Ethnomathematics and Culturally Responsive Pedagogy in Mathematics Learning

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Abstract

This paper examined ethnomathematics and culturally responsive pedagogy in Mathematics Learning. It looked at ethnomathematics as a form of traditional education that is focused on the incorporation of culturally relevant educational materials that convey mathematical principles from the students' everyday lives. Ethnomathematical techniques aim to make classroom Mathematics more applicable and meaningful to learners in order to improve the quality of education generally and promote more culturally appropriate views of Mathematics. By examining the cultural aspects of Mathematics, ethnomathematics helps to improve learners' ability to establish meaningful connections and deepen their understanding of the subject by connecting mathematical concepts to their cultural contexts. Some benefits of ethnomathematics were pointed out as: ability of learners to think creatively, ability to conquer dullness as learning becomes more fascinating, Mathematics learning turns out to be more meaningful and learners comprehend the lesson easily, ability to create a fresh environment because learning is no longer solely focused on paying attention to the teacher's explanations; rather, it is engaging due to the utilization of numerous media and resources that are known to the students. The study also highlighted some challenges associated with ethnomathematics. One of the challenges was that many teachers believe that ethnomathematics is a barrier or a time-waster that inhibits them from fulfilling the requirements specified in the curriculum because many examples are practical and can be taught in group project settings. It also looked at implications of ethnomathematics to Mathematics Curriculum. Relationship of culturally responsive teaching to Ethnomathematics was also examined. Some suggestions were made at the end of the study. One of the suggestions stated that textbook authors and publishers should endeavour to incorporate examples of some local materials from the learners' cultural environment that will enhance effective use of ethnomathematics in schools.

Keywords: Ethnomathematics, pedagogy, mathematics, learning.

Introduction

The term ethnomathematics is used to express the relationship between culture and Mathematics. It was first introduced in 1986 by a Brazilian Mathematics educator, Ubiratan D'Ambrosio (Umar et al., 2019). It utilizes the etymology of some Greek root words such as ethno, mathema, and tics. It is a program that integrate mathematical concepts and practices used by members of various cultural groups, which are recognized not only as indigenous societies but as groups of employees, professional classes, and groups of children of a certain age group as well (Milton & Daniel, 2016). 'Ethno' describes the things that make up the cultural uniqueness of a group such as language,

beliefs, values, food and dress, habits, and physical traits. 'Mathema' means to; explain, understand or know and 'tics' means 'techne' which is rooted in art and techniques. Ethnomathematics is basically defined as the way, skill, and means of comprehending, managing, describing, and linking our social and natural environment with Mathematics (Mania, & Alam, 2021). A basic understanding of ethnomathematics is necessary for teachers as it allows them expand their mathematical sensitivity to further instruct their learners effectively (D'Ambrosio, 2001).

Ethnomathematics analyzes the cultural facet of Mathematics and delivers mathematical notion of the curriculum in a way that is connected to learners' cultural environment by improving their capacity to make significant connections and expand their comprehension of Mathematics. It connects learners' varied ways of knowing and learning as well as knowledge that is culturally rooted with school Mathematics as it explores educational and culturally rich means to present more comprehensive developmental programs for the various populations served at educational organizations. Teaching Mathematics concepts via cultural significance and various ethnomathematical perspectives assists learners to know about certainty, culture, humanity, environmental issues by providing mathematical content and methods that allow them to effectively master school Mathematics (Milton & Orey, 2020). According to Ekwueme, (2013), the study of Mathematics and the teaching of Mathematics in the context of the learners' cultural environments is the focus of ethnomathematics. It entails an examination of the various ways that people think mathematically across cultural groups as well as how Mathematics is used in science, technology, engineering, and other fields. Ethnomathematics transcends all academic fields. It is the Mathematics that is practiced by recognized cultural groupings. It covers a wide range of concepts, from different numerical and mathematical systems to multicultural Mathematics instruction, and its purpose is to add to the comprehension of culture and Mathematics, primarily by highlighting the linkages between the two. It is notable that every community, regardless of the sophistication of its civilisation, creates a certain type of Mathematics that aids its members in resolving difficulties in daily life.

