

# **Ethnomathematics: Historical Overview, Critical Analysis, Implications and Applications**

## **Introduction**

The purpose of this study was to introduce the concept of Ethnomathematics by means of a summary of current research, a historical background of the subject, and its current and potential applications. To accomplish this goal, the current study will consist of two parts. First, the study will seek to provide a comprehensive summary, synthesis, and analysis of some of the current and recent scholarly literature concerning ethnomathematics. Second, the applicability of ethnomathematics as a practical teaching approach, particularly for underrepresented minority students, will be critically evaluated.

In Western scholarly discussion, there is often an assumption that empirical data and the mathematical calculations that produce them, are superior to and more reliable than those produced through qualitative analysis. This assumption is based in large part on the broader idea that numbers and mathematical functions are purely objective, and as a result, are immune to the influence of subjectivity (Arismendi-Pardi, 1999).

In fact, the association of mathematics with objectivity and factuality has lasted since the scientific revolution that

took hold in Europe over the course of the sixteenth and seventeenth centuries (Rowlands and Carson, 2002). The long-term consequences of this association are clearly evident today in the way that mathematics is categorized in Western society and privileged among other types of analytical activities (Bishop, 2002).

With respect to academic objectivity, disciplines such as science and math are often regarded as representing the purest form of analysis, because they are assumed to be independent of the subjectivity of the individual and rely instead on universal truths and facts (Bishop, 2002). On the other hand, disciplines such as literature, history, and cultural studies are often discounted in comparison because of the importance given to the subjective interpretation that is involved in investigations and analyses that are attempted in these fields.

What has only recently come to be recognized, however, is that the supposedly universal facts and truths that form the foundation of mathematics are, in actuality, deeply embedded in a Western cultural tradition (Bishop, 2002). As commented on a University of Idaho website, "It is important to recognize that often something we think of as universal is merely universal to those who share our cultural and historical perspectives." Although these foundational concepts are found throughout much of Western science and culture, there exists a broad array of

distinct mathematical systems and methods that have been developed in other cultural traditions and that do not share the same assumptions (Fitzsimons, 2002).

While brief surveys of the history of mathematics have always included the contributions of non-Western cultures, such as those of the Egyptians and Mayans, these achievements were typically treated as milestones on the pathway of the development of Western mathematics (Zaslavsky, 2002). Moreover, these topics of attention are rarely, if ever, available to students studying mathematics at any level (Powell, 2002). However, researchers that have begun adopting a more culturally sensitive approach to the study of the history and development of mathematics traditions attempt to avoid this assumption (Bishop, 2002).

Because of the deep degree to which the idea of the universality and objectivity of mathematics is embedded in Western culture, there has been a great deal of resistance to the suggestion that mathematics could be regarded as a product of distinct socio-cultural tradition (Weiger, 2000). Many traditionalist mathematicians and scientists have vigorously objected to the basic premise of recent analyses that have attempted to locate mathematics within a specific cultural context (Rowlands and Carson, 2004).

However, among those researchers that see value in identifying and further exploring the role of culture in mathematics, the initiation of this direction of questioning has led to a series of possible directions for further research, theory, and practical application (Gerdes, 1996). Although the first scholarly discussion of the relatively new discipline now referred to as ethnomathematics occurred in the 1970s, it is only in the last ten to 15 years that sufficient research activity had been completed to form a substantial body of scholarly literature, as well as a credible source for possible instructional application (Knijnik, 2002).

Proponents of ethnomathematics argue that culturally diverse mathematical traditions are worthy of validation, acknowledgement, and study in the scholarly community (Weiger, 2000). As stated by Adam, Alanqui, and Barton, "Ethnomathematics recognizes the uniqueness of traditional cultures by highlighting aspects of their complex knowledge systems and showing them to be living and dynamic and valuable and valid in their own terms and context" (2003). Furthermore, supporters of ethnomathematics claim that a culturally-sensitive approach to mathematics instruction could prove to be an essential means of introducing underrepresented minorities to mathematical competency (D'Ambrosio, 2001). This is in response to the reality that in the United States, the underrepresented

minorities (Blacks and Hispanics) have lower success rates and higher dropout rates than any other racial or ethnic group (Schoenfeld, 2002). As remarked by Arismendi-Pardi, "Ethnomathematics recognizes the cultural heritage of underrepresented students in an effort to build their self-esteem and encourage them to become interested in mathematics"(1999).

