre-test) and 60% (post-test). Generally, the performance of the Control group learners ranged from 25% to 80% in the pre-test and 25 to 90% in the post-test.

Table 2

t-test analysis between the pre-test and post-test performances of the Control group

Descriptive statistics	***Pre-test***	***Post-test***
Mean	46.00	50.25
Variance	254.21	261.78
Observations	20	20
Pearson Correlation	0.14	
Hypothesized Mean Difference	0	
Df	19	
t Stat	-0.90	
P(T<=t) one-tail	0.19	
t Critical one-tail	1.73	
P(T<=t) two-tail	0.38	
t Critical two-tail	2.09	

P > 0.05, Not statistically significant

Table 2 above presents the result of t-test analysis (paired sample means, p = 0.05) between the pre-test and post-test performance of the Control group (Conventional lecture method). The results showed that the p-value (0.38, two-tail) is greater than 0.05, and this suggests that there is no significant difference between the pre-and post-tests performances of the Control group. Furthermore, the fact that the p-value is greater than 0.05, we, therefore assume that the data is normally distributed.

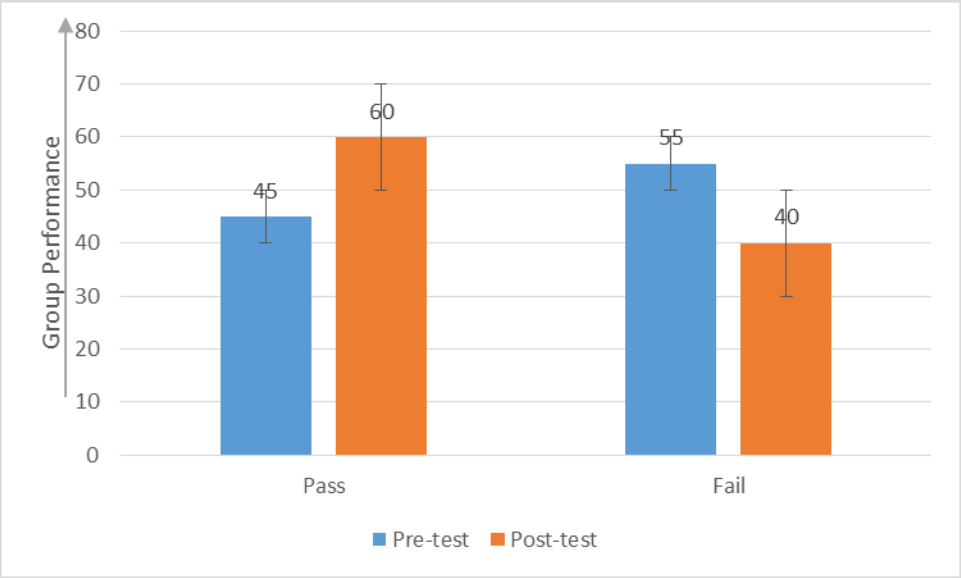

Figure 4

Grade 3 learners who passed and failed pre-test and post-tests in the Control group

Figure 4 above depicts the percentage of learners who failed and passed the pre and post-tests in the Control group. The results showed that only 45% of the learners passed the pre-test while in the post-test, 60% of them passed.

4.2.2. Performance of Grade 3 learners taught using Ethnomathematics-based teaching approach (Experimental group)

Having investigated the performance of learners exposed to the conventional lecture method (control group), the performance of those learners exposed to the Ethnomathematics-based teaching approach will be investigated next.

Table 3

Descriptive statistics of the performance of Grade 3 learners in the Experimental group (n=20)

Descriptive statistics	*Pre-test*	*Post-test*
Mean	54.25	78.75
Median	52.5	80
Mode	50	75
Standard Deviation	17.19	12.13
Skewness	0.18	-0.76
Range	60	45
Minimum	25	50
Maximum	85	95
Count	20	20

Table 3 above presents the descriptive statistics of the Experimental group (n = 20) learners' performances in the pre-and post-tests. The mean score recorded by the learners in the Experimental group was 54.25% in the pre-test and 78.75% in the post-tests. Furthermore, the Experimental group recorded a lower median score (52.5) in the pre-test than in the post-test (80). The same group of learners (Experimental group) recorded a modal mark of 50% in the pre-test and 75% in the post-test. The range of marks recorded by the Experimental group were (25% to 85%) in the pre-tests and (50% to 90%) in the post-test. The Experimental group's minimum mark was 25% in the pre-test and 50% in the post-test, while the maximum mark was 85% in the pre-test and 95% in the post-test.

Table 4

t-test analysis between the pre-test and post-test performances of the Experimental group

Descriptive statistics	*Pre-test*	*Post-test*
Mean	54.25	78.75
Variance	295.46	147.04
Observations	20	20
Pearson Correlation	-0.25	
Hypothesized Mean Difference	0	

Df	19
t Stat	-4.68
P(T<=t) one-tail	8.08E-05
t Critical one-tail	1.73
P(T<=t) two-tail	0.00016
t Critical two-tail	2.09

P < 0.05, Statistically significant

Interestingly, the result of t-test (paired two sample means, p = 0.05) two-tailed analysis of the Experimental group performances in the pre- and post-test (Table 4 above) was statistically significant. The assumption therefore is that, the data (pre-test and post-test) is not normally distributed because p-value is less than 0.05, and this is interpreted as a significant deviation from the normal distribution.

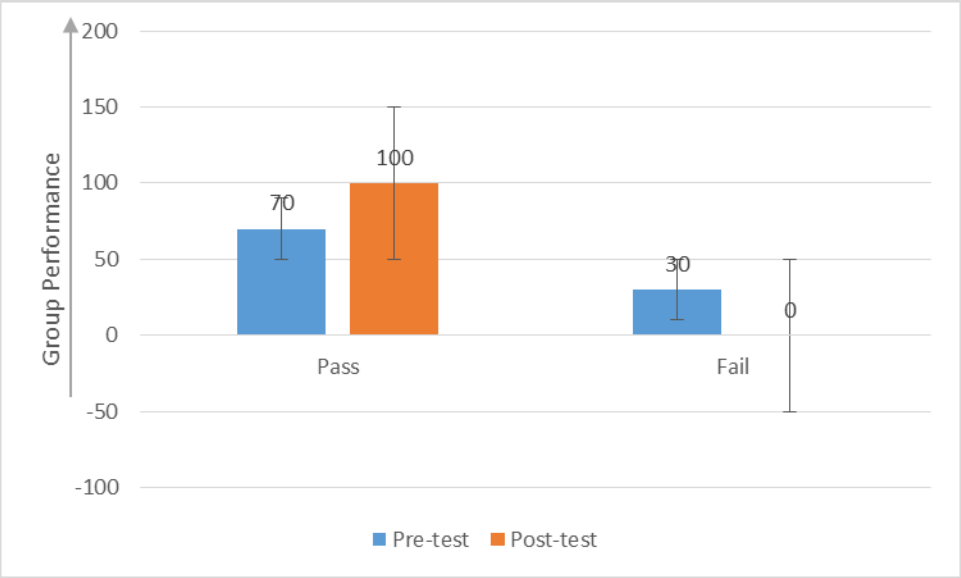

Figure 5

Grade 3 learners who passed and failed pre-test and post-tests in the Experimental group.

Figure 5 above shows that there are only 70% of Grade 3 learners who passed the pre-test in the experimental group. The figure further indicates that all the learners (100%) passed the post-test in the Experimental group.

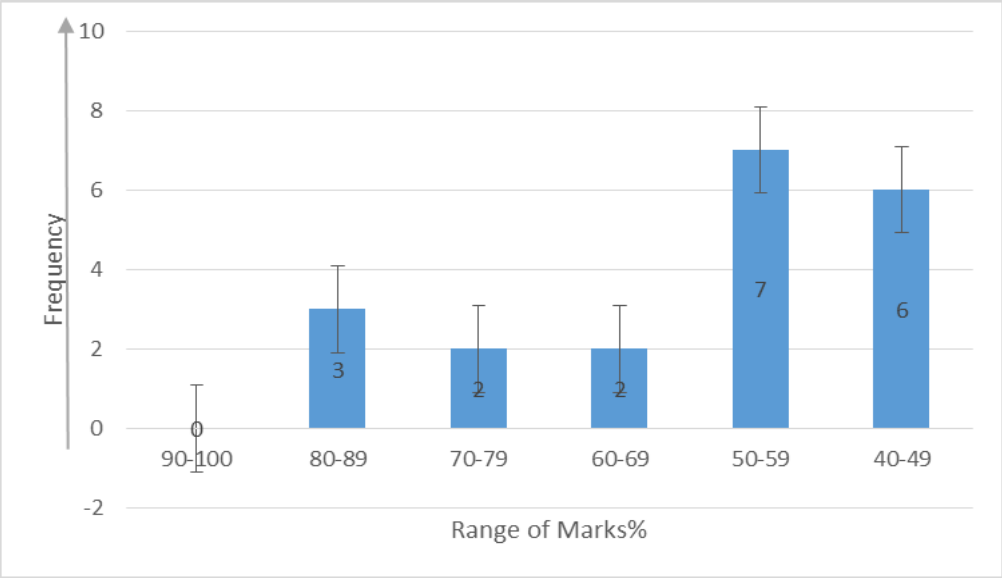

Figure 6

Frequency distribution of the Pre-test marks obtained by the Experimental group in the pre-test

Figure 6 above shows the frequency distribution of the range of marks obtained by the learners in the experimental group in the pre-test. The figure showed that no learner scored between 90-100, three learners scored within the range of 80 - 89, two learners each scored within the range of 70-79 and 60 - 69, seven learners scored within the range of 50-59, and six learners scored within the range of 0 – 49.

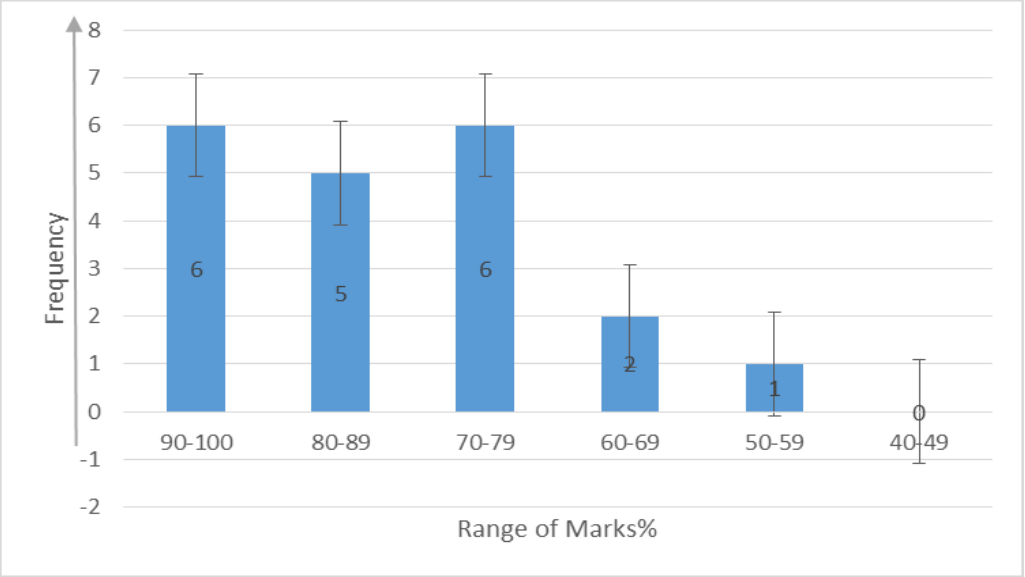

Figure 7

Post-test range of marks versus frequency of the Experimental group

The frequency distributions of the marks obtained by learners in the Experimental group in the post-test are shown above in Figure 7. The figure (figure 10) revealed that six learners scored between 90 - 100, five learners scored within the range of 80 - 89, six learners scored within the range of 70 -79, two learners scored within the range of 60 - 69, one learner scored within the range of 50 -59, and no learner scored within the range of 0 - 49. Thus, all learners in the Experimental group passed the post-test.

4.2.3. Performance of Control versus Experimental groups.

Comparing performance in the pre-tests

This section presents the findings of the relative performance between the Control and Experimental groups.

Table 5

The t-test analysis (paired sample means) (Pre-tests) for Control versus Experimental group.

