# The Cultural and Language Challenges in Teaching Saudi Arabian Students, in the English Language, the Mathematics Needed in Order to be Successful in the Degree Programs of Engineering, Computer Technology and Business Management.

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**Abstract**

This paper deals with cultural factors and language challenges in teaching Saudi Arabian students, in the English language, the mathematics they need in order for them to be successful in their degree programs in Engineering or Computer Technology or Business Management. The approach in accomplishing this goal is utilizing a paradigm in teaching and learning mathematics based on the Ethno-mathematics between 700 and 1100 C.E., which was developed by the Arabs, on the Arabian geological peninsula, and the method is one which creates a classroom environment based on "ethno-mathematics" and "history of mathematics" which will result in making mathematics more alive, realistic and accessible. Ethno-mathematics 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.

**Introduction**

The cultural nature of mathematics: At the heart of beliefs about the cultural nature of mathematics is the nature of mathematics itself. Even mathematicians cannot agree on the nature of mathematics. One primary issue is whether mathematics is external or internal to the person. For example, some believe that mathematics is a human invention; others believe that mathematics is embedded in nature and must be discovered. The authors of this paper believe that mathematics is a cultural product that has developed as a result of various activities within a culture, but that the "results" of mathematics is embedded in nature and must be discovered. Thus each culture has investigated mathematics in the light of its own needs and activities but the results of their investigation are in agreement with the results of other cultures. That is, the cultural "products" that are observed are common to all cultures included counting, locating, measuring, designing, playing, and explaining.

Utilizing a paradigm in teaching and learning mathematics based on the Ethno-mathematics of the Arabs, particularly between 700 and 1100 C.E., John Sasser, Professor of Mathematics at Prince Mohammad Bin Fahd University in Saudi Arabia, gives evidence in his book, The Islamic Connection, of how the Arabs coupled their own civilization of the Babylonians with the Egyptians and the Greeks and acted as a medium for transmitting to Europe those intellectual influences which resulted in the Renaissance. No people in the Middle Ages contributed to human progress so much as did the Arabic speaking people. For over five centuries (700 CE - 1100 CE) during the Middle Ages more works were produced in philosophy, medicine, history, religion, science and mathematics through the medium of Arabic, than through any other language. The reader should keep in mind that within this book "Arabian" refers to an inhabitant of the geological peninsula.

Islam permeates every aspect of the Muslim's life and the Quran is the declaration of Allah to show the right path. Thus, once one understands some things the Quran teaches, then one sees how the influence of Islam cannot be divorced from the Arabs contributions in Mathematics.

From the 7th through the 11th centuries, significant contributions were made to mathematics by the Arabic speaking people because of Islam. [Sasser, 2000].
Amongst the vast anthropological research exploring the development of mathematical thought, an extensive body of research showed an intuitive mathematical thinking emerging in largely undereducated cultures. Such intuitive mathematical development was observed in the native people of Australia (Harris, 1991), in Liberia (Gay & Cole, 1967), in North America (Ascher, 1991), in the Pacific Islands (Kyselka, 1981), and in Africa (Gerdes, 1991a, 1991b; Zaslavsky, 1973.
The development of mathematical thought is also explained by looking into the connection between culture and mathematics. This connection is at least two-folds. On one hand, it explores the evolution of mathematics, the cultural history that gave it the nature of mathematics as we know it today. Work that lends itself to such historical analysis is found in Fang and Takayama (1975), Joseph (1991), Kline (1953), and Swetz (1987). On the other hand, it focuses on the politics of mathematics, the extent to which mathematics shape society's political stands and ways. A sample of such work is explored in Bishop's (1990) essay on the influence of western mathematics on society.
This work provides convincing evidence that mathematical thought is developed intuitively and apart from formal schooling.