On the other hand, critics of ethnomathematics tend to take a more hierarchical approach to the assessment of the value of varying mathematical traditions. While those in this group acknowledge that non-Western approaches to mathematics exist and have been used successfully by many societies, they continue to regard Western mathematics as the perfected endpoint of the evolution of various historical and cultural mathematical traditions (Rowlands and Carson, 2002). Some opponents of ethnomathematics also accuse proponents of overstating and exaggerating the fundamental differences between Western and non-Western mathematical traditions (Weiger, 2000).

In recent years, the field of ethnomathematics has expanded considerably. Although the idea of placing mathematics into a cultural context has not received universal support, and in fact, has been loudly protested by some scholars, the debate over the issue has emerged as a significant part of the scholarly discourse in the field (Knijnik, 2002).

However, at the present time, ethnomathematics remains a developing discipline. Reflecting its recent introduction to the scholarly discourse, however, the literature relating to the subject of ethnomathematics is widely spread, and, in some cases, contradictory (Hammond, 2000). Also, there is a lack of empirically based data to support the claim that ethnomathematics is a better way for students to learn math (Weiger, 2000). As a result, the practical application of ethnomathematics as a component of mathematics instruction has until now been limited (Bishop, 2002).

During the same period in which the concept of ethnomathematics first began to emerge in the literature, a crisis in the mathematical achievement of underrepresented minorities, in particular, Black and Hispanics in the United States began to take shape. Based on the findings produced using an array of assessments and measures, such as those used by the NAEP, the U.S. National Assessment of Educational Progress, there exists a considerable difference in the mathematical achievement of Caucasians of European heritage and many of their counterparts from underrepresented minority groups (Lee, 2002).

Since the differences in the test scores and mathematical performance among racial, ethnic, and cultural groups were first measured, a broad range of remedial methodologies have been developed and implemented in American public schools. However,

in spite of these concerted efforts, little measurable progress has been made in closing the mathematics performance gaps between racial, ethnic, and cultural groups in the United States. As noted by Jaekyung Lee, during the 1970's and the first half of the 1980's, the NAEP, a federally funded national sampling of student performance in core subject areas, reported considerable academic improvement for Black and Hispanic students and a substantial closing of the Black-White and Hispanic-White achievement gaps. However, since then this progress slowed down and showed signs of regression during the 1990's (2002).

Proponents of ethnomathematics as a field of study have suggested that this disciplinary context may also have practical application as a framework for mathematics instruction. While some attempts to develop and implement a multiculturally-oriented mathematics curriculum have been documented in the literature, the existing body of scholarly assessment of the effectiveness and success of such programs has been overshadowed by the longstanding debate over the broader ideological questions surrounding a multicultural approach to education (Weiger, 2000).

In addition, the existing published literature relating to ethnomathematics is characterized by a highly split mix of opinions and broad editorial overviews of narrowly-focused

research studies. The term itself is not clearly defined and its proponents have yet to agree on a conclusive definition. At the present, few comprehensive, critical syntheses of the body of literature pertaining to ethnomathematics have been undertaken.

Moreover, even fewer have combined the goal of analysis with a focus on the potential usefulness of ethnomathematics as a foundation of mathematics instruction, with a particular emphasis on the instruction of students coming from underrepresented minority groups. The current study will seek to address both of these issues, with an analysis that will be based on a review of some of the existing published scholarly literature on the subject.