Descriptive statistics	***Experimental***	***Control***
Mean	*54.25*	*46*
Variance	295.46	254.21
Observations	20	20
Pearson Correlation	0.40	
Hypothesized mean difference	0	
Df	19	
tStat	2.02	
P(T<=t) one-tail	0.03	
t Critical one-tail	1.73	
P(T<=t) two-tail	0.06	
t Critical two-tail	2.09	

P > 0.05, not statically significant

As shown in Table 5 above, the result of T-test analysis (paired sample means) of the variation between the performance of the Experimental and Control groups was not statistically significant (p = 0.06). This suggests that the Grade 3 learners in both the Control and Experimental groups have similar entry level knowledge about the numeracy

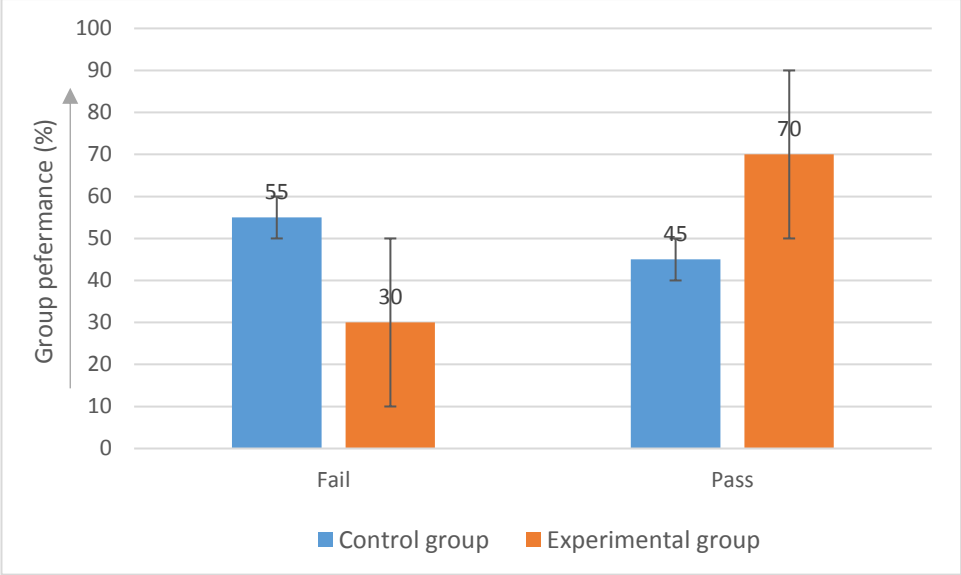

Figure 8

Comparison between pre-test performance of the Control and Experimental groups

Moreover, Figure 8 above also depicts the relative performance of learners in the Control and Experimental groups in the pre-test. The graph revealed that only 45% of the learners passed the pre-test in the Control group while 70% of the learners in the Experimental group passed the pre-test.

Comparing performance in the post-tests

Table 6

Paired Two Sample for Means (Post-tests) of control versus experimental group.

Descriptive statistics	***Experimental***	***Control***
Mean	78.75	50.25
Variance	147.04	261.78
Observations	20	20
Pearson Correlation	0.25	
Hypothesized Mean Difference	0	
Df	19	
t Stat	7.23	
P(T<=t) one-tail	3.64E-07	
t Critical one-tail	1.73	
P(T<=t) two-tail	7.29E-07	
t Critical two-tail	2.09	

P < 0.05, Statistically significant

Table 6 above shows the result of t-Test analysis (paired sample means) of the variation between the performance of the Experimental and Control groups in the post-test was statistically significant ($p = 7.29 \times 10^{-7}$). This implies that the learners in the Experimental groups performed better than those in the Control group. This means that the Ethnomathematics-based teaching approach used to teach the Experimental group has a positive effect on Grade 3 learners' performance in numeracy concepts.

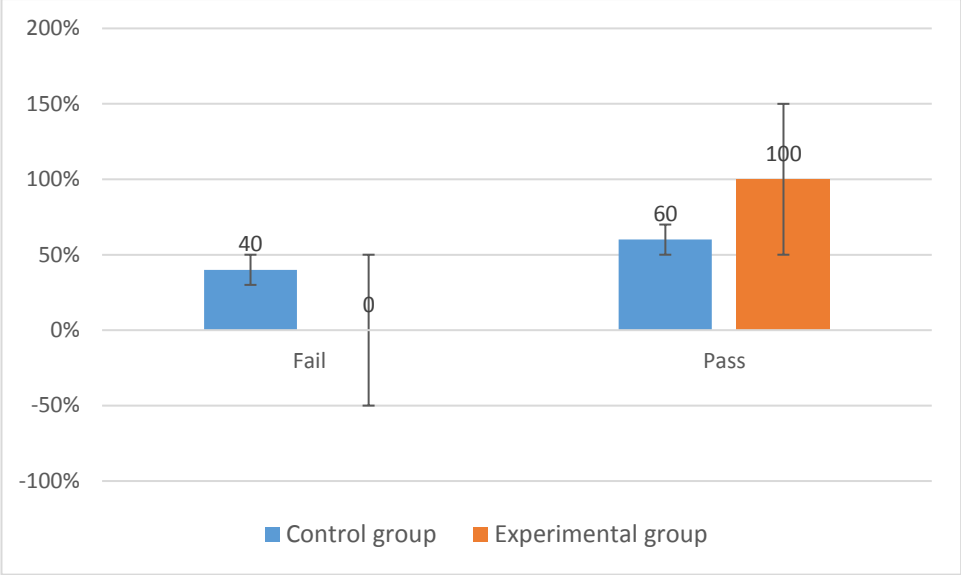

Figure 9

Relative performance of the Control and Experimental groups in the Post-test.

Figure 9 above depicts the relative performance of learners in the Control and Experimental groups in the post-test. The graph showed that 60% of learners in the Control group passed the post-test while 40% of them failed. Interestingly, the same graph showed that all the learners (100%) in the Experimental group passed the post-test.

4.3. The perceptions and challenges of Grade 3 mathematics teachers in using the Ethnomathematics-based teaching approach to teach numeracy concepts

4.3.1. Demographic information of the participants

The demographic information of the study's participants is presented in Table 15 below.

Table 7

Demographic information of the study participants

Gender	Years of teaching experience range	Frequency
Female	0-10	7
	11-20	4
	21-30	4
	Subtotal	15
Male	0-10	9
	11-20	3
	21-30	3
	Subtotal	15

The table showed that 15 female and 15 male teachers participated in the study. Seven (7) female teachers had 3 - 10 years of teaching experience, 4 female teachers had 11 - 20 years of teaching experience and another 4 female teachers had 21 - 30 years of teaching experience. The table also showed that there were 9 male teachers who had 3 - 10 years teaching experience in the lower primary phase, 3 of them had 11 - 20 years of teaching experience, and another 3 male teachers had 21-30 years of teaching experience. Thus, all the research participants have sufficient years of cognate experience and hence could respond adequately to the research objective.

4.3.2. Teachers' perceptions of using the Ethnomathematics-based teaching approach to teach numeracy concepts

The perceptions of the participants (Grade 3 teachers) about their usage of Ethnomathematics-based teaching approach in teaching numeracy concepts are classified under the following subthemes: teachers' awareness of Ethnomathematics-based teaching approach, teachers' usage of Ethnomathematics-based teaching approach compared to other teaching methods to enhance learners' understanding of numeracy concepts, and relating Mathematics to learners' culture.

Teachers' awareness of Ethnomathematics-based teaching approach.

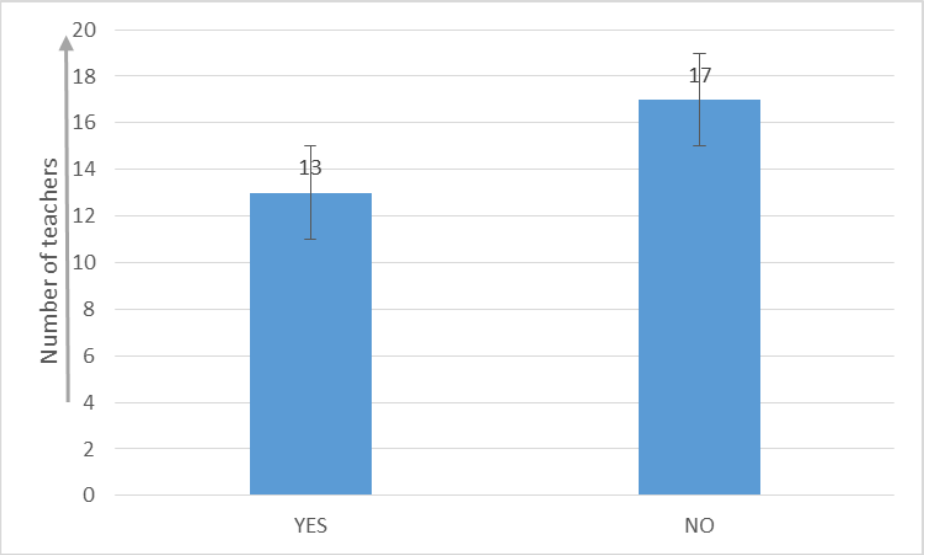

Figure 10

Teachers' awareness of the Ethnomathematics-based teaching approach

Figure 10 above show the responses that teachers had to the question '' Do you use Ethno Mathematics based approach to teach numeracy concepts? Respond by saying Yes or No

If your answer in 1 was a Yes, explain how this approach is used in your lessons?

As seen in Figure 16 above, when asked whether the participants (Grade 3 teachers) are aware of the Ethnomathematics-based teaching approach and its usage, most teachers (n =

17) Stated that they were not aware of the concept of Ethnomathematics-based teaching approach and so do not use it to teach numeracy concepts. , For example, Teacher 1 stated "No, I am hearing of this Ethnomathematics-based teaching approach for the first time and I do not use it to teach mathematics. However, I would love to try it if I receive training on how it is used; maybe, learners will perform well". Teacher 10 also concurred by stating that "I am hearing of the Ethnomathematics-based teaching approach for the first time but the way it is described, it is very interesting and I believe that it may work well''.

Other teachers (n = 13) stated that they were aware of Ethnomathematics-based teaching approach but some were not sure if they are using it properly. For example, Teacher 30 stated that ''Yes, I am aware of this cultural way of teaching mathematics and I normally use it sometimes. However, it gets very difficult sometimes for example, if I have Oshiwambo, Thimbukushu, Sifwe, etc speaking learners in my classroom, it means I have to give home examples based on each of the cultures or tribes and this is very difficult but learners really enjoy it''.

The participants (n = 13) added that they give examples of what learners do at home in which numeracy concepts are embedded. They also stated that they often ask learners to think of daily activities where numbers are reflected. For example, Teacher 17 stated that ''for my learners, I normally give them examples based on items in their homes, where numbers are reflected. For example, if I am teaching counting concept,

I will tell them that numbers represent certain objects at home, for example; two spoons, three dishes, four cups, etc. I will then ask them to count in that order, e.g. 1 cup, two loves of breads, etc.''

Teacher 5 on the other hand stated that whenever I teach fractions, I normally use a loaf of bread as an example because bread is something the learners always see at home. For the bread, when we cut a loaf into two equal pieces, each piece is referred to as a half which is 1 over 2; meaning one piece represents a part of the full loaf of bread which in this case, is a whole number. I normally use the example of Oshiwambo chickens (the running chicken) saying out of 7 running chickens, 2 of the chickens represent a fraction of the total number of 7 chickens. In this case, the fraction is 2 over 7.

Teacher 8 stated that ''my learners find it very fun because at some point they even recite a song out of their daily life activities, for example, three little cats, to represent the concept of counting and computation as numeracy concepts''. Teacher 8 further elaborated that ''why mathematics is believed to be a subject of only symbols is because it will not make sense to only learn the symbols without relating them to real-life situations. It is meaningless''

Teacher 17 stated that ''Ethnomathematics relates mathematics to home examples and yes, when I use it my learners seem to improve".

Teachers' usage of Ethnomathematics-based teaching approach compared to other teaching methods to enhance learners' understanding of numeracy concepts

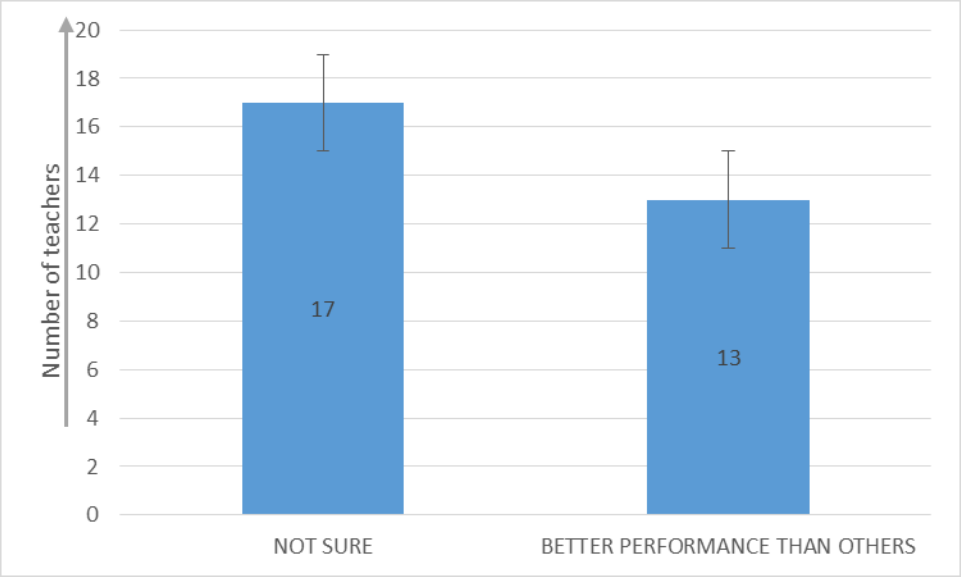

Figure 11

Teachers' usage of Ethnomathematics-based teaching approach compared to other teaching methods to enhance learners' understanding of numeracy concepts

Figure 11 above show the response that teachers had to the question ''what do you think about Ethno Mathematics approach as compared to the other methods you use to teach numeracy concepts in your class in terms of academic performance?'