Oral transmission of this kind of Mathematics is made to subsequent generations. Despite the fact that this Mathematics was either oral or unwritten in the majority of traditional African communities, it still met the users' immediate needs. In an effort to incorporate this style of Mathematics into school Mathematics, which is frequently kept and taught by teachers as foreign and unconnected to the child's culture, Mathematics historians and Mathematics instructors in Africa are currently interested in exploring this type of arithmetic. This particular branch of Mathematics has been referred to by many researchers under several titles, including traditional Mathematics, mathematical heritage, native Mathematics, natural Mathematics, and non-standard Mathematics. Mathematics and culture are connected through ethno mathematics. In other words, ethnomathematics connects the child's environment to the field of Mathematics by bringing Mathematics and culture together. It stresses mathematical procedures with cultural roots. The teaching and learning of Mathematics using an ethno- mathematics approach is a creative, cultural, and activity-based approach (Ekwueme, 2013).

Ethnomathmatics refers to Mathematics as a cultural practice. It is the value of Mathematics as a science in the society. It focuses on using Mathematics in a way that is consistent with one's culture and heritage. In order to create the future, ethnomathematics focuses on the learner's background, present environment, and prior experiences. It emphasizes what students already know and/or their background, current location, interests, skills, and cultural activities. The future is built by using an ethnomathematics approach that links the past and the present. This makes Mathematics useful and pertinent to the requirements of students and the general public. Students learn the necessary Mathematics while also developing their mathematical skills, inventiveness, and good research habits through training in ethnomathematics. This strategy is sufficient to aid in resolving the issue of learners' rote memorizing of mathematical concepts, procedures, principles, reasoning, and computations. For this, the strategy offers the chance to engage actively, learn via doing, and make the students in some ways, the main participants in the teaching process (Ekwueme, 2013).

A great deal of today's curriculum is so detached from the learners' reality, that it is impossible for them to participate fully in it. The way Mathematics is taught in many classrooms has virtually no connection with the world that the learners are experiencing. Just as literacy is more than reading and writing, Mathematics must also be regarded as more than counting, calculating, sorting, or comparing. Educators are to help students realize their full mathematical potential by recognizing the importance of culture in their learning through the study of ethnomathematics. Learners must be taught to value variety in the Mathematics classroom and to comprehend both the influence that culture has on Mathematics and how this influence results in different ways in which Mathematics is used and communicated. Ethnomathematics helps learners to understand how Mathematics continues to be culturally adapted and used by people around the globe and throughout time. In a typical Mathematics classroom, the importance of culture has been strangely absent from its content and teaching. This makes a lot of students and teachers to believe that Mathematics is a discipline without cultural significance. This perception somehow affects learners during lessons as they are not allowed to create personal understandings of the Mathematics that is presented. The values, traditions, beliefs, language, and habits that reflect the culture of the learners are overlooked and they are expected to take in certain procedures by rote without necessarily gaining a deeper understanding of what is presented to them. This approach of teaching unfortunately restricts learning to the length of time that students accurately remember the procedures. An application of the knowledge of what is learnt is also often context specific and poorly generalized because it is limited to the types of problems practiced when the procedures were taught. Mathematics teachers should always encourage their learners to construct personal mathematical understandings and be able to explain their work. An acultural mathematical curriculum also distorts learning about how Mathematics has evolved and who has contributed to this evolution. The historical contributions that are described are often Eurocentric, paying reverence to the fair-skinned Greeks as the suppliers of most mathematical knowledge (Rex, 2002).

The notion of local culture in Mathematics learning can enhance learners' knowledge and sense of reasoning. Incorporating cultural settings into different Mathematics exercises creates a fun environment and makes Mathematics lessons exciting for learners. Students can better understand problems through contextual learning with ethnomathematics since problems pertaining to everyday

experiences increase students' inspiration. Students have the chance to address problems through contextual learning with ethnomathematics by connecting real-world events and cultural values that develop in the community. This promotes learning interactions at various thinking levels. Students can comprehend the value of Mathematics in their lives through background learning with ethnomathematics. By appreciating varied cultural experiences, knowledge is created to help students on an intellectual, social, emotional, and political situation. Ethnomathematics instruction can help learners reconstruct their understanding of Mathematics more effectively in spite of their existing level of cognitive development. Students turn out to be more self-assured in the techniques they employ on their own and stir up a sense of reverence for the distinctive characteristics of their local culture. The variety of problems students must solve helps them develop a deep understanding of Mathematics (Nur et al, 2020).

