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ETHNOMATHEMATICS; AN APPROACH FOR LEARNING MATHEMATICS FROM MULTICULTURAL PERSPECTIVES

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ABSTRACT

The term ethnomathematics is used to express the relationship between culture and mathematics. The term ethno describes 'all of the ingredients that make up the cultural identity of a group: language, codes, values, jargon, beliefs, food and dress, habits, and physical traits'. Mathematics expresses a broad view of mathematics which includes arithmetic; classifying, ordering, modelling and Mathematical practice is a cultural product. Many educators may be unfamiliar with the term, yet a basic understanding of it allows teachers to expand their mathematical perceptions and more effectively instruct their students. This research article describes the concept of ethamathematics and its uses from multicultural perspectives and its application in school curriculum for learning mathematics.

Keywords: Ethnomathematics, Multicultural Perspectives, Learning Mathematics

1.INTRODUCTION

The past two decades have seen ethnomathematics and multicultural approaches become much more widespread even to the extent of becoming commonplace. Multiculturalism has become a part of many curricula at the national, state, and local jurisdictions. The National Council for Accreditation of Teacher Education, USA require teacher education programs to demonstrate diversity in curriculum, instructional approach, faculty, and student body. Ethnomathematics is no longer an add-on course an edging, or an enrichment topic. Rather it is at the heart of the instructional methodology. Teachers see their diverse classrooms and must reach out to their entire class. Beyond boosting minority interests and self-esteem, it is necessary to prepare majority of the students to work in a diverse, multicultural world, with the recognition that the majority is not the only group which has made or can make contributions to mathematics.

Teachers must learn special instructional skills to accommodate different backgrounds and different learning strategies. It has now been recognized that culture can determine the student's feeling toward participation in class discussion, initiating questions, acceptance of authority, memorization of facts, seeking innovative ways of understanding, and many other aspects of classroom education. As spelled out in the 'Teaching standards' (NCTM 1991), a key to successful instruction is the teacher's "knowledge of students' understandings, interests, and experiences" and 'knowledge of the range of ways that diverse students learn mathematics'. Ethnomathematics is a key to finding those connections within mathematics as cultural groups blend two or more mathematical areas to meet their needs to other subject areas such as art, geography, economics, etc., as one looks at other cultures; and to the local culture of the learners by incorporating local mathematics (Shirley, 1995 and Masingila, 1995),. Students need to be able to "recognize and apply mathematics in contexts outside of mathematics (NCTM 2000). This might include the mathematics involved in their cultural heritage religion, art, textiles, music, or festivals.

NEED AND IMPORTANCE OF THE STUDY

Ethnomathematics is the cultural utility of mathematics as a science (Harbor-Peters, 2001). Ethnomathematics is an approach of teaching and learning mathematics which builds on the students' previous knowledge, background, the role his environment plays in terms of content and method, and his past and present experiences of his immediate environment and the approach could be in a practical way (D'Ambrosio, 2001). In D'Ambrosio's (1990) point of view, it is important to recognize that ethnomathematics is a research program that guides educational pedagogical practices. However, according to Monteiro,Orey, and Domite (2004), it is necessary to point out that the incorporation of the objectives of the ethnomathematics program as pedagogical practice in the school curricula and its operationalization and transmission in the field of education is a recent field of study that is still developing its own identity in the pedagogical

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arena. Therefore keeping the importance of this research work, the present researcher has identified and attempted to work out for the present context of mathematics and its need.

Ethnomathematics and Education

The ethnomathematical approach to education has Brazilian roots. Ethnomathematics has developed into both an educational practice and a separate discipline within academics (D'Ambrosio, 1979). D'Ambrosio has further emphasized that the notion `ethnomathematics' covers a much larger area than in its traditionally ethnocentric or exotic interpretation, and that the approach should be applicable to any learning context. The practice regarding mathematics education and Ethnomathematics still is considered different from the so-called Critical Mathematics Education (Vithal and Skovsmose, 1997).

Ethnomathematics in School Curriculum

A Classroom using ethnomathematical curriculum draws upon the students' own experiences and on experiences that are common in their cultural environments. Ethnomathematics aims to draw from the students' cultural experiences and practices of the individual learners, the communities, and the society at large. Rosa and Orey (2008) affirmed that ethnomathematics uses these cultural experiences 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. Ethnomathematics contributes to restoring the cultural dignity and offers the intellectual tools for the exercise of citizenship. It enhances creativity, reinforces cultural self-respect, and offers a broad view of mankind. In everyday life, it is a system of knowledge that offers the possibility of a more favorable and harmonious relation between humans and nature (D'Ambrosio 1999a).

According to the view of Rosa, M. & Orey, D. C. (2011), Ethnomathematics studies the cultural aspects of mathematics. It presents mathematical concepts of the school curriculum in a way in which these concepts are related to the students' cultural and daily experiences, thereby enhancing their abilities to elaborate meaningful connections and deepening their understanding of mathematics. Ethnomathematical approaches to mathematics curriculum are intended to make school mathematics more relevant and meaningful for students and to promote the overall quality of their education. Another notion of the implementation of an ethnomathematical perspective in the school mathematics curriculum helps to develop the students' intellectual, social, emotional, and political learning by using their own unique cultural reference to impart their knowledge, skills, and attitudes. This kind of curriculum provides ways for students to maintain their identity while succeeding academically.