The results show that most of the participants (n=17) stated that they are not sure whether Ethnomathematics-based teaching approach can improve learners' performance when used to teach numeracy concepts as compared to the conventional lecture method - the lecture method.

For example, teachers 8, 9, 28, and 30 all had similar response by stating that it is hard to say as to whether the Ethnomathematics-based teaching approach it can help learners perform better compared to the other methods as they are not aware of this method

However, Figure 17 also reveals that some participants (n = 13) argued that while teaching numeracy concepts such as addition, fractions, computation, etc, by giving home or daily life experiences and examples, they observed that learners' performances have been improving as compared to the learners' performances when taught using the conventional lecture methods. They further noted that if the Mathematics teachers could receive specialized training on how to apply the Ethnomathematics-based teaching approach, the foundation of learning Mathematics would be strengthened at the junior primary phase, with special respect to the comprehension of numeracy concepts. This was evident in the responses of Teachers 5, 8, 17, and 30.

Teacher 5 stated that ''since I have been using this method to teach many concepts such as fractions using the examples of marathon chicken for Oshiwambo speaking learners and bread example for all languages, I have observed interesting patterns in the performance of learners as compared to the other method which I also used''.

Teacher 8 concurred with Teacher 5 by stating that ''the Ethnomathematics-based teaching approach is good for learners and my learners perform well whenever I use it''.

Teacher 17 stated that ''well, whenever I teach my learners Mathematics by giving examples of food from their homes, they understand better than when I just write on the board''.

Teacher 30 disclosed that ''for learners to understand Mathematics, we should not teach them only symbols but also teach them where and how to apply these numbers at home. It is very important".

Relating Mathematics to learners' culture

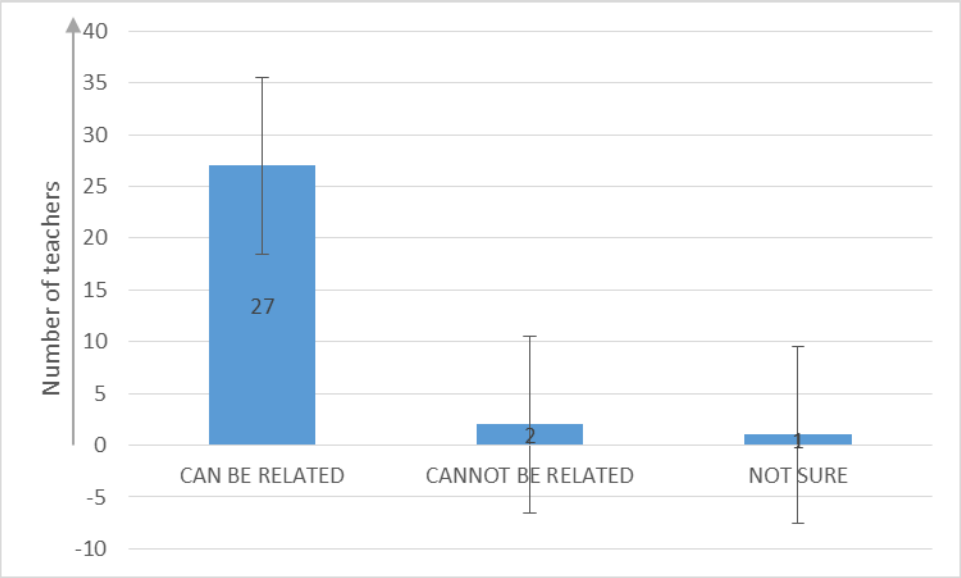

Figure 12

Teachers' perceptions on whether mathematics can be related to culture and how they teach it in relation to culture

Figure 12 above show the responses that teachers had to the question ''Do you think Mathematics can be related to the learners' culture? Motivate your view''

The figure above reveals that the majority of teachers (n=27) responded that Mathematics can be related to culture. They further stated that for the learning of number concepts to be meaningful, learners have to be taught what they experience daily. This means that the teachers ought to give examples from daily life experiences of learners (things which are done at home, ancient/modern) which reflect numbers. Teacher 4, for example, stated that ''absolutely, Mathematics and culture are related because for learning to be meaningful, we need to relate numbers to what learners see, hear, touch and experience in their everyday lives. If we were to teach symbols only, it would not have any impact on their lives'' Teacher 29 also responded that ''yes

obviously. What is the point of teaching number symbols to learners if they cannot relate them to anything? We need to understand that Mathematics itself is a culture and each culture has some customs/traditions/activities where numbers are reflected. Take, for instance, the conventional game known as 'mulabalaba' in Katima Mulilo. While this game is played for fun purposes, the participants are unknowingly practicing Mathematics. I mean, there are a number of numeracy concepts embedded in this game and these are counting, re-grouping, classification, seriation, patterning, ordering and so on''. Teacher 6 also echoed similar sentiment by saying that ''of course, Mathematics has to be related to culture for it to be meaningful''.

While majority of the participants shared that Mathematics and culture are indeed related, a few teachers (n=3) believe otherwise and one participant was completely not sure. When asked to justify their responses, one of them (Teacher 20) stated that ''Mathematics was not discovered in our country and therefore it is a subject based on symbols and teaching Mathematics by relating it to culture will bore learners'' Teacher 15 also stated that ''Mathematics will be boring when taught using examples from culture.' Lastly, Teacher 2 stated that ''I am not sure if Mathematics can be related to cultures because this Ethno-mathematics thing sounds too ambiguous''

4.3.3. The Teachers' challenges in using Ethnomathematics-based teaching approach to teach numeracy concepts

This section presents teachers' responses to the question "Is Ethno-Mathematics approach emphasized in your school curriculum? If yes, how is it incorporated during lesson preparation''

All Grade 3 teachers responded that Ethnomathematics-based teaching approach is not incorporated in the curriculum because it poses certain challenges. The challenges

faced by Grade 3 teachers in using the Ethnomathematics-based approach to teach numeracy concepts in the study area include non-inclusion of Ethnomathematics in the Grade 3 Mathematics syllabus, lack of time, and lack of specialized training in using the Ethnomathematics-based teaching approach.

Non-inclusion of Ethnomathematics in the Grade 3 Mathematics syllabus

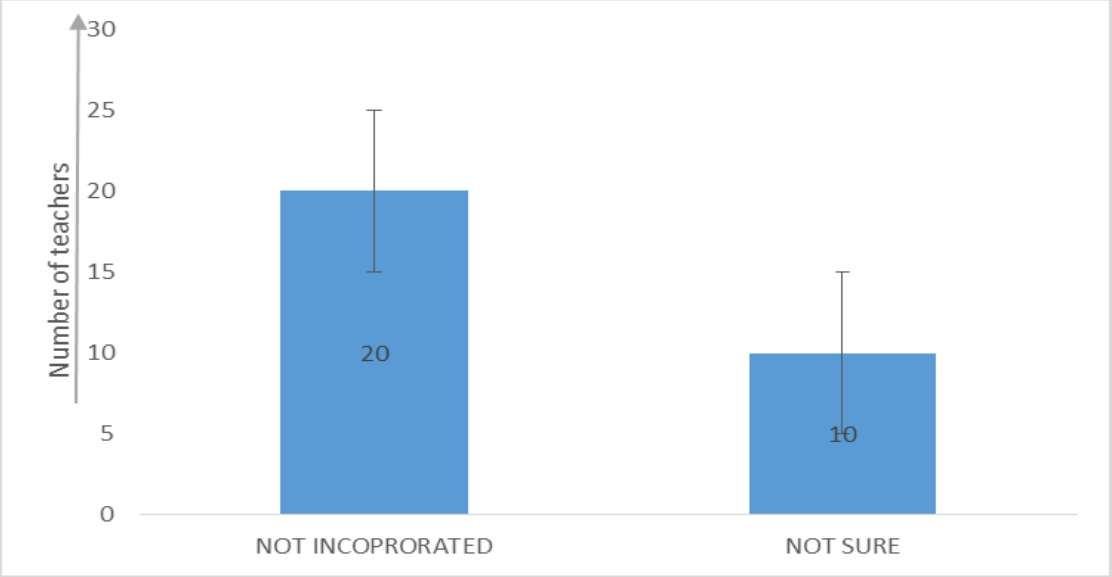

Figure 13

Teachers' responses on inclusion of Ethnomathematics-based approach in Grade 3 Mathematics syllabus

As seen from Figure 13, most teachers (n=20) indicated that the Ethnomathematics-based teaching approach is not incorporated or prescribed as a teaching method according to the Grade 3 Mathematics syllabus. When asked to explain further, most of them highlighted that their school management cautioned them against using teaching methods which might interfere with the conventional or normal learning process of learners. Thus, the non-inclusion of Ethnomathematics-based teaching

approach in the Grade 3 Mathematics syllabus constitutes a challenge as teachers viewed its usage as not recognised.

Other teachers (n=10) responded that they are not sure if this teaching method is prescribed in the school curriculum as it is more of a managerial duty to ensure which subject content knowledge and instruction are to be implemented at a school. For example, Teacher 1 stated that ‘‘this is more of a managerial question, therefore I am not sure as to whether this method is prescribed because I am not even aware of it and have never used it before”. Teacher 5 on the other hand stated that ‘‘even though I support this teaching method, I am not really sure if it is allowed in our school curriculum’’

Lack of time

The teachers added that the class lesson timetable slot (40 minutes per lesson) is not sufficient to make them teach using the Ethnomathematics-based teaching approach and give examples based on every culture in their classes. For example, Teacher 4 stated that ‘‘our time is limited; therefore, we cannot give examples from each culture and our school management doesn’t allow it”.

In addition, Teacher 7 who happens to be a school Head of Department (HOD) and at the same time the lower primary teacher in the school argued that ‘‘according to my knowledge, the Ethnomathematics-based teaching approach is one of those diverse methods and might bring complications. As a manager, with subject knowledge about management and leadership, I have noted that our curriculum is a homogenised kind of curriculum; in other words, it is limited in the way that subject knowledge has to address the learning outcomes. Furthermore, this approach might require more time

because the teachers need time to accommodate many cultures present in the school. With our limited time, this requires more time''.

Lack of specialized training in using the Ethnomathematics-based teaching approach

Some teachers responded that as much as the Ethnomathematics-based approach sounds good to them, it, however, require specialized training on how to use it. For example, Teacher 5 stated that ''this teaching approach to me is good, although we don't have specialized training on how to use it, otherwise it might work well''.

4.4. Discussion of the findings

The main objectives of this study were: i).To investigate the effects of the Ethnomathematics-based teaching approach on Grade 3 learners' performance in numerical concepts in a selected Lower primary school in the Zambezi region. ii). To establish the perceptions and challenges of Grade 3 Mathematics teachers in using the Ethnomathematics-based teaching approach to teach numeracy concepts in selected lower primary schools in the Zambezi region. This section will, therefore, discuss the findings based on the above-stated objectives.

4.4.1. Effects of the Ethnomathematics-based teaching approach on Grade 3 learners' performance in numerical concepts

Grade 3 learners' pre-test and post-test performances in the numeracy concepts.

The findings showed that although learners in the Control group scored 46% and 50% in the pre- and post-tests, respectively, learners in the Experimental group (n=20)

approximated mean scores of 54% in the pre-test and 79% in the post-test. The statistical significance of the difference in post-test performance between the Control and Experimental groups was demonstrated by the t-test analysis (paired sample means; $p < 0.05$). This shows that the Grade 3 learners' performance in the numerical concepts in the current study is improved by the Ethnomathematics-based teaching approach. The Ethnomathematics improved the grade 3 learners' performance because when they were taught using this approach, they were able to relate numeracy concepts to their everyday life experiences. A link between these findings and the theoretical framework of the study was therefore established. The theoretical framework of this study (socio-constructivism by Lev Vygotsky) emphasizes on the role of the social community of the learners in the acquisition of numerical knowledge. The social community of the learner includes their family, friends, neighbors, and other adults. This community becomes the biggest pool of numerical concepts knowledge. As a child interacts with their family, friends, neighbours, and other adults, for example, they will partake in home activtiies which involves fetching water, cooking, sharing of food, baking, etc. these activities reflect embedded numerical concepts such as measurement of capacity, weight, volume, fractions, and problem solving skills. The socio-constructivism theory and Ethnomathematics, therefore interacts within this study, because by acquiring numerical concepts such as measurement of capacity, weight, volume, fractions, and problem solving skills through socialization (which is what the socio-constructivism is all about) is considered ethnomathematics because the learning of these concepts consider the home environment from where they had arisen. This therefore, led to the improved performance of grade 3 learners taught using the Ethnomathematics-based teaching approach. Seemingly, the Ethnomathematics-

based approach may have the potential to improve the performance of lower primary learners, in general, in numeracy concepts if used properly, in order to strengthen the poor foundation of numeracy concepts laid at this phase. This will not only strengthen the foundation of numeracy concepts but also improve the performance of learners in the latter upper phases.