Benefits of Ethnomathematics

1. Ability to think creatively: All students can benefit from using ethnomathematics to expand their ability to think creatively. Students learn the value of diversity in thought and how it can inspire creativity when they are exposed to a wide range of viewpoints. Students will begin asking different questions instead of focusing on the one correct answer, which can result in different solutions or, they can still come up with the same answers but build up various ways to present and communicate them. The importance of this cannot be emphasized, so Mathematics teachers should encourage students to use their creativity to approach issues in a number of ways and then express themselves using diverse strategies. Teachers can use the following cultural customs to encourage learners' creativity in the classroom: (i) Adding a brief history of Mathematics in the lesson plan: educators can explain how various cultures or genders have contributed to the topic at hand. This can be done at the commencement of the class for about 1-3 minutes. Students will learn to respect various cultures as a result of this and this will also help to dismiss the notion that mathematically ability is reserved for a select group of people based on their race, social status, or gender in particular. (ii) Reminding students on a regular basis that Mathematics is not static and can originate from anyone or any culture depending on the desire to solve an issue. Students will benefit from having a growth mentality as they see themselves as capable of contributing to the field of Mathematics. This will also aid in dispelling the notion that Mathematics is an elite field. (iii) Explaining to students whenever feasible, how the same mathematical concept can be expressed in various ways depending on cultural understanding. Explaining to learners how different cultures express things like measure and numbering in various ways, for instance. Teachers can also show the class how two different students can communicate the same idea in a variety of ways depending on their cultural background. Students will benefit from seeing Mathematics as open with various answers and solution pathways.

   Furthermore, as this goes against the procedural approach to Mathematics, this will aid in fostering a growth mentality. Due to the fact that every student has the chance to share aspects of their culture in the classroom, ethnomathematics by its very nature encourages equity. In a perfect world, no culture would be granted prominence in an ethno mathematics

class. Ethnomathematics encourages equality. Given that mathematical concepts can be expressed in a variety of ways, each student is given the necessary instruction and tools to succeed (Wendy, 2018).

2. Ethnomathematics approach can stimulate and inspire learners to study Mathematics, conquers dullness and offers new hints as a result, as learning becomes more fascinating, Mathematics learning turns out to be more meaningful and learners comprehend the lesson easily (Mania, & Alam, 2021).
3. Finding a connection between academic Mathematics and Mathematics used outside of the classroom is intriguing because Mathematics is a tool for communication and a cultural creation that was developed to address issues. Mathematics is a type of human thinking exercise used as an attempt to thoroughly understand their surroundings. Understanding the backgrounds and cultures of the pupils is crucial since it will help tutors understand how learners think mathematically. Knowing how pupils think mathematically will make it simpler to choose the best method of Mathematics instruction for them.
4. Learning with a cultural perspective can assist students learn about, comprehend and value cultural values in their daily lives, increase students' knowledge of their culture and make it easier for students to adjust to the teaching and learning of Mathematics.
5. Additionally, the use of ethnomathematics in Mathematics education creates a fresh environment because learning is no longer solely focused on paying attention to the teacher's explanations; rather, it is engaging due to the utilization of numerous media and resources that are known to the students. Additionally, students can apply their learning outside of the classroom by visiting or interacting with local cultures, artifacts, and structures (Mania, & Alam, 2021).

Ethnomathematics also has some challenges which hinder its usage in some schools. Here are some of the challenges as well as solutions to them.

1. Many researchers and educators are cautious to promote the idea of ethnomathematics in the classroom, despite the fact that it is being championed by many as a method to infuse students' own cultural and historical knowledge into Mathematics classes and promote the acceptance of diversity. Some dread that Mathematics instructors will focus mainly on the Mathematics practices of foreign cultures, which will harmfully support the falsehood that Mathematics is only the product of advanced civilizations and obscure indigenous people did not have complex forms of Mathematics (D'Ambrosio, 2001). This can be fixed by including mathematical ideas from a variety of sources, such as regional cultural groups, as well as instances from the present to demonstrate that ethnomathematics is still in use today. Additionally, educators must take efforts to guarantee that a variety of cultures are fairly represented in the curricula.
2. Additionally, there is a chance of singling out learners who are members of a minority and thereby enhancing the idea that they are different. In order to avoid these possible issues, teachers must create a balance between the cultural examples they cover in class and make an effort to present the content as more global than regional.