### ***Defining Ethnomathematics***

The Brazilian philosopher of mathematics, Ubiratan D'Ambrosio, first coined the term "Ethnomathematics" in the 1970's in speeches emphasizing the influence of sociocultural factors on the teaching and learning of mathematics. Various definitions have been attached to this term all ranging from the general to the specific. According to ISGEM, the International Study Group on Ethnomathematics, a group started in 1985 and currently an affiliate of the National Council of Teachers of Mathematics, the definition they acknowledge is the one put

forth by D'Ambrosio in 1985 whom describes ethnomathematics as "the mathematical practices of identifiable cultural groups." As further detailed on the group's website, the prefix 'ethno' refers specifically to small-scale indigenous societies and in the broadest sense "to any group, national societies, labor communities, religious traditions, and professional classes." The 'mathematics' part of the word refers to practices that include "symbolic systems, spatial designs, practical construction techniques, calculation methods, measurements in space and time, specific ways of reasoning and inferring, and other cognitive and material activities which can be translated to formal mathematical representation." According to D'Ambrosio in 1994, ethnomathematics is "the study of different forms of mathematics that arise from different modes of thought." This definition is so broad that it can be used to describe the math that is practiced by the indigenous tribes in Africa as well as the math practiced by engineers that specifically relates to their field of interest.

In 1997, Ronald Eglash described ethnomathematics as "the study of mathematical concepts in cohesive social groups, with an emphasis on small scale or indigenous cultures." Marcia Ascher, another proponent and supporter of ethnomathematics, describes ethnomathematics as "the study of mathematical ideas

of traditional people." The term 'traditional' refers to indigenous people such as the Native Americans.

A University of Idaho website offers the following definition: Ethnomathematics is "the study of mathematics which takes into consideration the culture in which mathematics arises. Claudia Zaslavsky, in 1998, described ethnomathematics as "the meeting of cultural anthropology with mathematics and education. In 1997, Vithal and Skovsmose stated that ethnomathematics "refers to a cluster of ideas concerning the history of mathematics, the cultural roots of mathematics, the implicit mathematics in everyday settings and mathematics education." Moreover, in 2002, Knijnik described ethnomathematics as a "field of knowledge that studies cultural, social, and political dimensions of mathematics education."

Dr. Daniel Orey in 2004, described ethnomathematics as the "study of culturally related learning styles, historical developments in mathematics, and technology, prominent people in various cultural contexts who have made contributions to the field of mathematics, cultural applications of 'nontraditional' mathematics and various forms of mathematics that draw upon the interests, abilities and talents of teachers and students."

## ***Historical Overview of Ethnomathematics***

Throughout human history, the co-existence of different mathematical traditions, systems, and practices has been widely acknowledged. However, the relative immobility of most populations made these differences largely irrelevant, with the exception of a small group of traders, explorers, and other cultural emissaries (Malaty, 1998).

The scientific revolution of the seventeenth century firmly established Europe as the cultural and scholarly center of the world. After this time, the primacy of Western mathematics and number systems reached global dominance. In the following centuries, non-Western approaches to mathematics were generally regarded as inferior (Malaty 1998). When immigrants encountered Western culture, it was generally assumed that they should reject their native mathematical practices and learn Western mathematics, often in a harshly punitive educational environment that favored assimilation (Weiger, 2000).

In the 1960s, several groups of researchers documenting the cultures of non-Western tribes and societies began to develop a new approach to mathematics and math pedagogy. This approach was based on a shared recognition of the core importance of recognizing the validity of non-traditional, non-Western approaches to mathematics (Malaty, 1998).

The initial formulation of the field that would come to be known as ethnomathematics encouraged the use of a culturally sensitive perspective in the mathematical instruction and analysis. However, by the mid-1980s, a more radical version of this theory had been developed, which, in its strongest formulation, advocated replacing Western mathematics in favor of traditional cultural number systems and operations for native populations. This strategy was adopted primarily by activists and advocates in post-colonial and developing nations (Greene, 2000).

By 2000, this approach had been vigorously criticized in the research literature on the subject. Although the literature in the field remains somewhat scattered, the vast majority of publications that were introduced during the last decade advocate an approach that is closer to the aims and objectives of the late-1960s originators of ethnomathematics (Greene, 2000). Specifically, the consensus that now emerges from the literature advocates the use of culturally familiar materials, examples, and problems as a means of facilitating underrepresented minority students' ability to access and understand the concepts of formal Western mathematics (Weiger, 2000).

## **Review of Related Literature**

In this section, a number of studies, research results, and theoretical assessments of ethnomathematics will be summarized and reviewed. The articles that were chosen for inclusion in this section were selected on the basis of the degree of their representation of the body of literature as a whole, as well as their pertinence to the objectives of the current research.