The results mentioned above are consistent with what some writers have found on the differences in performance between the Ethnomathematics-based and Conventional (lecture) teaching approaches (Forbes, 2018). Similar findings were made by these authors, who showed that learners taught using an Ethnomathematics-based approach outperformed learners taught using a conventional (lecture) manner. For instance, a study by Orey and Rosa (2020) comparing the effects of an Ethnomathematics-based and conventional (lecture) method on learners' performance in geometry revealed statistically significant differences in post-test scores between the Ethnomathematics-based and conventional (lecture) groups ($p < 0.05$). The Experimental group outperformed the Control group in terms of performance. They added that the primary cause of this performance variance is that learners' understanding of numeracy concepts is improved when they are able to make connections between the concepts and their cultural backgrounds through the use of an Ethnomathethematics-based teaching approach.

From the same perspective, Ozofor & Onos (2018) found that, among other things, the Ethnomathematics approach was more successful in promoting learners' achievement in their study on the impact of the subject on senior secondary education learners. The Ethnomathematics approach led to considerable achievement gains for both genders. The results of the study showed a substantial interaction impact between gender and

method. For those involved in mathematics instruction, including teachers, these disclosures had grave ramifications.

The fact that learners are able to make a connection between numeracy concepts and their daily practices thanks to the Ethnomathematics-based teaching approach shows that mathematics can be meaningfully taught at all grade levels, even though the study mentioned above by Ozofor & Onos (2018) was not conducted on lower primary learners. The upper and senior grades may benefit from a solid foundation of numeracy concepts learned at the lower phase through establishing meaning (Geert, 2020). Thus, this result indicates that the teaching strategy based on Ethnomathematics is beneficial at all stages of learning.

Furthermore, learners exposed to the Ethnomathematics Instructional Approach (EIA) demonstrated superior achievement and were better off in their interest in mathematics than those exposed to the Conventional Lecture Method (CLM). This was the conclusion of a study by Oranito & Onile (2021) that looked into the effects of Ethnomathematics Instructional Approach on Learners' Achievement and Interest in Mathematics. Additionally, while teaching mathematics utilising EIA and CLM, there was a noticeable change in the learners' achievement and enthusiasm in the subject.

Last but not least, an analysis of data from a study by Achor, Imoko, and Uloko (2009) examined the impact of an Ethnomathematics teaching approach on the achievement and retention of senior secondary learners in locus. The findings showed that learners exposed to ETA outperformed those taught using a conventional approach in terms of both achievement and retention. As a result, there were notable differences in the

achievement and retention mean scores (F1, 248 = 241.317, p = 0.000) between the learners taught Locus with ETA and those taught the conventional method.

Lastly, the results of this study show that the Ethnomathethematics-based teaching approach helps learners make a connection between numerical concepts and their personal experiences, which helps them understand the teachings much better. This explains why, at the conclusion of the treatment, every student in the Experimental group passed the post-test. Therefore, when applied appropriately to teach numeracy concepts, an Ethnomathethematics-based teaching approach has the potential to help learners understand and perform very well. In line with the previously mentioned discovery that an Ethnomathethematics-based teaching approach helps learners make the connection between the numerical concepts and their experiences, According to Matang (2022), in a study comparing learners' performance in mathematics when calculating the area of a square between those who had previously learned about floor laying at home and those who were learning it for the first time, learners who had previously experienced floor laying at home outperformed learners who were learning it for the first time in calculating the area of a square.

Additionally, Katsap and Silverman (2016) emphasised that learners can reflect and value not just their own culture but also the cultures and customs of others through the use of mathematical concepts based on cultural viewpoints. Therefore, community members' participation is crucial to incorporating cultural elements into mathematical activity.

Furthermore, the results of the t-test comparing the pre-test performance of the Experimental and Control groups showed that the mean scores were not statistically

significant ($p > 0.05$). Before the learners were split into two groups, the Control group, which received instruction via conventional lecture methods, and the Experimental group, which received instruction using an Ethnomathematics-based teaching approach the pre-test's primary goal was to ascertain the learners' prior or entry-level knowledge. According to the pre-test findings, all of the learners appear to have comparable background or beginning knowledge of numerical concepts. This is understandable given that all of the Grade 3 classes were chosen from the same school, taught by the same teachers utilising the conventional lecture style, and thus had the same exposure to the ideas of numeracy before treatment.

In addition, the findings also indicate that only 35% of the learners scored 60% and above in the post-test of the Control group which is significantly lower compared to the Experimental group where 95% of the learners scored 60% and above in the same post-test.

In conclusion, these studies reveal the significance of the Ethnomathematics-based teaching approach. As demonstrated by the various authors' disclosures contrasting the effects of the Conventional Lecture Method and the Ethnomathematics-based teaching approach, there was a notable performance gap, with participants taught using the Ethnomathematics-based teaching approach performing significantly better than those taught using the Conventional Lecture method. These results confirm the findings of the current study, which highlighted that learners who receive instruction using an Ethnomathematics-based teaching approach have a tendency to make connections between the concepts of numeracy and their daily lives, giving the lessons they have learned significance. This approach, if applied appropriately, has the potential to strengthen the weak foundation of mathematics education at the lower primary level,

which is caused by reliance on conventional lecture methods that fail to connect mathematics to real-world applications. This is because the approach is supported by the findings of other authors as well as this study.

Hypothesis testing:

H0: There is no significant difference between the academic performances of Grade 3 learners taught using the Ethnomathematics-based approach and the lecture method respectively.

The difference in learners' post-test performance between the Control and Experimental groups was statistically significant ($p < 0.05$) according to the results of the paired sample means t-test. The null hypothesis was thus disproved. As a result, there is a notable difference in the academic achievement of Grade 3 learners who were taught using the lecture method and the Ethnomathematics-based approach, respectively. In the current study, the experimental group, which was taught using an Ethnomathematics-based approach, outperformed the control group, which was taught using a lecture method, on the post-tests.

4.4.2. Teachers' perceptions and challenges of incorporating Ethnomathematics-based approach when teaching numeracy concepts.

Perceptions on the awareness and application of Ethnomathematics-based teaching approach in teaching numeracy concepts

Majority of the teachers (n=17) responded that they are unaware of the Ethnomathematics-based teaching approach and hence, do not incorporate it in their teaching of numeracy concepts, while less number of teachers (n=13) responded that they are aware of Ethnomathematics-based teaching approach and that they apply it to relate numeracy concepts to real life when teaching.

This clearly indicates that the majority of participants are not familiar with the Ethnomathematics-based teaching technique and that it is not widely applied in the field of study. Several authors support this viewpoint by claiming that one of the reasons teachers are not adopting Ethnomathematics is a lack of understanding of the subject. For instance, Skovsmose and Vithal (1997) contended that there are some misunderstandings among academics regarding the definition of Ethnomathematics.

Furthermore, according to D'Ambrosio (1994), referenced by Skovsmose and Vithal (1997), Ethno-mathema-tics is a subset of Ethno-mathematics. Mathema is the comprehension and management of reality. Tics, which relates to art and techniques, is derived from the Greek word techne. By this, mathematics is seen as the "techniques of understanding." Since all methods of comprehension are rooted in culture, the prefix Ethno is crucial. Therefore, the term "Ethnomathematics" refers to the culturally ingrained methods of comprehension (Pradhan et al., 2021). This broadens the notion of Ethnomathematics beyond what was first thought to be included.

Because of the way the term has been defined, there is a lack of understanding and confusion about what an Ethnomathematics-based teaching approach actually is. This confusion may have contributed to the teachers in the current study's ignorance of the approach. Furthermore, it is evident from the smaller percentage of educators who replied that they are aware of the Ethnomathematics approach but are unsure if they are applying it correctly that they have insufficient understanding and awareness of this method of instruction. This may imply that Grade 3 teachers require specific training or orientation in this method, particularly in the study area.

Grade 3 teachers' perceptions on the usage of Ethnomathematics-based teaching approach compared to other teaching methods

The majority of teachers (n=17) said that, because they are unaware of it and have never used it before, they are unsure if an Ethnomathematics-based teaching approach can enhance learners' performance when used to teach numeracy concepts in comparison to other teaching methods that have been used.

Some participants (n=13) countered that learners performed better when taught numeracy concepts, such as addition, fractions, computation, etc. by providing examples and experiences from their homes or daily lives. This was in contrast to the learners' performance when taught using conventional lecture methods. They added that the basis of learning mathematics will be reinforced in the lower phase, particularly with regard to the understanding of numeracy concepts, if the mathematics teachers could have specific training on how to use the Ethnomathethematics-based teaching approach. This reflects a good knowledge and understanding of the concept of Ethnomathematics and its pedagogical aspect among these participants (teachers). It also suggests a positive perception towards the usage of Ethnomathematics-based teaching approach in improving Grade 3 learners' academic performance in numeracy concepts by some teachers.

These results showed ambiguity regarding the Grade 3 teachers' use of an Ethnomathematics-based teaching approach in comparison to other instructional strategies to improve learners' comprehension of the study area's numeracy concepts. The majority of participants (teachers) are unclear or unsure of the usage of the Ethnomathematics-based teaching approach, despite the fact that some teachers (n=13)

are using this method and have seen better performance trends as compared to the conventional lecture methods. According to a number of other academics, there is ongoing discussion regarding the definition and integration of Ethnomathematics in education, which has led to confusion regarding the application of this technique to improve learners' knowledge (Rowlands et al, 2018). Numerous writers have grounded their conclusions in their understanding of Ethnomathematics and the ambiguity created by criticism of its application. Because they don't know what Ethnomathematics is, some educators may decide not to use it.

For instance, by contrasting the Ethnomathematical programme with the school mathematics curriculum, Rowlands and Carson, as referenced by Pais (2011), conducted a critical evaluation of Ethnomathematics. They depended on the notion that knowledge is not limited to humans, although being created by them. This means that, regardless of the context in which a body of mathematical knowledge is formed, there exists a type of invariant, or essence, that is repeated in all of it. Thus, mathematics is a universal language. Therefore, although cultures have an impact on mathematics, Rowlands and Carson, as referenced by Pais (2011), assert that cultures do not actually define the subject matter of mathematics.

D'Ambrosio (1994), referenced by Skovsmose and Vithal (1997), elaborated on the idea of Ethnomathematics, stating that it is divided into Ethno-mathema-tics. Mathema is the comprehension and management of reality; tics, which come from the Greek word techne, are methods and artistic expression. This suggests that the "technique of understanding" is mathematics. Since all methods of comprehension are rooted in culture, the prefix Ethno is crucial. Accordingly, the term "Ethnomathematics" now refers to the culturally ingrained methods of comprehension (Maharaj & Sunzuma,

2019). Thus, the notion of Ethnomathematics encompasses far more than was first thought.

A study by Maharaj and Sunzuma (2019) also looked at the difficulties teachers have when incorporating Ethnomathematics methods into geometry instruction. Their findings included teachers' ignorance of Ethnomathematics approaches and how to incorporate them into geometry instruction; teachers' ignorance of geometry content; teachers' opinions about geometry instruction in schools; teachers' competency in teaching geometry; teachers' professional and teaching experience; and teachers' resistance to change.

Consequently, the participants' (teachers') answers regarding their uncertainty about using an Ethnomathematics-based teaching approach may have been influenced by the ongoing discussion about whether or not Ethnomathematics should be included in mathematics curricula, as well as the ambiguity surrounding the definition of this concept.

Perceptions about relating mathematics to learners' culture

The majority of lower primary educators (n = 27) emphasised the connection between mathematics and culture. The results emphasise that mathematics may be worthless if education does not have a real-world component, particularly for learners in Grade 3. For learners, knowing mathematical symbols and numbers is useless if they can't connect them to real-world situations.