3. How to teach different indigenous designs and Mathematics while maintaining awareness of the cultural context of such ideas is another difficulty for teachers of ethnomathematics. In other words, it is challenging to avoid ultimately evaluating indigenous concepts from a purely western perspective. In a similar spirit, it is crucial to avoid romanticizing other cultures because doing so often serves to strengthen rather than dispel the perception of primitivism. By inviting people from different ethnic groups to share their knowledge with the class, one can help to lessen the likelihood of these things happening.
4. Many teachers believe that ethnomathematics is a barrier or a time-waster that inhibits them from fulfilling the requirements specified in the curriculum because many examples are practical and can be taught in group project settings. The significance of letting students use their own cultural and historical backgrounds to build and discover practical links to the Mathematics curriculum is missing. Theoretically, when teachers take into account their pupils' backgrounds, learning is considerably improved. It is undeniably a powerful technique to give Mathematics life and enable pupils to recognize its importance for their own cultures to study Mathematics with them. Naturally, creating a project-based learning environment in the Mathematics classroom is also essential for success. What is required is a reconsideration of the design and organization of a Mathematics class (Brandt & Egan, 2015).

Implications of Ethnomathematics to Mathematics Curriculum

Ethnomathematics plays a part in the formal school Mathematics curriculum because context-relevant and constraint-filled problem-solving techniques give many abstract mathematical ideas the contextual meaning they require. Incorporating the role of ethnomathematics in the teaching of Mathematics implies that the Mathematics curriculum should be flexible enough to contain the ethnomathematical knowledge gained from day by day practices of Mathematics that students bring into the classroom. To attain this, Mathematics curriculum should include problems that: (a) build upon the mathematical understanding that learners have from their daily experiences, and (b)make learners do Mathematics in ways that are related to Mathematics in out-of-school situations.

Presently, learners are not encouraged to make connections between school Mathematics and out-of-school situations. This makes them unable to see the importance in the learning of school Mathematics in relation to what they do and meet outside of the boundaries of the formal Mathematics classroom. Incorporating ethnomathematics into the Mathematics curriculum will not only enable learners to develop a wide variety of problem-solving strategies but also legitimises their ownership of such knowledge. This will in turn add more meaning to many abstract mathematical ideas (Rex, 2002).

Finally, to incorporate the role of ethnomathematics in the teaching of Mathematics, the tutors are to become facilitators of the teaching-learning process, rather than authorities and transmitters of knowledge. They need to see learners as equal partners in the teaching-learning process and active participants in the information-sharing process. Making good use of students' rich ethnomathematical knowledge in the classroom enables them to develop a wide-range of problem-solving strategies which leads to high retention rate and boost performance (Rex, 2002). Therefore, there is need for educators to incorporate ethnomathematics with other strategies that are inclusive,

applicable to students' everyday lives, facilitate high cognitive level, and provide meaningful and impactful learning to lessen the challenges that persist in Mathematics education and increase student achievement in Mathematics (Wendy, 2018).

Culturally Responsive Teaching

According to Gonzalez, (2018) culturally responsive teaching includes: The use of students' cultural practices in daily instruction, accepting students' native language and families as assets, creating a friendly learning environment, and making the students aware of clear high expectations for everyone. According to Milton, & Orey, (2020), culturally relevant education came up due to concerns over severe academic achievement gaps faced by various low-income learners and those from linguistically and culturally varied households. It makes learning more significant and efficient by utilizing the cultural knowledge, past experiences, frames of reference, and learning modes of culturally and linguistically varied learners in order to build up their connection to schools, which will ultimately reduce behaviour issues and improve learning.

The implementation of culturally relevant education helps in the improvement of learners' intellectual, societal, and political learning by using their cultural referents to develop mathematical knowledge. It draws on learners' existing experiences to make lessons more applicable and effective, so as to increase students' engagement with learning. Schools that are culturally sensitive contextualize their teaching and learning methods while upholding educational rigor. By utilizing teaching practices that are culturally appropriate, educators, school administrators and members of staff are able to identify and build upon the strength of the learners in these schools. In order to assist students to gain knowledge of concepts, it is imperative to permit the integration of culturally relevant pedagogy into the curricula which is created to fit together school culture and student backgrounds. It is the goal of ethnomathematics and culturally sensitive pedagogy-based approaches to Mathematics education to make Mathematics concepts more significant and appropriate to learners (Milton and Orey, 2020).