In order to demonstrate the development and evolution of thought pertaining to the subject of ethnomathematics, the review of literature will be ordered chronologically. Each review will consist of a summary of the article or study being assessed, as well as a brief analysis of the impact of the findings or conclusion offered by the authors.

### Articles and Studies Addressing the Concept of Ethnomathematics

Powell and Frankenstein (1997) reject the approach used by Western industrialized countries for dealing with ethnomathematics by teaching the mathematics used by indigenous peoples as a "folkloristic" introduction to "real" mathematics. They recommend that ethnomathematics be studied as a means to reveal the vital role that mathematics has played throughout the development of human civilization. Also according to Powell and Frankenstein, the study of mathematics is also a powerful means to validate students lived experiences. In other words, by

studying the mathematics used in their culture, children learn that their ancestors contributed to the development of important mathematical ideas. As a result, the students would be more inclined to learn the math because they will see the relevance to their own lives.

Zaslavsky (1998) suggests that mathematical concepts and ethnomathematical perspectives must be integrated in the curriculum in a way that is sensitive to all cultures. She suggests that the problems faced by underrepresented minorities are a result of the schools ignoring the ethnomathematical knowledge that these children bring from their homes and communities. Mathematics needs to be placed in a relevant context in order for it to have meaning for students. One recommendation she has is that new textbooks and teaching materials be produced.

Fitzsimons (2002) offers an overview of the recent research pertaining to ethnomathematics, both as a concept and a pedagogical method. From a disciplinary perspective, the author identifies a number of advantages that have been associated in the literature with the socio-cultural study of mathematics and mathematics instruction in different settings and with different student populations.

According to the author, the implementation of a socio-cultural perspective in studying mathematics is important

because it helps to show the privilege and authority that have been granted to discourses that are based on Western mathematics, as well as the numerous instances in which this privilege has influenced the distribution of power in modern society. In addition, the author asserts that linking mathematics with other sociocultural activities and artifacts serves to diminish the disconnect that has divided practical and academic mathematics instruction over the course of the last century.

Fitzsimons advocates the incorporation of ethnomathematics into Western math curricula in order to achieve a number of beneficial outcomes, including more equitable math performance scores in minority and majority populations, a more balanced view of the history, use, and significance of both Western and non-Western mathematical traditions, and the inclusion of the larger community and cultural context in mathematics instruction.

Adam, Alangui and Barton (2003) identify five different possibilities for an ethnomathematical curriculum. The principal notion that is characterized in all five is the belief that "the cultural aspects of the students' milieu should be infused in the learning environment in a holistic manner, including the epistemology of mathematics, its content, the classroom culture, and the approach to mathematics learning."

Of the five approaches, the one that Adam, et.al., favor is the fusing of the mathematical concepts and practices originating in the learner's culture with those of formal academic mathematics. As stated, it is "hypothesized that a curriculum of this type will motivate students to recognize mathematics as part of their everyday life, enhance students' ability to make meaningful mathematical connections and deepen their understanding of all forms of mathematics." Adam et al., however, admit that more studies need to be done to confirm or disprove these hypotheses.

Grattan-Guinness (2005) offers an overview of the history of mathematics and mathematics instruction over the course of the twentieth century. The author argues that both the first decades and the last decades of the twentieth centuries saw a flurry of advancement and development in the fields of mathematics and mathematics instruction, while the middle of the twentieth century was largely characterized by stasis and relative inactivity.

The author maintains that one of the most sustained criticisms of academic mathematics and mathematics instruction that was directed at the field in the latter decades of the twentieth century is the disconnect between these theories and calculations and the type of mathematical operations that are required in everyday life. Grattan-Guinness reports that one

approach that mathematics instructors have used to overcome the gap between the theoretical and the practical is placing math within a cultural context.

### Articles and Studies Addressing the Use of Ethnomathematics as a Teaching Tool

Davison and Miller (1998) discussed the challenge of engaging students from ethnic, cultural, and racial minority backgrounds in Western curricula, with a particular emphasis on science and mathematics. The authors report that many educators who work with Native American students, in particular, express concern over the difficulty of developing an engaging approach to Western science and mathematics that successfully engages their students.