Many writers concurred that there is a connection between learners' cultures and mathematics (Madusise, 2020). A prevalent misunderstanding in the teaching of mathematics, according to Fasheh (1982), has been and continues to be the idea that

the subject can be taught meaningfully and successfully without reference to the student's culture or background. This, not the subject's difficulty, is, in my opinion, the primary cause of the vast majority of learners' perceptions of mathematics as pointless, unintelligible, and unpopular (Fasheh, 1982). It is a fallacy, no doubt, that mathematics is taught as an abstract topic, which contributes to learners' perceptions that mathematics is hard and unintelligible in most schools. According to Madusise (2020), there is a need for teachers to adopt radical teaching practices in order to incorporate mathematics into the real world and use it as a springboard for classroom activities. This is in line with the National Curriculum Study Policy (NCS) of South Africa. Therefore, research into the mathematical concepts ingrained in the cultural practices, ethnic communities, and language communities of the learners is necessary if such a classroom activity is to have any chance of being implemented.

Additionally, Y d'Entremont (2015) asserted that there is a connection between mathematics and culture. He went on to say that pupils may reflect and value not only their own culture but also the cultures and customs of others when they are taught mathematical concepts that are grounded in cultural viewpoints. In order to successfully include cultural elements into mathematics activity, community people must be involved. Many cultures, including Harappa, Egyptian, African, Minoan, Mycenaean, Greek, Roman, Arabic, Indian, Chinese, Aztec, Mayan, Incas, Native Americans (Indians), and Eskimos, are credited with the invention and development of mathematics (Acharya et al., 2021). As a result, throughout history, the teaching and learning of mathematics has contributed to the dissemination of knowledge and the replication of culture. In order to create common understandings and applications,

mathematicians have tried to standardise mathematical knowledge and procedures, according to Acharya et al. (2021).

It's interesting to note that only three teachers (n=3) think mathematics has nothing to do with culture. These teachers contend that since mathematics is an abstract discipline free of cultural bias and founded on facts, axioms, and equations, and that it was not discovered in our nation, it is challenging to apply indigenous culture to the study of mathematics. Mitchelmore and White (2004) contend that mathematics is an abstract topic, which is in line with the views of these educators. They went on to say that mathematics is an independent system that is not connected to the social or physical world. Even though everyday language is frequently used to describe mathematical concepts, the meaning of each term is exactly determined in relation to other mathematical terms, not by the meaning of the words alone (Mitchelmore & White, 2018). Furthermore, the syntax of a mathematical argument is defined precisely and differs from the grammar of ordinary language. For instance, whereas symbols like x and P are commonly used in everyday English, things like x 0 and (-1) are not known to anyone outside of mathematics. Rules for working with mathematical objects and relationships make up a significant portion of mathematics.

4.4.3. Teachers' challenges of incorporating Ethnomathematics-based approach when teaching numeracy concepts.

Non-inclusion of Ethnomathematics-based approach from the Grade 3 syllabus

The Grade 3 Mathematics syllabus does not specify an Ethnomathematics-based teaching approach, according to all 30 participants. One of these teachers, who doubles as the department head, claimed that the Grade 3 Mathematics syllabus does not expressly call for this method, based on his expertise in curriculum creation,

leadership, and management. The Ethnomathematics-based teaching approach is still not a well-defined technique in and of itself, despite the fact that some teachers may be employing examples from the learners' everyday lives and cultures to teach numeracy concepts. The participants stated that teaching approaches based on Ethnomathematics are relatively complex and need more time and training in order for Grade 3 teachers to use them effectively while teaching numerical concepts. The results of the study showed that even though Lower Primary teachers were trained to value cultural variety, implementing the Ethnomathethematics-based teaching approach is still difficult. The participants believe that longer exposure times or more specific training are needed in order to accommodate the various cultures (including language registers, customs, traditions, etc.). This indicates that the majority of teachers struggle to comprehend or are forced to comprehend the various cultures present in the classroom. A number of authors have also reported the non-inclusion of Ethnomathematics-based teaching approach in syllabus/curriculum as a challenge (Anderson & Wagne, 2019).

Specifically, Anderson and Wagner (2021) think that a contributing factor in this rejection is the misconception that mathematics is a culture-free field. The belief that an Ethnomathematics-based teaching approach may diminish rather than increase indigenous learners' opportunities to value their cultural traditions and practices for their own sake and to acquire appropriate mathematical understandings is the reason why it is not included in the school curriculum or syllabus (Meaney et al., 2021).

The diverse-based Ethnomathematics programme takes into account how to teach mathematics by connecting it to various cultural activities that incorporate

mathematical ideas. As such, integrating it into a curriculum that is predicated on a single viewpoint is difficult.

Furthermore, Ethnomathematics challenges the elitist state imposed solely on academic mathematics, which oppresses other forms of mathematics (such as non-Western mathematics, ethnic mathematics, everyday mathematics, and workplace mathematics), and rejects the dominant Eurocentric approach to the history of mathematics (Mukhopadhyay et al., 2009 as cited by Naresh 2015). But it also encounters opposition from unexpected places, including some educational campaigners from underdeveloped countries and certain leaders of historically marginalised groups. These people fervently feel and worry that their communities' educational, intellectual, and technical advancement will be hampered by an excessive focus on Ethnomathematics and its teaching.

According to Gay (2000), who was referenced by Naresh (2015), integrating an Ethnomathematics curriculum with a critical viewpoint will assist us in addressing these issues and fostering an insightful conversation based on the provision of culturally relevant mathematics education.

The majority of participants said that the administration of their school had warned them not to use any techniques that weren't listed in the syllabus. The researcher agrees with the aforementioned opinions since, in her experience as a former Lower Primary teacher, she found that most school administrators, including principals and heads of department, have a phobia of learning new information that is not included in the curriculum. According to Turugari (2022), the misinformation around the application of this teaching style is the primary reason why the majority of school heads oppose

integrating Ethnomathematics into their curricula. According to him, when explaining how to apply the Ethnomathematics-based method, instructional models had to be utilised.

Lack of teaching time

Some educators claimed that because all of the languages spoken in the classroom must be covered in a single lesson, the Ethnomathematics-based teaching approach necessitates longer instructional times. These responses claim that the allotted time for them to instruct is just forty minutes. Therefore, incorporating anything that would disrupt the regular school schedule is prohibited per school policy. This result is consistent with the findings of Nawesab (2012), as reported by Sunzuma and Maharaj (2019), which showed that educators said that integrating Ethnomathematics methods into maths instruction takes a lot of effort to prepare and execute lessons.

Lack of specialized training

One of the participants stated that the lack of specialized training on the Ethnomathematics-based teaching approach was a challenge to the teachers. Thus, the teachers are not sure if they are using the Ethnomathematics-based teaching approach correctly, and therefore require training on this approach.

Speaking in the same direction, Sunzuma et al (2021), recommended training of the teachers on the use of the Ethnomathematics approach in the teaching and learning of numeracy concepts.

4.5. Summary of chapter four

In summary, this chapter investigated the performance of learners who were taught using the conventional lecture method and the performance of those who were taught

using the Ethnomathematics-based teaching approach by analysing the results of the pre-and post-tests.

The chapter also examined teachers' responses on their perceptions and challenges of using the Ethnomathematics-based teaching approach to teach numeracy concepts. The results were presented under the following sub-headings: the teachers' awareness of the Ethnomathematics-based teaching approach, teachers' usage of Ethnomathematics-based teaching approach compared to other teaching methods to enhance learners' understanding of numeracy concepts and relating mathematics to real life. The challenges experienced by teachers were presented under the following headings: the non-inclusion of Ethnomathematics in the Grade 3 Mathematics syllabus, lack of time, and lack of specialized training in using the Ethnomathematics-based teaching approach.

The chapter then discussed the main findings as related to the effects of the Ethnomathematics-based teaching approach on Grade 3 learners' performance in numerical concepts and teachers' perceptions and challenges of incorporating the Ethnomathematics-based approach when teaching numeracy concepts. These findings were compared to the literature that had been reviewed.

CHAPTER FIVE: SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1. Summary of the study

This study assessed the effect of Ethnomathematics-based teaching approach on Grade 3 learners' performance in numeracy concepts. The study addressed the following research objectives: 1) to investigate the effects of Ethno-Mathematics based teaching approach on Grade 3 learners' performance in numeracy concepts in a selected lower primary school in the Zambezi region. 2) To determine the perceptions and challenges of Grade 3 Mathematics teachers in using Ethno-Mathematics based teaching approach to teach numeracy concepts in Lower primary schools in the Zambezi region. The study employed a mixed research design in order to collect broad and indepth data that address the research objcetives.

While open-ended questionnaires and interview guides were used to gather qualitative information about teachers' perceptions and challenges in using the Ethnomathematics-based teaching approach to teach numeracy concepts to Grade 3 learners, pre- and post-tests were used to collect quantitative data about the effects of the approach on the performance of Grade 3 in a numerical concept. Forty (40) Grade 3 learners were sampled using the basic random sampling methodology. The learners were split into two groups, the Control and Experimental groups, each with 20 learners, and were taught using the lecture method and the Ethnomathematics-based approach, respectively. Following that, both groups were evaluated using standard post-tests to identify any noteworthy variations in their performance and, consequently, the impact of the Ethnomathethematics-based teaching approachology.

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Before the intervention, a common pre-test was given to all 40 learners to determine their baseline knowledge. For this exercise, a single school was chosen to prevent variables pertaining to varied educational backgrounds from influencing the study's conclusions. The study's findings showed a significant difference ($p < 0.05$) in the performance of learners taught utilising the lecture technique and the Ethnomathethematics-based teaching approach, respectively. In contrast to the Control group, who received instruction via lectures, the Experimental group's post-test results showed a considerable increase based on their use of an Ethnomathematics-based approach. This indicates that the Grade 3 learners' understanding of the numerical concepts in this study is improved by the Ethnomathethematics-based teaching approach.

Additionally, thirty lower primary mathematics teachers in the Zambezi region were chosen using the normal case purposive sampling procedure in order to fill out the survey questionnaires. A teacher had to have taught lower primary mathematics in the research region for at least two years in order to be eligible to be included in the sample. Furthermore, eight of the thirty teachers who made up the subsample were chosen to take part in the follow-up interview. The teacher's availability and willingness to take part in the follow-up interview determined the subsample. Additionally, thirty lower primary mathematics teachers in the Zambezi region were chosen using the normal case purposive sampling procedure in order to fill out the survey questionnaires. A teacher had to have taught lower primary mathematics in the research region for at least two years in order to be eligible to be included in the sample. Furthermore, eight of the thirty teachers who made up the subsample were

chosen to take part in the follow-up interview. The teacher's availability and willingness to take part in the follow-up interview determined the subsample.

5.2. Conclusions drawn

The study found that, in comparison to a lecture approach, an Ethnomathethematics-based teaching approach enhances Grade 3 learners' performance in numerical concepts. This indicates that there is a favourable impact of the Ethnomathematics-based approach on Grade 3 learners' academic achievement in numerical concepts. The pre- and post-test findings showed wide differences in the two groups' performance, the Experimental and Control groups, with the Experimental group outperforming the Control group.

The better results of the Experimental group, which was taught using an Ethnomathematics-based approach, clearly show that, as argued by Nambira et al. (2009), a reliance on conventional/conventional lecture methods, which do not establish a link between numbers and how they are used in everyday life situations, was indeed the cause of the learners' poor performance in numeracy concepts in Grade 3. The lecture method, which focuses solely on classroom examples and depends on the theoretical presentation of numeracy concepts, was one of these teaching strategies.

The study also found that using an Ethnomathethematics-based teaching approach presents difficulties for lower primary teachers. One of these difficulties is time. It became clear that the Ethnomathematics-based technique takes a long time due to its complexity. The goal of this strategy is to provide accommodations for the ethnic diversity found in Grade 3 classrooms. As such, additional time and planning are

required. Teachers also mentioned that another difficulty was that it was not covered in the Grade 3 syllabus, and school administrators forbade them from utilising anything that wasn't curriculum-recommended.

In addition to discussing the difficulties, the study described how educators felt about the Ethnomathematics-based method. When questioned, the majority of teachers said that this strategy might be effective since it connects mathematics to real-world contexts and culture. Some went on to say that learners will start to understand the material when it is connected to real-world scenarios or culture.

The study came to the conclusion that, despite the difficulties it brings, lower primary teachers are in favour of using the Ethnomathematics-based method based on these perceptions. Because a strong foundation in mathematics which is primarily numerical in nature that is established in the pre- and lower-primary phases has a very positive influence on the performance of the same learners in the later upper grades, it is safe to say that, when implemented effectively, this teaching approach has the potential to change the mathematics performance patterns at the lower primary as well as at the upper and secondary phases.

5.3. Recommendations

Based on the results of this study, the following recommendations were made:

1. The National Institute for Educational Development (NIED) and the Ministry of Education, Arts and Culture should put more emphasis on the usage of the Ethnomathematics-based teaching approach, and give lower primary teachers' specialized training on how to use Ethnomathematics-based teaching approach in their teachings of numeracy concepts.

2. The Ministry of Education, Arts and Culture should also supply more teaching resources which are compatible with the Ethnomathematics-based teaching approach.

3. Teachers should explore the use of Ethnomathematics-based teaching approach to enhance Grade 3 learners' comprehension of numeracy concepts.