Multicultural Perspectives of Learning Mathematics

An important change in mathematical instruction needs to take place in order to accommodate continuous and ongoing change in the demographics of students in mathematics classrooms. Some scholars have developed a theory of culturally relevant pedagogy that examines the teaching-learning process within a critical paradigm and through explicit connections between the students' culture and the school subject matter (Rosa & Orey, 2003). In this perspective, it is necessary to integrate a culturally relevant curriculum in the existing mathematics curriculum.

According to Torres-Velasquez and Lobo (2004), ethnomathematics perspectives is an essential component of culturally relevant education because it proposes that teachers contextualize mathematics learning by relating mathematical content to students' culture and real-life experiences. The guidelines of the National Council of Teacher of Mathematics (NCTM, 1991) highlighted the importance of building connections between mathematics and students' personal lives and cultures. Rosa and Orey (2006) affirmed that 'when practical or culturally-based problems are examined in a proper social context, the practical mathematics of social groups is not trivial because they reflect themes that are profoundly linked to the daily lives of students". According to Rosa and Orey (2008), culturally relevant mathematics curriculum should focus on the role of mathematics in a socio-cultural context that involves the ideas and concepts associated with ethnomathematics.

Ethnomathematics as described as a way in which people from a particular culture use mathematical ideas and concepts for dealing with quantitative, relational, and spatial aspects of their lives (Borba, 1997). This way of viewing mathematics validates and affirms all people's experience of mathematics because it demonstrates that mathematical thinking is inherent to their lives. Mathematics is identified in cultural activities in traditional and non-traditional societies (Dowling, 1991; Rosa & Orey, 2007). This means that ethnomathematics refers to mathematical concepts embedded in cultural practices and recognizes that all cultures and all people develop unique methods and sophisticated explications to understand and to transform their own realities. Ethnomathematics might be characterized as a tool to act in the world" and as such, it provides insights into the social role of academic mathematics (Orey, 2000).

It also recognizes that the accumulated methods of these cultures are engaged in a constant, dynamic, and natural process of evolution and growth. D'Ambrosio (2001) states that ethnomathematics has come to mean the study of how people within various cultural groups develop techniques to explain and understand their world in response to problems, struggles, and endeavours of human survival. This includes material needs as well as arts and spirituality through the use of the development of cultural artifacts; objects created by members of a specific cultural group that inherently give cultural clues about the culture of its creator and users. In the context of culturally relevant pedagogy, there is a need to examine the embeddedness of mathematics in culture, drawing from a body of literature that takes on the cultural nature of knowledge production into the mathematics curriculum. Mathematics as part of the school curriculum must reinforce and value the cultural knowledge of students rather than ignore or negate it. A culturally relevant curriculum should fully integrate students' cultural mathematics knowledge through ethnomathematics (Rogoff, 2003).

2.REVIEW OF STUDIES

Studies conducted by Bandeira and Lucena (2004) and Lean (1994) focused on school mathematics and the effect of cultural factors on teaching and learning academic

mathematics. Dossey (1992) and Orey (2000) observed that mathematical knowledge results from social interactions in which relevant ideas, facts, concepts, principles, and skills are acquired as a result of cultural context. Shirley (1995) is of the view that Ethnomathematics has come to include the documentation and the study of culturally related learning styles. It is found to facilitate development of learners in Mathemathics especially women (Gilmer and Milwankee, 2001; Knijinik, 1997). Carraher (1991) argued that mathematics practices existing out-of-school are shown by students who develop the understanding of numbers even before they come to school.

Carraher, and Schleiman (1985) suggested that some important mathematical concepts are developed outside the school without specific instructions because these concepts and procedures would appear to arise through an individual's social interactions in everyday activities such as commerce and production of goods. Based on Nunes(1992) research with Brazilian vendors, it is possible to conclude that mathematical ideas and practices that are used outside the school may be considered as a process of modelling rather than a mere process of manipulation of numbers. In this regard, Orey (2000) states that the application of ethnomathematical techniques and the tools of mathematical modelling allow us to see a different reality and give us insight into science practised in a different way.

According to Rosa and Orey (2003), this mathematical approach is presented as a cultural response to students' needs by making connections between their cultural background and mathematics. This approach supports the view that "mathematics is conceived as a cultural product which has developed as a result of various activities" (Bishop, 1988). Lipka (2002) states that, links are made to familiar practices and concept by realizing and understanding the need for mathematical characteristics such as accuracy and formal reasoning in both academic mathematics and in real-life situations. It is assumed that a curriculum of this nature motivates students to recognize mathematics as part of their everyday life and enhances the students' ability to make meaningful mathematical connections by deepening their understanding of all forms of mathematics.