Relationship of Culturally Responsive Teaching to Ethnomathematics

Culturally responsive teaching and ethnomathematics are teaching approaches that provide different ways for learners to preserve their cultural identity while succeeding academically. They are designed to bring home, school customs to students' cultural backgrounds to form a firm foundation to help them understand themselves and their peers, and also develop and structure social interactions, and conceptualize knowledge. Both ethnomathematics and culturally responsive teaching-based approaches are projected to make school Mathematics relevant and significant so as to promote the overall success of student learning experiences.

The main aim of ethnomathematics is to draw from the students' cultural experiences and use them as vehicles to make Mathematics learning more meaningful and to provide students with the insights of mathematical knowledge as embedded in their social and cultural environments.

Culturally responsive teaching and ethnomathematics help students to know more about themselves, culture, society and environmental issues by providing them with mathematical content and approaches that enable them to successfully master academic Mathematics, retain knowledge and perform better (Milton & Orey, 2015). To contain the continual changes in the demography of

learners in our classes, significant adjustments in Mathematics instructions are required. It is essential to incorporate culturally relevant pedagogy into the present Mathematics curriculum because it suggests that teachers contextualize learning by connecting mathematical knowledge to students' actual life experiences. The practical Mathematics of social groups is not trivial when considered in an apt social context since it represents values, viewpoints, and issues that are connected to students' everyday lives. According to this viewpoint, kids may succeed in Mathematics when their comprehension is linked to significant cultural referents and when the training presumes that every learner can master Mathematics. The role of Mathematics in a socio-cultural setting that uses the ideas and concepts connected with an ethnomathematical perspective to address problems is the focus of curriculum activities established in accordance with the principles of a culturally relevant pedagogy (Milton, & Orey, 2020).

In culturally relevant pedagogies, Mathematics knowledge is seen as variations on ethnomathematics. This occurs because ethno, mathema, and tics are each characterised as strategies or procedures for solving everyday problems. Ethno is defined as racially peculiar groups with their slangs, codes, marks, mythologies, and even distinct ways of thinking and inferring. In a classroom where Mathematics is taught in a culturally relevant manner, teachers build on students' prior knowledge (ethno) and tailor the lessons to their cultural and personal experiences (mathema), all the while sharpening their critical thinking abilities (tics)

The addition of deep cultural features in the Mathematics curriculum has lasting benefits for learners' mathematical accomplishment because cultural features help students recognize how Mathematics is a part of everyday life, help them to make significant connections and help them to have deeper understanding of Mathematics as a result. Given that varied instructional methods incorporate the socio-cultural background of the students, the pedagogical approach towards an ethnomathematics viewpoint enables a broader understanding of the school context in which these activities transcend the classroom setting. In this way, the school community possesses the pedagogical components required to create the Mathematics curriculum.

Given that it is a research program that directs educational pedagogical practices, the area of ethnomathematics offers some opportunities for educational initiatives that contribute to achieving this goal. However, it is important to note that the operation and transmission of the goals of the ethnomathematics program as pedagogical practice in the school curricula is a topic of study that is still forming its own character in the pedagogical pitch. A broad change in Mathematics education can be seen in the tendency toward culturally relevant pedagogies and ethnomathematical approaches to curriculum. In order to improve the overall quality of education, ethnomathematical techniques aim to make school Mathematics more appropriate and important for students. In doing so, it is vital to advocate for the inclusion of a more culturally relevant understanding of Mathematics in the school curriculum. The leadership of the school should encourage and support a Mathematics curriculum that is based on student context and prior knowledge and that gives teachers more liberty and creativity in selecting academic mathematical themes to address in the classes. This instructional strategy can be carried out by teachers and students conversing about mathematical topics that encourage reflection on social issues. Students look at ideas, customs, and mathematical

techniques produced by members of various ethnic groups in this setting in order to incorporate them into the Mathematics curriculum. Therefore, using an ethnomathematical approach, teachers can help students critically analyze both the dominant culture and their own culture. The student background is infused into the learning environment in a holistic way by a culturally relevant Mathematics curriculum built on an ethnomathematical perspective, giving students the chance to relate to new learning experiences and also recognize the skills they have already mastered or come across in their daily lives.