4. In future, the study will also be be extended to other regions in Namibia. More schools will also be involved in the study for the expansion of the sample size in order to acquire more detailed and reliable findings.

5.4. Limitations of the study

This study acknowledges the involvement of the researcher as both the data collecter, and teacher of the learner as one of the biases which arose in the study on top of what is indicated in chapter one as limitations, and that it might affect the findings of the study. To limit this bias, the future study will have the teacher/s teach their own learners under the guidance of the researcher who has more knowledge on the Ethnomathematics-based teaching approach.

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APPENDICES

APPENDIX A: ETHICAL CLEARANCE CERTIFICATE

UNAM
UNIVERSITY OF NAMIBIA

ETHICAL CLEARANCE CERTIFICATE

Ethical Clearance Reference Number: FOE /558 /2020 **Date: 6 February, 2020**

This Ethical Clearance Certificate is issued by the University of Namibia Research Ethics Committee (UREC) in accordance with the University of Namibia's Research Ethics Policy and Guidelines. Ethical approval is given in respect of undertakings contained in the Research Project outlined below. This Certificate is issued on the recommendations of the ethical evaluation done by the Faculty/Centre/Campus Research & Publications Committee sitting with the Postgraduate Studies Committee.

Title of Project: PROJECT: The Effect of Ethno-mathematics instruction method in teaching mathematics numeracy skills in lower primary using: A case study in the Zambezi Region, Namibia

Researcher: KAREN FELSIO MUSWALALI

Student Number: 201188155

Supervisor(s): Dr. J. Abah (Main) Dr. P. February (Co)

Faculty: Faculty of Education
Take note of the following:

(a) Any significant changes in the conditions or undertakings outlined in the approved Proposal must be communicated to the UREC. An application to make amendments may be necessary.
(b) Any breaches of ethical undertakings or practices that have an impact on ethical conduct of the research must be reported to the UREC.
(c) The Principal Researcher must report issues of ethical compliance to the UREC (through the Chairperson of the Faculty/Centre/Campus Research & Publications Committee) at the end of the Project or as may be requested by UREC.
(d) The UREC retains the right to:
(i) Withdraw or amend this Ethical Clearance if any unethical practices (as outlined in the Research Ethics Policy) have been detected or suspected,
(ii) Request for an ethical compliance report at any point during the course of the research.

UREC wishes you the best in your research.

Dr. J.E. de Villiers

Ms. P. Claassen

APPENDIX B: PERMISSION LETTERS

The Regional Director

Zambezi region: Directorate of Education

Private Bag 5006

Katima Mulilo

Dear: Madam

Subject: Request for permission to conduct a study in schools of Zambezi region

I am Karen Feliso Muswalali, an Assistant Lecturer at the University of Namibia, Katima Mulilo campus in Zambezi region.

I am currently registered with the University of Namibia as a postgraduate student. As part of the course requirements, a student needs to submit a research thesis.

I am hereby requesting for permission to conduct a study in schools of Zambezi region (All circuits).

I am interested in investigating the effects of Ethno Mathematics in Grade 3 learners 'achievement in numeracy. The study will be conducted during normal school hours because part of the data collection requires the researcher to teach as a normal lesson. This will not interfere with the teaching curriculum as numeracy is a crucial aspect in the lower primary phase whose poor academic performance characterized the poor performance in the upper primary phase in the year 2009.

I therefore, humbly request your office to kindly consider this request as the results of the study will benefit both learners and teachers in terms of recommending a new teaching

strategy which may be used to alleviate poor performance in mathematics as a result of numerical concepts incomprehension.

Yours Faithfully,

……Karen Feliso Muswalali (Mr)

Email: kmuswalali@unam.na; Contact: 0812503440

REPUBLIC OF NAMIBIA
ZAMBEZI REGIONAL COUNCIL

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Our Ref: 13/2/9/1

Private Bag 5006
Katima Mulilo, Namibia

University of Namibia
Private Bag 1096
Katima Mulilo
Namibia

Dear Mr Karen Feliso Muswalali

REQUEST TO CONDUCT A RESEARCH IN PRIMARY SCHOOLS IN THE ZAMBEZI REGION

Your letter to the office of the Regional Director: Zambezi Region dated 20 February 2020 with the caption request to conduct a Research in Primary School in the Zambezi Region was received.

Kindly be informed that approval is granted to you to conduct a research as requested, but let me draw your attention to the following aspects: **NOTE!**

- The granted approval should not disrupt the normal teaching and learning at those schools you intend visiting.
- You are therefore, requested to share your findings with the Ministry of Education, Arts and Culture.

By copy of this letter Inspector of Education concerned is notified accordingly of your presence to these schools.

I trust and hope you will find this in order.

MINISTRY OF EDUCATION ARTS & CULTURE
Zambezi Regional Directorate
2020 -03- 06
Office of the Director
Private Bag 5006 · Katima Mulilo

MS JOY ZAMBO MAMILI
REGIONAL DIRECTOR: EDUCATION, ARTS AND CULTURE

APPENDIX C: GRADE 3 LEARNERS' PRE-TEST ASSESSMENT ACTIVITY

Pre-test activity

PRE-TEST FOR ALL LEARNERS

TOTAL NUMBER OF LEARNERS: 40

TOTAL MARKS: 100

Concepts of mass

Compare the pair of items listed below and indicate HEAVIER THAN OR LIGHTER THAN in the space provided. The one in bold is the one you compare to the other

1. A bottle top and **empty bottle** ……
2. **Tin** and mahangu seed……..
3. **A ruler** and a duster…….
4. **A can** and a clay pot……..
5. **An abacus** and a pounding stick…….

Concepts of length

Compare the pair of items listed below and indicate LONGER THAN OR SHORTER THAN in the space provided. The one in bold is the one you compare to the other

6. A duster and a **meter stick**…….
7. A bottle of water and **a tin of beans**……..
8. **A table** and a knife……
9. A box of chalk and a **rafting stick**……
10. A **new pencil** and a chalk…….

Concepts of volume

Study the items diagrams below and indicate the volume capacity in the space provided.

Choose the volume capacity description using the key words below:

EMPTY, FULL, HALF

11. **.....**

12. **.....**

13. **.....**

14. **.....**

15. **.....**

Concepts of Height

Compare the pair of items listed below and indicate which one is TALLER THAN or SHORTER THAN in the space provided. The one in bold is the one you compare to the other

16. Glass cup and **plastic bucket**…….
17. Baby and her **mother**……..
18. **Table** and Coca-Cola cool drink can……
19. Window and **door**……
20. Baby feeding bottle and **Network tower**…….

APPENDIX D: 3-WEEK LESSON PREPARATION (CONTROL AND ETHNOMATHEMATICS METHOD).

Lesson preparation: DAY 1: LENGTH (Ethno-Mathematics)

Grade: 3A (group 1)

Number of learners: 20

Date: 06.09.2021

Duration: 40 minutes

Day: 1 of 15

Topic: Measurement

Focus: Concept of length

Teaching approach: Ethno-mathematics

Lesson objective : Learners will compare and order objects as well as use measurement vocabulary correctly.

Teaching aids : Cooking stick, small cooking oil container

Teacher's activities	**Learners' activities**
Lesson introduction The teacher will ask learners to sing any song related to measurement	Learners will sing a song
Methodology	

The researcher will make use of home-based materials, bring them to class and compare their lengths using the terminologies "longer than and shorter than."	Learners will participate by pointing out which home-based material is "longer or shorter'' than the other depending on the order asked.
The researcher will ask learners to compare between the lengths of the following materials: lying cooking stick vs lying small cooking oil container,	Learners will determine which one of the two home materials presented is shorter or longer than the other by oral means.
Reinforcement Put emphasis on the terms "short and long'' as related to length by means of demonstration using the two given home-based materials.	Learners will pay attention

Lesson preparation: DAY 1: LENGTH (Lecture method)

Grade: 3B (group 2)

Number of learners: 20

Date: 06.09.2021

Duration: 20 minutes

Day: 1 of 15

Topic: Measurement

Focus: Concept of length

Teaching approach: Lecture

Lesson objective : Learners will compare and order objects as well as use measurement vocabulary correctly.

Teaching aids : maths textbook, Chart, and poster.

Teacher's activities	**Learners' activities**
Introduction The teacher will ask learners to sing any song related to measurement	Learners will sing a song
Methodology The researcher will explain the concept of length by asking learners to compare the lengths of different materials which are	Learners will state how long (by saying 'longer or shorter') it takes to reach mentioned places.

drawn on the poster, chart and textbook and also to imagine the distance between places in town and duration to reach places from another places by means of comparison. Learners will be asked to compare the lengths of the following: distance from regional council building to open market, how long it takes to walk to Tobias Hainyeko School from cowboy versus how long it is to walk from BOMA location.	Learners will respond and participate by stating the stating whether the distance from the places compared is longer or shorter.
Reinforcement Ask learners what they have learned	Learners will state what they have learned.

Lesson preparation: DAY 2: Mass (Ethno-mathematics method)

Grade: 3A (group 1)

Number of learners: 20

Date: 07.09.2021

Duration: 40 minutes

Day: 2 of 15 (Wednesday)

Topic: Measurement

Focus: Concept of Mass

Teaching approach: Ethno-mathematics

Lesson objective : Learners will compare and order objects as well as use measurement vocabulary correctly.

Teaching aids : ceramic dish, Empty basin, plastic dish, full 10kg mealie meal.

Teacher's activities	**Learners' activities**
Introduction The teacher will ask learners to sing any song related to measurement	Learners will sing a song
Methodology Using the materials collected from home (empty basin, full 10kg mealie meal bag, plastic dish, and ceramic dish, the researcher will explain the concept of mass by means of asking learners to lift and determining which one is heavier or lighter than the other. Learners will be asked to compare the mass of the following: full 10kg mealie meal versus plastic dish, empty basin versus ceramic dish.	Learners will compare the mass of the given home-based classroom materials by stating which one is heavier than or lighter than the other depending on the order of questioning. Learners will compare the mass of the given objects in the order asked.

Reinforcement The researcher will ask what learners have learned from the lesson	Learners will state what they have learned from the lesson.

Lesson preparation: DAY 2: Mass (Lecture method)

Grade: 3B (group 2)

Number of learners: 20

Date: 07.09.2021

Duration: 40 minutes

Day: 2 of 15 (Thursday)

Topic: Measurement

Focus: Concept of Mass

Teaching approach: Lecture method

Lesson objective : Learners will compare and order objects as well as use measurement vocabulary correctly.

Teaching aids : Mathematics textbook, Chart and poster

Teacher's activities	**Learners' activities**
Introduction The teacher will ask learners to sing any song related to measurement	Learners will sing a song
Methodology	

The researcher will explain the concept of mass to learners by using by using pictures of materials drawn in the mathematics textbook, poster and chart. The following drawings on the chart, textbook and poster will be used to explain the concept of mass: duster, new-born baby, steel spoon, a car, bread, empty cool drink tin. The researcher will ask learners to compare the drawn materials in the following order: duster versus bread, empty cool drink can versus new born baby, and a car vs steel spoon.	Learners will listen attentively and pay attention on what is drawn in the textbook, chart and poster and also pay attention to what the researcher is explaining. Learners will compare the drawn materials in the order given by the researcher.

Reinforcement Ask learners what they have learned	Learners will state what they have learned.

Lesson preparation: DAY 3: Height (Ethno-mathematics method)

Grade: 3A (group 1)

Number of learners: 20

Date: 08.09.2021

Duration: 40 minutes

Day: 3 of 15(Thursday)

Topic: Measurement

Focus: Concept of Height

Teaching approach: Ethno-mathematics

Lesson objective : Learners will compare and order objects as well as use measurement vocabulary correctly.

Teaching aids : bucket, coffee cup, 750ml coke can, 2liter coke container

Teacher's activities	**Learners' activities**
Introduction The teacher will ask learners to sing any song related to measurement	Learners will sing a song
Methodology	

The researcher will explain the concept of height by means of demonstrating home based materials brought to class. The materials will be displayed in front of the class in the following order and ask learners to compare them using the terms ‘taller than and shorter than’: coffee cup versus bucket, and 2liter coke container versus 750ml coke can.	Learners will compare the heights of the displayed materials in the order given by using the terms ‘taller than and shorter than’.
Conclusion Ask learners what they have learned	Learners will state what they have learned.

Lesson preparation: DAY 3: Height (Lecture method)

Grade: 3B (group 2)

Number of learners: 20

Date: 08.09.2021

Duration: 40 minutes

Day: 3 of 15 (Monday)

Topic: Measurement

Focus: Concept of Length

Teaching approach: Lecture method

Lesson objective : Learners will compare and order objects as well as use measurement vocabulary correctly.

Teaching aids : mathematics textbook, chart and poster.