According to the authors, the type of ethnomathematics and ethnoscience that completely disregard Western assumptions are of limited utility in public school settings. In these environments, it is important to find meaningful instructional methods that can be used to help students engage with the required curriculum. Therefore, the most advantageous approach to incorporating ethnomathematics into a public school curriculum is in using culturally significant examples and vignettes to illustrate conventional mathematical operations and calculations.

Specifically, the authors report that Native American art can be used to teach students about patterns while quilts and loom beadwork can be used to demonstrate geometry. Both of these examples use familiar cultural artifacts as a point of access to Western mathematical concepts. The authors also note that these findings have implications for the training and instruction of pre-service teachers who are likely to work with populations of minority students.

Greene (2000) states that professors of ethnomathematics are not trying to replace the great European thinkers who have shaped modern mathematics but instead they are blending European ideas with African, Asian, Native American, and other mathematical innovations, teaching both European and non-European practices. She offers examples of several professors who incorporate ethnomathematics into their daily teachings. For example, Robert N. Proctor, a professor at Pennsylvania State University, tells his students that the Mayans had the most accurate calendar in the world until the Gregorian reform calendar was adopted in 1582. Another example is Mr. Ron Eglash of Rensselaer's department of science and technology studies who discusses African geometric fractals and their application today.

Bishop (2002) offered an overview of cultural issues in mathematics instruction. More specifically, the author sought to

outline unique issues and concerns involved in researching multiculturally oriented mathematics instruction and ethnomathematics in general.

Bishop attempts to locate the cultural context of math, noting that it shifts considerably in different national, ethnic, and racial environments. The author views ethnomathematics as useful for two primary reasons. First, he argues that identifying the cultural components of math in certain cultures can help students and teachers alike to be more aware of the cultural aspects of math in the Western tradition. Rather than viewing Western math as the norm and all other cultural mathematics traditions as deviations from that norm, a cultural perspective helps students and teachers to see the value in a plurality of traditions.

In addition, Bishop notes that the increasing mobility of the world's population has made the development and implementation of effective cross-cultural instructional methods to be a priority. However, in the study described by Bishop, an ethnomathematics-oriented curriculum was largely unsuccessful in its attempts to expand Chinese students' conceptions of mathematics.

In the type of ethnomathematics-oriented curriculum described by Bishop and other researchers, students are introduced to the mathematical operations developed in

unfamiliar cultural contexts as a way of expanding their perspective of math and deepening their understanding of the cultural influence on how we perceive and use math. In another type of ethnomathematics-oriented curriculum, teachers employ cultural signifiers and situations that are familiar to a particular group of students in order to facilitate their grasp of traditional, Western mathematics.

Civil (2002) reported on the outcome of a study that sought to employ a familiar cultural context in order to facilitate traditional math instruction for young Hispanic and Native American students. Ultimately, Civic regards the use of a familiar cultural context as an effective manner of connecting the activities she differentiates as "everyday mathematics" and "academic mathematics."

In one example that Civil describes, a class of second-graders participated in a learning module that drew heavily on the cultural traditions and social patterns of the surrounding communities, contexts that were familiar to the students. Based on the increased level of student engagement and parental involvement, the author described the experience as a success. In conclusion, Civil asserts that ethnomathematics may be an effective tool for bridging everyday mathematics and academic mathematics, as well as helping students from traditionally

marginalized minority groups become more successful in Western mathematics.

Meaney (2002) acknowledges that math is a high-status subject, and that in order to attain success in a number of socioeconomically advantageous career pathways, students need to be conversant in mathematics. From this perspective, the author identifies the development of successful mathematics pedagogies with social justice, because the presence or absence of this skill set can largely determine whether a student will be able to succeed in a number of high-status educational and professional settings.

However, when a student population with a sizable number of ethnic, racial, or cultural minority students is confronted with the rigors of traditional, Western mathematics, a number of difficulties can arise. If left unaddressed, these difficulties can limit students' potential for success in mathematics and in life. The author identifies a number of problems that are likely to cause difficulties for minority students receiving instruction in traditional Western mathematics, many of which are based on cultural and linguistic differences.