**The Cultural Nature of Mathematics Education**
Culture and mathematics have a strong reciprocal and circular connection. Cultural institutions influence the mode of mathematics teaching, learning, and curriculum. Similarly, the mathematical knowledge consumed in schools can and does influence culture and communities.
Two culturally specific contexts prevail in the body of research in the areas of teaching and learning mathematics:

**Employing cultural examples relevant to students' lives, and Multiculturalism where students are exposed to different cultural contexts.**
Many researchers are in support of the type of Ethno-mathematic activities that seek to empower the mathematical teaching with students' relevant experience. The work of Nelson-Barber and Estrin (1995) and Bradley (1984) urges the reevaluation of mathematics teaching to reflect the cultural aspects of the Native Americans; Gerdes (1988, 2001) suggested the use of African Art in elementary schools settings, and Malloy (1997) , Flores (1997) provided cultural activities to improve mathematics instructions to African American and Hispanic Students respectively. A very notable Algebra Project that began in Mississippi in 1982 has been implemented in urban and rural communities across the U.S.. It was proposed by Robert Moses in (Moses and Cobb, 2002) and provided convincing evidence of efficacy of the ethno-mathematics activities.
The use of multicultural activities in mathematics education programs was advocated in many research work such as Zaslavsky's (1991, 1998) who suggested the use of ethno-mathematics in middle school and elementary schools, Karp's (1994) who used multicultural children's literature in teaching mathematics, and Dolinko (1997) who suggested to integrate the use of national flags in instructions. Additional supporting work can be found in Yao (1984) and Presmeg (1998) who suggest multicultural mathematical activities that would empower the students' learning of mathematics.
The situated-cognition literature views the cultural influence on mathematics from a different aperture. This line of research advocates the study of the mathematics learned by adults and students while performing necessary life skills rather than studying the codified mathematics as taught in schools , Barton (1996). Exemplary works of the situated-cognition line of work is

represented in the study of Brazilian candy vendors (Saxe, 1988), the work with illiterate Brazilians (Carraher, & Schliemann's, 1985), The work in the Kewa of Papua New Guinea (Lancy's, 1983), the study of dairy farmers in the United States (Schribner's, 1984), the study of carpet layers (Masingila, 1992), and the study of American shoppers (Lave, 1988).

Place-based pedagogy further explains the circular relation between mathematics education and society. Smith (2002) relates how administrators, teachers, and parents in Fairbanks (AK) restructured their mathematics and science curriculum to take part in the preservation efforts of nearby natural resources. Students of a Calculus course in Seaside (OR) took part in determining the effects of tides on the onshore buildings (Smith, 2002). Place-based projects showed their efficacy when the standardized test scores of high school students improved after working on a project to gather data about a local river (Lewicki, 2000). Many examples of place-based projects emerged as in Big Springs (NE) when students used measurement and scaling to build clay replicas of some buildings (Kroger, 2000) and in Tillamook (OR) when students, through modeling, helped loggers figure out the number of trees and stumps in logged areas (Loveland, 2002).

**Need for Collaboration**

Collaboration among mathematics professionals should take place on: (a) widening the limits of the nature and goals of place-based pedagogy and (b) defining theories and conducting research on place-based pedagogy.

**Widening the nature and goals of Place-Based Pedagogy:**

When comparing the practical applications of ethno-mathematics and those of place-based pedagogy, analytical studies found that ethno-mathematics seek a more comprehensive connection between mathematics and culture than that implied by place-based pedagogy. The dominant characteristics of place-based pedagogy illustrated in the literature, Smith (2002) and Gruenewald (2003), do not encompass all of Barton's dimensions of ethno-mathematics Barton's (1996).

Practical applications of place-based pedagogy invite the students to use mathematics to solve their own community problems. Such practices help the students grasp a deeper understanding of their local environment and circumstances Smith (2002). As significant as this role is for Mathematics to play in place-based pedagogy, it does not maximize on the full benefit of the interaction that exists between mathematics and culture as does the ethno-mathematics applications. This partial role is justifiable though given that place-based pedagogy evolved as an attempt from educators seeking to bridge the gap between schooling and the lives of students. As a consequence, a broader nature of mathematics was not explored and the use of mathematics was prescribed by these connections bridging schools and student lives.

Most place-based pedagogy clearly falls in the mathematics education domain as it defines mathematics as a cultural tool for describing rural places and solving rural problems. The collaborations between the subject experts have the potential to broaden the goals of place-based pedagogy, particularly with regard to mathematics. An enhancement to place-based pedagogy is called for to focus on describing the native existing mathematical concepts, their historical progress, and their uses to explore the locale with all of its dimensions. The latter can help students own up to the mathematics that emerge from their own culture, and value and accept the role that mathematics plays in their culture. When place-based mathematics pedagogy extends fully to cover all of Barton's dimensions of ethno-mathematics, newer mathematics classrooms will materialize for rural teachers and students.