Teacher's activities	**Learners' activities**
Introduction The teacher will ask learners to sing any song related to measurement	Learners will sing a song
Methodology	

The research will use the textbook, chart and poster drawings to explain the concept of height. The following drawings will be used to explain the concept: 2liter coke container, 750ml coke can, bucket and coffee cup. The researcher will ask learners to compare the heights of the materials drawn by using the terms shorter than or longer than in the given order: coffee cup versus bucket, and 2liter coke container versus 750ml coke can.	Learners will compare the heights of the materials drawn by using the terms shorter than or longer than in the given order: coffee cup versus bucket, and 2liter coke container versus 750ml coke can.
Conclusion Ask learners what they have learned	Learners will state what they have learned.

Lesson preparation: DAY 4: Volume (Ethno-mathematics method)

Grade: 3A (group 1)

Number of learners: 20

Date: 09.09.2021

Time: 40 minutes

Day: 4 of 15 (Wednesday)

Topic: Measurement

Focus: Concept of volume.

Teaching approach: Ethno-mathematics approach

Lesson objective : Learners will compare and order objects as well as use measurement vocabulary correctly.

Teaching aids : 3 transparent water containers

Teacher's activities	**Learners' activities**
Introduction The teacher will ask learners to sing any song related to measurement	Learners will sing a song
Methodology	Learners will listen attentively.

The researcher will explain the concept of volume by using transparent home containers. The researcher will use three transparent containers and fill them all with water then label them 1, 2 and 3. Container 1 will be full, container 2 will be empty, while container 3 will be half. The researcher will explain that volume means how much water each of the displayed container has and ask them to use the terms half, full and empty to compare the 3 containers.	Learners will give examples.
Conclusion Ask learners what they have learned	Learners will state what they have learned.

Lesson preparation: DAY 4: Volume (Lecture method)

Grade: 3A (group 1)

Number of learners: 20

Date: 09.09.2021

Duration: 40 minutes

Day: 4 of 15 (Thursday)

Topic: Measurement

Focus: Concept of volume.

Teaching approach: Lecture method

Lesson objective : Learners will compare and order objects as well as use measurement vocabulary correctly.

Teaching aids : textbook, chart/poster, word cards

Teacher's activities	**Learners' activities**
Introduction The teacher will ask learners to sing any song related to measurement	Learners will sing a song
Methodology The researcher will teach the concept of volume by means of asking learners to compare the volumes of containers drawn on the chart and those drawn in the maths	Learners will compare the volume of the pictures drawn on the chart/poster and in the textbook.

textbook. Container 1 is filled with water to capacity, container 2 is filled half and container 3 is empty The researcher will ask learners to paste the correct word card next to the right picture	Learners will paste the word cards next to the corresponding picture.
Conclusion Ask learners what they have learned	Learners will state what they have learned.

Lesson preparation: DAY 5: Length (Ethno-mathematics method)

Grade: 3A (group 1)

Number of learners: 20

Date: 10.09.2021(Friday)

Duration: 40 minutes

Day: 5 of 15

Topic: Measurement

Focus: Concept of length.

Teaching approach: Lecture method

Lesson objective : Learners will compare and order objects as well as use measurement vocabulary correctly.

Teaching aids : Cooking stick, small cooking oil container

Teacher's activities	**Learners' activities**
Introduction The teacher will ask learners to sing any song related to measurement	Learners will sing a song
Methodology As revision, the researcher will ask two learners from the class (a male and a female) to come to the front and demonstrate the	Learners will respond by saying which home material is 'shorter than' or 'longer than' the other.

comparison between the length of a lying cooking stick and that of a lying small cooking oil container and ask the class which one is 'longer than' and 'shorter than' the other. Learners were now put in smaller groups and were given other home materials to compare lengths using the terms 'longer than' and 'shorter than'	Learners compared the materials as asked using the given terminologies.
Conclusion Ask learners what they have learned	Learners will state what they have learned.

Lesson preparation: DAY 5: Length (Lecture method)

Grade: 3B (group 2)

Number of learners: 20

Date: 10.09.2021(Friday)

Time: 40 minutes

Day: 5 of 15

Topic: Measurement

Focus: Concept of length.

Teaching approach: Lecture method

Lesson objective : Learners will compare and order objects as well as use measurement vocabulary correctly.

Teaching aids : Chart

Teacher's activities	**Learners' activities**
Introduction The teacher will ask learners to sing any song related to measurement	Learners will sing a song
Methodology As revision, the researcher will paste 4 charts in the classroom containing drawings of two	

sets of different materials/distance lengths to compare. Since learners will be divided into 4 groups each consisting of 5 learners (20), the researcher will assign a chart to each group and ask them to compare the lengths of the different materials (drawings) on the chart using the terms 'longer than' and 'shorter than' set of materials drawn were; 30 cm ruler vs 1 meter ruler, rubber vs duster, cooking stick vs small cooking oil, pencil vs fan belt, the length of distance from Zambezi regional council building to open market versus the distance from standard bank building to Weinel shell. Other groups will comment as to whether their answers are correct or not.	Learners in groups will respond by saying which home material is 'shorter than' or 'longer than' the other. Learners compared the materials as asked using the given terminologies.
Conclusion Ask learners what they have learned	Learners will state what they have learned.

Lesson preparation: DAY 6: Mass (Lecture method)

Grade: 3B (group 2)

Number of learners: 20

Date: 13.09.2021 (Monday)

Duration: 40 minutes

Day: 6 of 15

Topic: Measurement

Focus: Concept of length.

Teaching approach: Lecture method

Lesson objective : Learners will compare and order objects as well as use measurement vocabulary correctly.

Teaching aids : Chart

Teacher's activities	**Learners' activities**
Introduction The teacher will ask learners to sing any song related to measurement	Learners will sing a song
Methodology As revision, the researcher will paste 4 charts in the classroom containing drawings of two sets of different materials/distance lengths to compare. Since learners will be divided into 4 groups each consisting of 5 learners (20), the researcher will assign a chart to each group and ask them to compare the lengths of the different materials (drawings) on the chart using the terms 'longer than' and	Learners in groups will respond by saying which home material is 'shorter than' or 'longer than' the other.

'shorter than' set of materials drawn were; 30 cm ruler vs 1 meter ruler, rubber vs duster, cooking stick vs small cooking oil, pencil vs fan belt, the length of distance from Zambezi regional council building to open market versus the distance from standard bank building to Weinel shell. Other groups will comment as to whether their answers are correct or not.	Learners compared the materials as asked using the given terminologies.
Conclusion Ask learners what they have learned	Learners will state what they have learned.

REVISION OF CONCEPTS

Lesson preparation: DAY 6: Mass (Ethno-mathematics method)

Grade: 3A (group 1)

Number of learners: 20

Date: 13.09.2021 (Monday)

Duration: 40 minutes

Day: **6** of 15

Topic: Measurement

Focus: Concept of Mass.

Teaching approach: Lecture method

Lesson objective : Learners will compare and order objects as well as use measurement vocabulary correctly.

Teaching aids : ceramic dish, Empty basin, plastic dish, full 10kg mealie meal.

Teacher's activities	**Learners' activities**
Introduction The teacher will ask learners to sing any song related to measurement	Learners will sing a song
Methodology As revision, the researcher will ask two learners from the class (a male and a female) to come to the front and demonstrate the comparison between the mass of the	The two learners will compare the mass of sets of home materials given in front of the class using the terms 'heavier than' and 'lighter than'

following set of objects: ceramic dish versus Empty basin, plastic dish versus full 10kg mealie meal. The researcher will ask the two learners to compare the mass of sets of home materials given in front of the class using the terms 'heavier than' and 'lighter than'	 The two learners will compare the mass of sets of home materials given in front of the class using the terms 'heavier than' and 'lighter than'
Conclusion Ask learners what they have learned	 Learners will state what they have learned.

REVISION OF CONCEPTS

Lesson preparation: DAY 7: Mass (Lecture method)

Grade: 3B (group 2)

Number of learners: 20

Date: 14.09.2021 (Tuesday)

Duration: 40 minutes

Day: 7 of 15

Topic: Measurement

Focus: Concept of length.

Teaching approach: Lecture method

Lesson objective : Learners will compare and order objects as well as use measurement vocabulary correctly.

Teaching aids : Chart

Teacher's activities	**Learners' activities**
Introduction The teacher will ask learners to sing any song related to measurement	Learners will sing a song
Methodology As revision, the researcher will paste a chart consisting of drawings of the following sets of materials/objects: ceramic dish versus Empty basin, plastic dish versus full 10kg	Learners in groups will respond by saying which home material is 'heavier' and 'lighter than' the other.

mealie meal. The researcher will now ask two learners to compare the two sets of drawn objects. Other groups will comment as to whether their answers are correct or not.	
Conclusion Ask learners what they have learned	Learners will state what they have learned.

REVISION

Lesson preparation: DAY 7: Volume (Ethno-mathematics method)

Grade: 3A (group 1)

Number of learners: 20

Date: 14.09.2021 (Tuesday)

Duration: 40 minutes

Day: 7 of 15

Topic: Measurement

Focus: Concept of volume.

Teaching approach: Lecture method

Lesson objective : Learners will compare and order objects as well as use measurement vocabulary correctly.

Teaching aids : 3 transparent home containers

Teacher's activities	**Learners' activities**
Introduction The teacher will ask learners to sing any song related to measurement	Learners will sing a song
Methodology	Learners will compare the capacities of the 3 transparent home containers.

The researcher will provide learners will 3 transparent home containers and a bucket full of water. The researcher will now ask two 3 learners to come from of the class considering gender balance. Learner 1 will be asked to fill container his container with water full to capacity. Learner 2 will be asked to fill her container half of water, and learner will be asked to not fill the container will water. The class will be asked to judge which learner did it the right way. After that, these three learners will be asked to put correct word cards next to the right container. The following words will be written on the cards: Empty, Full, and Half full.	The class will judge which learner did it the right way. The three learners will be asked to put correct word cards next to the right container. The following words will be written on the cards: Empty, Full, and Half full.
Conclusion Ask learners what they have learned	Learners will state what they have learned.

Lesson preparation: DAY 8: Volume (Lecture method)

Grade: 3B (group 2)

Number of learners: 20

Date: 15.09.2021 (Wednesday)

Duration: 40 minutes

Day: 8 of 15

Topic: Measurement

Focus: Concept of volume.

Teaching approach: Lecture method

Lesson objective : Learners will compare and order objects as well as use measurement vocabulary correctly.

Teaching aids : textbook, chart/poster, word cards

Teacher's activities	**Learners' activities**
Introduction The teacher will ask learners to sing any song related to measurement	Learners will sing a song
Methodology The researcher will teach the concept of volume by means of asking learners to compare the volumes of containers drawn on the chart and those drawn in the maths	Learners will compare the volume of the pictures drawn on the chart/poster and in the textbook.

textbook. Container 1 is filled with water to capacity, container 2 is filled half and container 3 is empty The researcher will ask two learners from each group (4 groups) to paste the correct word card next to the right picture	Learners will paste the word cards next to the corresponding picture.
Conclusion Ask learners what they have learned	Learners will state what they have learned.

Lesson preparation: DAY 8: Volume (Ethnomathematics method)

Grade: 3B (group 2)

Number of learners: 20

Date: 15.09.2021 (Wednesday)

Duration: 40 minutes

Day: 8 of 15

Topic: Measurement

Focus: Concept of volume.

Teaching approach: Lecture method

Lesson objective : Learners will compare and order objects as well as use measurement vocabulary correctly.

Teaching aids : textbook, chart/poster, word cards

Teacher's activities	**Learners' activities**
Introduction The teacher will ask learners to sing any song related to measurement	Learners will sing a song
Methodology	

The researcher will teach the concept of volume by means of asking learners to compare the volumes of containers drawn on the chart and those drawn in the maths textbook. Container 1 is filled with water to capacity, container 2 is filled half and container 3 is empty	Learners will compare the volume of the pictures drawn on the chart/poster and in the textbook.
The researcher will ask two learners from each group (4 groups) to paste the correct word card next to the right picture	Learners will paste the word cards next to the corresponding picture.
Conclusion Ask learners what they have learned	Learners will state what they have learned.

APPENDIX E: GRADE 3 LEARNERS POST-TEST ACTIVITY FOR ALL GROUPS (CONTROL/LECTURE AND ETHNOMATHEMATICS)

POST-TEST ACTIVITY FOR ALL LEARNERS

TOTAL NUMBER OF LEARNERS: 40

TOTAL MARKS: 100

NAME……...

GRADE……

Concepts of mass

Compare the pair of items listed below and indicate HEAVIER THAN OR LIGHTER THAN in the space provided. The one in bold is the one you compare to the other

12. A bottle top and **empty bottle** ……
13. **Tin** and mahangu seed……..
14. **A ruler** and a duster…….
15. **A can** and a clay pot……..
16. **An abacus** and a pounding stick…….