Still, Meaney does not recommend the use of an immersive ethnomathematics approach that completely discounts the importance of Western modes of mathematics. Instead, the author advances the notion of a combined methodology that relies on

culturally familiar situations, concepts, and strategies to begin to allow students a means of engaging with traditional Western mathematics. The author also recommends that parents and other community members should be encouraged to play an active role in curricular development in order to ensure that the content and instructional methods are consistent with the cultural tradition of the community.

Nicol and Crespo (2005) employed a different approach, in which they employed culturally unfamiliar examples as a means of engaging students in mathematics instruction. The students were presented with real-world examples of mathematics problems from unfamiliar cultural contexts, such as the Mayan Codex. The authors reported that this activity evoked deep engagement and interest from students, while also reinforcing the concept that mathematics can be highly relevant in real-world problem-solving situations.

#### Articles and Studies Criticizing Ethnomathematics

Vithal and Skovsmose (1997) assessed ethnomathematics from its inception to the mid-1990s, based on a literature review of qualitative and quantitative studies of the subject. The authors present a comprehensive analysis of the variables that led to the popularity and growing prevalence of ethnomathematics. They identify the end of colonialism and the advent of post-colonial

modernity as the chief compelling factor, as well as former colonial societies' attempts to rid themselves of lingering Eurocentrism.

Vithal and Skovsmose argue that an ethnomathematics that completely rejects Western mathematical precepts and assumptions may have been necessary during a transitional period in the interim between colonialism and post-colonialism. However, they strongly reject the notion of permanently abandoning traditional Western mathematics.

While the authors express empathy with the aims and underlying intentions of the proponents of ethnomathematics, they question the utility of an education that abandons large swaths of received knowledge. In conclusion, they suggest that educators employ culturally familiar pedagogical modalities and examples to initiate minority students into the modes of thinking that are necessary to master Western mathematics.

Rowlands and Carson (2002) undertook a critical review of ethnomathematics, both as a concept and as a pedagogical strategy. Based on the findings of their literature review, the authors strongly object to the type of ethnomathematics instruction that discounts the importance of formal, Western mathematical concepts and skills. They argue that this approach ultimately serves to render students unfit for many rewarding career paths. As stated, "there is every danger that

mathematics as an academic discipline will become accessible only to the most privileged in society and the rest learn multicultural arithmetic within problem solving as a life skill."

However, the authors do not object to the practice of using culturally familiar contexts and examples to teach formal mathematics. Indeed, for minority students, this practice can be highly beneficial, the authors conclude. However, the cultural contexts should be used to allow students to gain access and fundamental conversancy with formal, Western mathematics, rather than replacing them altogether. An ethnomathematical curriculum that rejects formal mathematics will disenfranchise the students that it is purportedly trying to serve, particularly the underrepresented minority.

Weimer (2005) describes 'ethnomathematics' as politically correct nonsense that is corrupting and diluting "one of the most important tools a young person can develop in life." This tool refers to mathematical competency. According to Weimer, mathematics is a subject that is "as universal and international as can be." He feels that ethnomathematics adds "an ideological agenda to a subject that offers marketable skills to all." He suggests that the discussion of cultures and their histories should be left to cultural anthropologists and left out of the math classroom.

The purpose of this study was to introduce the concept of Ethnomathematics by means of a summary of current definitions, a historical background of the discipline and its current and potential applications. In the previous sections a review of related literature was presented. As evidenced by the diverse range of views represented in these sections, the scholarly literature on the subject of ethnomathematics and multiculturally oriented mathematics instruction is complex and disparate, resisting overarching summaries. However, many scholars and analysts seem to tend to reject radical forms of ethnomathematics, instead focusing on a hybridized approach that uses culturally familiar examples and contexts to introduce students to the concepts that comprise Western mathematics. In the following section, the potential for the application of Ethnomathematics in the present day American classroom will be assessed.