According to Bandeira and Lucena (2004), mathematical curriculum conceived in an ethnomathematical perspective helps to develop mathematical concepts and practices that originate in students' culture by linking them to academic mathematics. Duarte (2004) investigated the uniqueness of mathematical knowledge produced by workers in the home construction industry through a study of mathematical ideas and practices that they develop in construction sites. According to Kurumeh (2004), ethnomathematics teaching approach is used to explain the reality of relationship between cultural environment and mathematics while teaching. The secret behind the Japanese and Chinese success in mathematics, science and technology today is traceable to their use of ethnomathematics (Kurumeh, 2004; Uloko and Imoko, 2007).

Rosa and Orey (2006) argue that an ethnomathematics curriculum offers students, especially minority students, the motivation to perceive mathematics as an important cultural tool that facilitates their mathematical learning. They also affirm that the establishment of cultural connections is a fundamental aspect in the development of new strategies to the process of teaching and learning mathematics because it allows students to perceive mathematics as a significant part of their own cultural identity. Warschauer (1999) affirmed that the use ethnomathematics in the school curricula is an effective tool that improves the learning of mathematics by the minority students. The ethnomathematics curriculum focuses on mathematics as a process rather than as a collection of facts, and it is based on the idea that mathematics is a human creation that emerges as people attempt to understand their world. Therefore, mathematics is seen as a process and as a human activity, rather than just as a set of academic content (D'Ambrosio, 2002). This implies that an ethnomathematical curriculum is not just about the application of relevant contexts in learning and teaching mathematics, but is also about generating formal mathematics from cultural ideas (Gerdes, 1994).

DEFINITION OF ETHNOMATHEMATICS

Ethno' refers to the 'cultural context' while 'mathema' refers 'to explain', 'to know' or 'to understand' and 'tics' has to do with techno which is also rooted in art and techniques. Thus according to Davidson (2000), Ethnomathematics is the art or technique of explaining, knowing and understanding diverse cultural contexts. D'Ambrosio (1990) defined ethnomathematics in the following way: The prefix *ethno* is today accepted as a very broad term that refers to the social-cultural context and therefore includes language, jargon, and codes of behavior, myths, and symbols. The derivation of *mathema* is difficult, but tends to mean to explain, to know, to understand, and to do activities such as ciphering, measuring, classifying, inferring, and modelling. The suffix - *tics* is derived from *techne*, and has the same root as technique.

In other words, *ethno* refers to members of a group within a cultural environment identified by their cultural traditions, codes, symbols, myths, and specific ways used to reason and to infer. *Mathema* means to explain and understand the world in order to transcend, manage and cope with reality so that the members of the cultural groups can survive and thrive, and '*tics'* refer to techniques such as counting, ordering, sorting, measuring, weighing, ciphering, classifying, inferring, and modelling. Rosa and Orey (2003) states that the *mathema* develops the *tics* within the context of *ethnos* because it consists of daily problems people face, larger problems of humanity, and endeavours of the humans to create a meaningful world (Rosa & Orey, 2007).

RESEARCH QUESTIONS

1) What are the contributions of ethnomathematics in education?
2) How ethnomathematics can be useful in multicultural perspectives of school curriculum in mathematics?

3.METHOD OF RESEARCH

This paper carries the work of Historical Research. The materials are collected from the authentic forms of books,

theses, journals and web resources. Historical research is the systematic and objective location, evaluation and synthesis of evidence in order to establish facts and form a conclusion about past events (Borg, 1963).

4.DISCUSSION

Teachers and the public in general do not commonly say that mathematics and culture are connected. When teachers do acknowledge a connection, often they engage their students in multicultural activities merely as a curiosity. Such activities usually refer to a culture's past and to cultures that are very remote from that of the children in the class. This situation occurs because teachers may not understand how culture relates to children and their learning. Although multicultural mathematics activities are important, they should not be our final goal. As our students experience multicultural mathematical activities that reflect the knowledge and behaviors of people from diverse cultural environments, they may not only learn to value the mathematics but, just as important, may develop a greater respect for those who are different from themselves. Ethnomathematics perspectives is an essential component of culturally relevant education because it proposes that teachers contextualize mathematics learning by relating mathematical content to students' culture and real-life experiences (Torres-Velasquez and Lobo (2004). A culturally relevant curriculum should fully integrate students' cultural mathematics knowledge through ethnomathematics (Rogoff, 2003). From the studies mentioned in this paper it is evident that the contribution of ethnomathematics is vital to the society and school mathematics for the learning and further progress of the students.

5.CONCLUSION

Every culture has its own way of mathematical measuring and thinking which is part of its inheritance and the result of the struggle for its survival. This goes without doubt. Ethnomthemtics can also be used inherently to achieve better development in education by incorporating it into the school curricula. The ethnomathematics curriculum can play a major role in mathematics education. The kind of practice will also to be helpful to those students belonging to a multicultural society and would pave the way for learning mathematics from multicultural perspective. Ethnomathematics is central to the process of teaching, to the methodology of instruction. It needs to be included throughout the mathematics education programs for students and teachers as well. This might be as straightforward as broadening the content of courses to include worldwide history of mathematics and multicultural applications of mathematical content. Thus ethnomthemtics leads to a healthy way of life.

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