**Conducting Research on Place-Based Pedagogy:**

The scarce research on place-based pedagogy does not provide substantial data on its effect on students, schools, and communities. Broadening the nature of the mathematical applications of place-based pedagogy though, would give rise to a newer variety of research questions which in its turn would reinforce the viability of place-based pedagogy. A newer line of empirical research is needed to clarify the implementation and impact of place-based pedagogy.
The following offer ways for ethno-mathematics research to evolve in rural contexts and for place-based pedagogy research to expand.

**Ethno Mathematics Research in Rural Contexts**

Barton (1996) differentiated the empirical methodologies that depict all aspects of ethno-mathematics research into four types: descriptive, archaeological, mathematizing, and analytical. We will look at the first two different methodologies using Saudi Arabia to illustrate the particularities of the place.
Descriptive ethno-mathematics research and activities explain how mathematics is used in a particular culture. They depict how mathematics is instinctively used by members of a culture in everyday life. Descriptive ethno mathematics research in Saudi Arabian culture might focus on: (a) how mathematics is used to prevent the expansion of desertification that eradicates villages (b) how mathematics is used in local oil industries or (c) how mathematics can be exploited to justify why a local oasis is changing. Much of the current work in place-based pedagogy falls in the Descriptive ethno-mathematics research category. Descriptive research also investigates the attitude of the community in general about mathematics its teachings and learning. Studies might focus on (a) how Saudi Arabian community members perceive mathematics as a school subject; (b) where Saudi Arabian mathematics students go and what they do; or (c) what positions do mathematics teachers play in Saudi Arabian communities. Strategies for helping mathematics educators and policymakers connect mathematics to communities will be on target with the help of this line of research.
Archeological ethno-mathematics research studies the fashion in which Mathematics has taken part in the making and development of the local culture (Barton, 1996). Saudi Arabian examples in this line of research may include (a) how Saudi Bedouin women used concepts of geometry to design and create local tapestry patterns, or (b) how Saudi Bedouin nomads used mathematics to map out and prepare land for communities in a desert region. In the previous examples, individuals were not aware that they were using complex mathematical manipulations.

**Expanded research on place-based pedagogy**
Place-based mathematics pedagogy has strong attributes, yet the goals, nature, and benefits of place-based pedagogy are missing from the literature. Mathematics in place-based pedagogy assumes the role of a tool to explain and to solve community problems. It has not been extensively used as a language to describe our world. This role can be developed in Saudi Arabian classrooms where understanding important geometric concepts can be achieved through analyses of local dress designs, arts and jewelry. Mathematics also can be viewed as the logic to critically explore a situation. This role can be accomplished by having teachers of students in Saudi Arabia ask students to use reasoning to investigate how natural incidents, like drought, dust storms that blow strong northwesterly winds, or plateau erosion affect their communities physically, socially, or economically. Researchers would be interested in uncovering the effects

that these classroom explorations have on students' grasp of mathematical concepts, on their reception of mathematics, and on the deepening of their awareness of their local culture.

**Strengths and challenges of collaboration**

Collaboration between teachers, mathematicians and mathematics educators is vital to the development of an understanding of the purpose and effectiveness of place-based pedagogy. Teachers, especially rural teachers bring in classifications of the important issues that consume the communities they are in. Mathematicians filter the circumstances into mathematical challenges and problem solving. Mathematics educators supplement the experience with various approaches of teaching and learning mathematics. They can judge whether the activity in hand is developmentally appropriate for the particular audience or not.

Researchers of place-based pedagogy focused in their literature on urban, gender, and ethnicity issues but more work on place-based pedagogy is yet to be put forth towards Bedouin culture in Saudi Arabia. Bedouin locales can serve as a bed for ethnographic math research. On the other hand, Bedouin culture is difficult to classify globally under the same characteristics. The practices and beliefs of Bedouin families are different from urban families.

**All students have a right to be skillful in mathematics.**

They have the right to a multipurpose mathematics. They have the right to be taught thought provoking mathematics applicable to their lives. Mathematicians, mathematics educators, rural educators can merge their efforts to provide an empirical basis for improving mathematics teaching and learning. This will assist rural teachers to unveil the true mathematics that is significant and constructive to their students.

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