### ***Assessing the Efficacy of Ethnomathematics as a Pedagogical Tool***

The core idea of ethnomathematics has evolved considerably in recent years, making a linear history of its application in classroom settings difficult (Malaty, 1998). In fact, a core deficiency of the existing published literature on the subject is the variation in the operational definition of what forms a curriculum or pedagogy informed by the tenets of

ethnomathematics. Another shortcoming is the lack of clear, empirical evidence either supporting or discrediting the claims for the usefulness of ethnomathematics as a curricular construct or pedagogical methodology (Greene, 2000).

However, based on the majority consensus in recently published assessments of ethnomathematics, there seems to be a strong sense that the use of culturally familiar contexts, examples, materials, and resources to facilitate minority students' understanding of the concepts and assumptions upon which Western mathematics is well-founded (Weiger, 2000).

According to the literature on the subject, the worldview and operational paradigms that are evident in many non-Western cultures are not readily compatible with developing a familiarity with Western mathematics, precisely because of the significant degree to which Western culture is reflected in the dominant mathematics (Weiger, 2000). As a result, many proponents of a modified approach to ethnomathematics suggest using culturally relevant examples and contexts as a means of introducing underrepresented minority students to these concepts (Greene, 2000).

The majority of researchers and theorists envision this as a transitional step on the pathway to achieving a fully functional grasp of formal Western mathematics. Today, it is widely agreed that equitable economic opportunities and social

justice for minorities are unlikely to be achieved by failing to ensure that they are well-versed in the dominant mathematical paradigm of Western culture (Greene, 2000).

While deep immersion in ethnomathematics is now largely regarded as a transitional pedagogy to help minority students gain access to the Western academic discourse, there are also benefits to engaging all students in multiculturally-oriented mathematics instruction. In addition to introducing students to unfamiliar cultural traditions, multiculturally-oriented mathematics instruction can also be employed as a means of introducing the concept of critical cultural analysis, allowing students to identify many of the often-unrecognized traits and characteristics of their native culture (Greene, 2000).

Another important benefit that is associated with ethnomathematics in the literature is the emphasis on the significance of using math as part of everyday life. This can be particularly useful for cultural minority students who may have difficulty distinguishing the usefulness and relevance of formal, Western mathematics to their lives (Edwards and Ruthven, 2003). By employing culturally-significant examples and contexts from everyday life, the often-substantial disconnect that students perceive as separating real life from the academic world can be minimized (Greene, 2000).

A related benefit of using ethnomathematics as a component of formal, Western mathematics instruction is the heightened potential for parental involvement. Many anecdotal reports in the literature report that engaging parents in processes such as curricular content development and the creation of culturally-relevant models has served to strengthen the commitment of parents, and, by extension, the community as a whole, to the notion of formal instruction in mathematics and other academic subjects (Civil, 2002).

### ***Conclusion and Recommendations***

The purpose of this study was to introduce the concept of Ethnomathematics by means of a summary of current research and definitions, an historical background of the topic, and its current and potential applications in the classroom. Although the last several decades have produced a rapidly expanding body of literature pertaining to ethnomathematics, there remain a number of highly pertinent questions and concerns that have gone unaddressed. At the present time, there is no universally accepted operational definition of what constitutes ethnomathematics and its instructional elements. Furthermore, a lack of quantitative data on the subject makes a credible determination of the ability of ethnomathematics to encourage

material improvements in the current math achievement gap very difficult.

However, despite these shortcomings, the literature does seem to suggest that the use of ethnomathematics can be highly beneficial, particularly in a number of specific circumstances. The most frequently cited context for the effective application of ethnomathematics as a teaching tool appears to be in facilitating the introduction of underrepresented minority students to precepts and assumptions of Western mathematics. In a limited, complementary role, multiculturally-oriented math instruction can be beneficial for all students.

### Recommendations

1. It is recommended that scholars, theorists, researchers, and practitioners in the field of ethnomathematics work towards devising a unified, universally-applicable operational definition of the discipline. This will facilitate further quantitative study of the efficacy of ethnomathematics-based pedagogy and curricula.
2. It is further recommended that all of the major elements of ethnomathematics-based instructional methodologies should be assessed in formal empirical studies.

3. It is also recommended that future research on the subject should focus on the development of more specific frameworks for the application of ethnomathematics concepts with different student sub-populations.