Concepts of length

Compare the pair of items listed below and indicate LONGER THAN OR SHORTER THAN in the space provided. The one in bold is the one you compare to the other

17. A duster and a **meter stick**…….
18. A bottle of water and **a tin of beans**……..

19. **A table** and a knife……

20. A box of chalk and a **rafting stick**……

21. A **new pencil** and a chalk…….

Concepts of volume

Study the items diagrams below and indicate the volume capacity in the space provided.

Choose the volume capacity description using the key words below:

EMPTY, FULL, HALF

22. **.....**

12. **.....**

13. .....

14. .....

15. .....

Concepts of Height

Compare the pair of items listed below and indicate <u>which one is TALLER THAN or SHORTER THAN</u> in the space provided. The one in bold is the one you compare to the other

21. Glass cup and **plastic bucket**…….

22. Baby and her **mother**……..

23. **Table** and Coca-Cola cool drink can……

24. Window and **door**……

25. Baby feeding bottle and **network tower**…….

APPENDIX F: RESULTS OF THE CONTROL GROUP PERFORMANCE CONVERTED IN PERCENTAGE

Control Group Performance		
	Pre-test/out of 20	**Post-test/out of 20**
Learners' ID	100	100
1	80	70
2	75	60
3	60	40
4	55	65
5	50	60
6	40	90
7	45	60
8	30	30
9	25	50
10	50	25
11	60	25
12	55	40
13	45	30
14	40	50
15	25	50
16	30	55
17	30	45
18	25	45
19	45	60
20	55	55

APPENDIX G: RESULTS OF THE EXPERIMENTAL GROUP PERFORMANCE

Experimental Group performance	**Pre-test/out of 20**	**Post-test/out of 20**
Learners' ID	100	100
1	80	90
2	75	60
3	70	95
4	30	80
5	85	75
6	60	85
7	55	90
8	50	75
9	25	90
10	80	50
11	40	90
12	30	85
13	55	75
14	50	80
15	50	75
16	60	95
17	45	60
18	55	70
19	40	75
20	50	80

APPENDIX H: GRADE 3 TEACHERS QUESTIONNAIRES AND FOLLOW-UP INTERVIEW

QUESTIONNAIRE FOR TEACHERS

I would like to know your views about applying Ethnomathematics approach to teaching numeracy concepts in Grade 3 Mathematics. Ethnomathematics based approach is a method in which mathematical numeracy concepts are taught by relating them to the learners' indigenous or cultural knowledge. E.g. teaching about temperature by giving such example as using a clay pot for cooling liquids (water, milk, etc.) at home.

1. Do you use Ethnomathematics based approach to teach numeracy concepts? Tick Yes or No

   ……

   ……

1.1. If your answer in 1 was yes, explain how this approach is used in your lessons?

……

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1.2 If no, briefly justify your answer

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2. What do you think about Ethno Mathematics approach as compared to the other methods you use to teach numeracy concepts in your class in terms of facilitating learner's understanding and performance?

……

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3. Is Ethnomathematics approach emphasized in your school curriculum? If yes, how is it incorporated during lesson preparation?

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3.1. If no, do you perhaps know why it is not used?

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4. Do you think Mathematics can be related to the learners' culture? Motivate your view

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5. In your experience, how do learners react to lessons taught using Ethno- Mathematics approach?

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6. How do you teach by relating Mathematics to cultural practices/ knowledge?

……

……

……

THANK YOU FOR PARTICIPATING IN THIS STUDY

APPENDIX I: FOLLOW-UP INTERVIEW SCHEDULE

Interview schedule for teachers

You are requested to answer the following questions orally. Participation in voluntarily therefore you are free to withdraw from the study anytime.

I would like to know your views about applying Ethnomathematics approach to teaching numeracy concepts in Grade 3 Mathematics. Ethnomathematics based approach is a method in which mathematical numeracy concepts are taught by relating them to the learners' indigenous or cultural knowledge. E.g. teaching about temperature by giving such example as using a clay pot for cooling liquids (water, milk, etc.) at home.

4. Do you use Ethnomathematics based approach to teach numeracy concepts? Tick Yes or No

……
……

4.1. If your answer in 1 was yes, explain how this approach is used in your lessons?

……
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1.2 If no, briefly justify your answer

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5. What do you think about Ethno Mathematics approach as compared to the other methods you use to teach numeracy concepts in your class in terms of facilitating learner's understanding and performance?

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Is Ethnomathematics approach emphasized in your school curriculum? If yes, how is it incorporated during lesson preparation?

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If no, do you perhaps know why it is not used?
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4. Do you think Mathematics can be related to the learners' culture? Motivate your view
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In your experience, how do learners react to lessons taught using Ethno- Mathematics approach?
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How do you teach by relating Mathematics to cultural practices/ knowledge?
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THANK YOU FOR PARTICIPATING IN THIS STUDY

APPENDIX J: INFORMED ASSENT AND CONSENT FORMS FOR PARTICIPANTS

PARTICIPANT INFORMATION LEAFLET AND ASSENT FORM FOR LEARNERS

ANNEX 5

TITLE OF THE RESEARCH PROJECT: AN INVESTIGATION OF THE EFFECT OF ETHNOMATHETHEMATICS-BASED TEACHING APPROACH ON GRADES 3 LEARNERS' ACADEMIC PERFORMANCE IN NUMERICAL CONCEPTS: A CASE STUDY IN THE ZAMBEZI REGION, NAMIBIA.

REFERENCE NUMBER: (LEAVE OPEN)

PRINCIPAL INVESTIGATOR: KAREN FELISO MUSWALALI

ADDRESS: GREENWELL LOCATION, KATIMA MULILO, NAMIBIA, ERF.2100, P.O. BOX 124, KATIMA MULILO.

CONTACT NUMBER: 0812503440

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this research. Please ask the researcher any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way

whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the Research Ethics Committee at The University of Namibia and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and Namibian National Research Ethics Guidelines.

What is this research study all about?

The study will be conducted at your school in Zambezi region, rural. There is one school selected from which participants will come from. A total number of 40 learners will be selected to participate in this study.

This study aims to investigate the effects of Ethno mathematics approach of Ethnomathematics based teaching method on grades 3 learners' academic performance in numerical concepts.

The researcher will personally divide the 40 learners into two groups during the experimental teaching (control group (20 learners) and experimental group (20 learners). Before the treatment, all 40 learners will be given a uniform test to find out their prior knowledge on the numerical topic "Measurement". A conventional Grade 3 lesson plan will be used to plan all the lessons.

1 primary school will be selected by means of purposeful criterion sampling, with 40 Grade 3 from the school being selected by random sampling.

Why have you been invited to participate?

As a Grade 3 learner at your current school, you need to comprehend all numerical topics as they form a foundation for the understanding of mathematics in higher phases of learning. By means of random sampling, your name has been identified as a participant for the investigation of the effect of Ethnomathematics based teaching method on grades 3 learners' academic performance in numerical concepts

What will your responsibilities be?

To participate during the lesson and answer an assessment activity based on the two methods which will be used for teaching for comparison.
For a period of 1 hour during testing.

Will you benefit from taking part in this research?

There are no immediate benefits in taking part in the study

Are there in risks involved in your taking part in this research?

There are no foreseeable risks involved in participating in this research.

If you do not agree to take part, what alternatives do you have?

There are no consequences for not participating in the research.

Who will have access to your medical records?

Only the researcher, supervisor and statistician may have access to the provided data.

1. **Will you be paid to take part in this study and are there any costs involved?**

No payment will be received by participants and there are no monetary costs involved.

2. **Is there anything else that you should know or do?**

*You can contact the Centre for Research and Publications at **+264 61 2063061;** **pclaassen@unam.na** if you have any concerns or complaints that have not been adequately addressed by the investigator.*

You will receive a copy of this information and consent form for your own records.

DECLARATION BY PARTICIPANT

By signing below, I ……..…… agree to take part in a research study entitled "*AN INVESTIGATION ....”*

I declare that:

a) I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
b) I have had a chance to ask questions and all my questions have been adequately answered.
c) I understand that taking part in this study is **voluntary** and I have not been pressurized to take part.
d) I may choose to leave the study at any time and will not be penalized or prejudiced in any way.
e) I may be asked to leave the study before it has finished, if the researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (*place*) .....….....…….. On (*date*) ……...…….. 2019.

..... **.....**

Signature of participant Signature of witness

DECLARATION BY INVESTIGATOR

I, *Karen Muswalali,* declare that:

- I explained the information in this document to ……;
- I encouraged him/her to ask questions and took adequate time to answer them;
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above;
- I did not use an interpreter. (*If an interpreter is used then the interpreter must sign the declaration below.)*

Signed at (*place*) .Katima Mulilo.....….....…….. On (*date*) …25/11/……...…….. 2019.

…… ……

Signature of investigator Signature of witness

INFORMED CONSENT FOR TEACHERS

PARTICIPANT INFORMATION LEAFLET AND ASSENT FORM FOR TEACHERS

ANNEX 5

TITLE OF THE RESEARCH PROJECT: AN INVESTIGATION OF THE EFFECT OF ETHNOMATHEMATICS BASED TEACHING METHOD ON GRADES 3 LEARNERS' ACADEMIC PERFORMANCE IN NUMERICAL CONCEPTS: A CASE STUDY IN THE ZAMBEZI REGION, NAMIBIA.

REFERENCE NUMBER: (LEAVE OPEN)

PRINCIPAL INVESTIGATOR: KAREN FELISO MUSWALALI

ADDRESS:

CONTACT NUMBER: 0812503440

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this research. Please ask the researcher any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way

whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the Research Ethics Committee at The University of Namibia and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and Namibian National Research Ethics Guidelines.

What is this research study all about?

The study will be conducted at selected schools in Zambezi region. There is ONLY 13 schools selected from which participants will come from. A total number of 40 teachers will be selected to participate in this study.

This study aims to investigate the effects of Ethno mathematics approach of Ethnomathematics based teaching method on grades 3 learners' academic performance in numerical concepts.

The researcher will personally distribute 40 questionnaires to 40 lower primary teachers. However, the number will be affected by the number of teachers who will agree to participate as participants are free to choose not to. A follow-up preliminary interview schedule will be conducted with at least 10 teachers as a follow up for questionnaire. This will also be determined by the physical number of teachers who will agree to participate.

13 primary schools will be selected by means of purposeful criterion sampling, with 40 Grade 3 teachers from the schools being selected by random sampling.

No medication will be used during the investigation.

Why have you been invited to participate?

As a lower primary teacher at your current school, you need to use or explore an excellent teaching method in your classroom to help your learners comprehend numerical concepts better instead of relying on the current conventional lecture methods. Since the poor performance of

learners in mathematics has been influenced by the poor teaching methods used at the lower primary phase. Your name has been identified as a participant for the investigation of the effect of Ethnomathematics based teaching method on grades 3 learners' academic performance in numerical concepts.

What will your responsibilities be?

To participate in answering questionnaires and interview schedule.
For a period of 1 hour during testing and for a feedback session thereafter (1 hour).

Will you benefit from taking part in this research?

Benefits include learning about a new teaching approach numerical topic in ways which might influence the limiting of your current reliance on conventional lecture methods.

Are there any risks involved in your taking part in this research?

There are no risks involved in participating in this research.

If you do not agree to take part, what alternatives do you have?

There are no consequences for not participating in the research.

Who will have access to your medical records?

Only the researcher, supervisor and statistician may have access to the provided data.

What will happen in the unlikely event of some form injury occurring as a direct result of your taking part in this research study?

Insurance pertaining to adverse-related research events is covered by the University of Namibia.

Will you be paid to take part in this study and are there any costs involved?

No payment will be received by participants and there are no monetary costs involved.

Is there anything else that you should know or do?

You can contact the Centre for Research and Publications at **+264 61 2063061; pclaassen@unam.na** if you have any concerns or complaints that have not been adequately addressed by the investigator.

You will receive a copy of this information and consent form for your own records.

DECLARATION BY PARTICIPANT

By signing below, I ……..…… agree to take part in a research study entitled "*AN INVESTIGATION ….*"

I declare that:

f) I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.

g) I have had a chance to ask questions and all my questions have been adequately answered.

h) I understand that taking part in this study is **voluntary** and I have not been pressurized to take part.

i) I may choose to leave the study at any time and will not be penalized or prejudiced in any way.

j) I may be asked to leave the study before it has finished, if the study doctor or researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (*place*) .....….....…….. On (*date*) ……...…….. 2019.

..... **.....**

Signature of participant Signature of witness

DECLARATION BY INVESTIGATOR

I, *Karen Muswalali,* declare that:

- I explained the information in this document to …….;
- I encouraged him/her to ask questions and took adequate time to answer them;
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above;
- I did not use an interpreter. (*If an interpreter is used then the interpreter must sign the declaration below.)*

Signed at (*place*) .Katima Mulilo.....….....…….. On (*date*) …25/11/……...…….. 2019.

..... **.....**

Signature of investigator Signature of witness