The idea that Mathematics is seen of as a cultural product that has evolved as a result of numerous activities is supported by culturally relevant pedagogies. Since every culture is thought to have mathematical solutions to problems encountered on a daily basis, this approach aims to make Mathematics more accessible to students by using these solutions as the basis for developing Mathematics lessons. Teachers who employ this type of curriculum would be replete with examples taken from the students' own experiences and their sociocultural surroundings. For instance, ethnomathematics aims to draw from the cultural experiences and practices of the students in order to use them as tools to not only make Mathematics learning more meaningful but also to give students an understanding of how mathematical knowledge is embedded in their social and cultural environments (Milton, & Orey, 2020). It is crucial to stress that research on culturally relevant pedagogy examines the cultural congruence between students' backgrounds, communities, and schools, which in turn forms one of the primary tenets of an ethnomathematics curriculum (Milton & Daniel, 2016).

Conclusion

Ethnomathematics and culturally responsive education are two instructional approaches that provide students several means of retaining their cultural identity while excelling intellectually. They are made to assist students understand themselves and their peers as well as to create and structure social relationships and conceive information by bringing school traditions from the students' home cultures. It is anticipated that both ethnomathematics and culturally sensitive teaching methods will make school Mathematics relevant and important in order to advance the overall success of student learning experiences

Suggestions

1. Seminars and workshops should be organized for educators to enlighten them on the utilization of ethnomathematics approach in order to empower them on the correct path to present lessons to a varied group of students.
2. Curriculum organizers should incorporate ethnomathematics approach in the secondary school Mathematics curriculum as a strategy to make lesson more applicable and effective so as to increase students' engagement in learning.
2. Textbook authors and publishers should endeavour to incorporate examples of some local materials from the learners' cultural environment that will enhance effective use of ethnomathematics in schools.

References

Brandt, A. & Egan, J. C. (2015). The importance of ethnomathematics in the math class. *Ohio Journal of School Mathematics*, 71(1), 31-36

D'Ambrosio, U. (2001). What is ethno mathematics, and how can it help children in schools? http://math.hawaii.edu/~mchyba/documents/syllabus/Math499/Ethnomath/Ambrosiopdf

Ekwueme, C.O. (2013). *Mathematics teaching and learning in schools*. Radiant Ventures Nig. Ltd.

Gonzalez, V. (2018).Culturally responsive teaching in today's classrooms https://ncte.org/blog/2018/01/culturally-responsive-teaching-todays-classrooms/

Mania, S. & Alam, S. (2021). Teachers' perception toward the use of ethnomathematics approach in teaching math. *International Journal of Education in Mathematics, Science, and Technology (IJEMST), 9*(2), 282-298. https://doi.org/10.46328/ijemst.1551

Milton, R. & Daniel, C. A. (2016). State of the arts in ethnomathematics. https://link.springer.com/chapter/10.1007/978-3-319-30120-4_3

Milton, R. & Orey, D.C. (2015). The Connections between culturally relevant pedagogy and ethnomathematics. XIV CIAEM-IACME, Chiapas, México.

Milton, R. and Orey, D. C. (2020). Principles of Culturally Relevant Education in an Ethnomathematical Perspective. https://doi.org/10.37001/remat25269062v17id306

Nur, A.S., Waluya, S.B., Rochmad, R.,& Wardono, W. (2020). Contextual learning with ethnomathematics in enhancing the problem solving based on thinking levels. *Journal of Research and Advances in Mathematics Education,* 5(3), 331 – 344. https://doi.org/10.23917/jramathedu.v5i3.11679

Rex, M. (2002). The Role of ethno mathematics in mathematics education in Papua New Guinea: Implications for mathematics curriculum. http://citeseerx.ist.psu.edu/view doc/download?doi=10.1.1.562.7228&rep=rep1&type=pdf

Umar, I.O., Tudunkaya M.S.,&Muawiya H.U. (2019). Effect of ethno mathematics teaching approach on performance and retention in trigonometry among secondary school students in Zaria local government area Kaduna state, Nigeria.*Abacus.The Journal of Mathematical Association of Nigeria. 44(1),* 104-112.

Wendy, A.F. (2018).Using ethnomathematics principles in the classroom: A handbook for mathematics educators. https://dr.library.brocku.ca/bitstream/handle/10464/13665/ MRP%20-%20Wendy%20Ann%20Forbes.pdf?isAllowed=y&sequence=1