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On the Importance of an Ethnomathematical Curriculum in Mathematics Education

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ABSTRACT
Cultural values, traditions, and symbols are manifested in the life every society. Culture, therefore, occupies a very important place in human life and society, affecting economic, social, religious, and educational activities. Education in general and mathematical education in particular is also affected by cultural values. This essay discusses the importance of the development and implementation of math curricula that integrates cultural and folkloric elements and values from the daily life and society of the students, including folklore stories, games, and tools, and their contribution to increasing student motivation to study math, which in turn improves their academic achievements in this subject.

Keywords: ethnomathematics, curriculum, motivation, academic achievements, folklore

INTRODUCTION

One of the challenges currently facing math teachers is how to impart to students the mathematical rules and content in a more effective, enjoyable, and successful manner. Arguments in recent years have revolved around the contribution of culture to the promotion of the math taught in schools. The question debated was and remains, "Can the instruction of mathematics that includes cultural values from the students' daily lives contribute to a more meaningful education, to better student achievement, and higher motivation?"

In order to answer this question numerous studies have been conducted and various curricula have been implemented by mathematics educators and researchers around the world. One solution to this problem was proposed by researchers who support the ethnomathematics approach and who testified to the importance of integrating cultural elements and values in mathematics instruction. In their view, an ethnomathematical curriculum contributes to the development of student skills and talents, to a more meaningful comprehension of the material, and to better achievements in math (e.g., Amit & Abu Qouder, 2015; D'Ambrosio, 2002; Lipka, Wong, & Ihrke, 2012; (Verner, Massarwe, & Bshouty, 2013).

On this background, the proposed paper will discuss the following issues: (1) the definition and essence of ethnomathematics; (2) the historical development of the ethnomathematical approach; (3) the political aspect of ethnomathematics; (4) Lev Vigotsky's constructivist theory and its relation to ethnomathematics; (5) the importance of developing a curriculum that integrates cultural values; (6) the contributions of an ethnomathematical curriculum; (7) various approaches regarding the ethnomathematical curricula; (8) proposals for the development of ethnomathematical curricula.

Here are some examples that explain how we would include literature and folkloric cultural values of Bedouin society such as (stories, games, Bedouin folk costume and units of length and weight in Bedouin culture) in our paper, and how we can include it in the process of mathematical education.

FOLKLORE STORIES IN MATH EDUCATION

It is impossible not to mention the vast literature for young children in kindergarten and elementary school, which integrates mathematical elements as a tool that serves math instruction. As math educators, we can use such stories in order to introduce the world of mathematical concepts such as numbers, Permutation, Union (set theory),

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Contribution of this paper to the literature

- This essay discusses the learning difficulties of math students, which are a product of the lack of meaning, logic, and reality they experience, language deficiencies, and inability to analyze and organize complex mathematical concepts.
- This essay discusses the integration of cultural values and elements from the students' daily lives, such as folklore stories, in math instruction.
- This essay highlights the contribution of a curriculum that integrates a variety of methods and learning strategies such as literature, cultural values, and folklore to (1) the instruction of math and the development and promotion of math education and (2) to the broadening of the students' personal knowledge and horizons with information from fields other than mathematics.

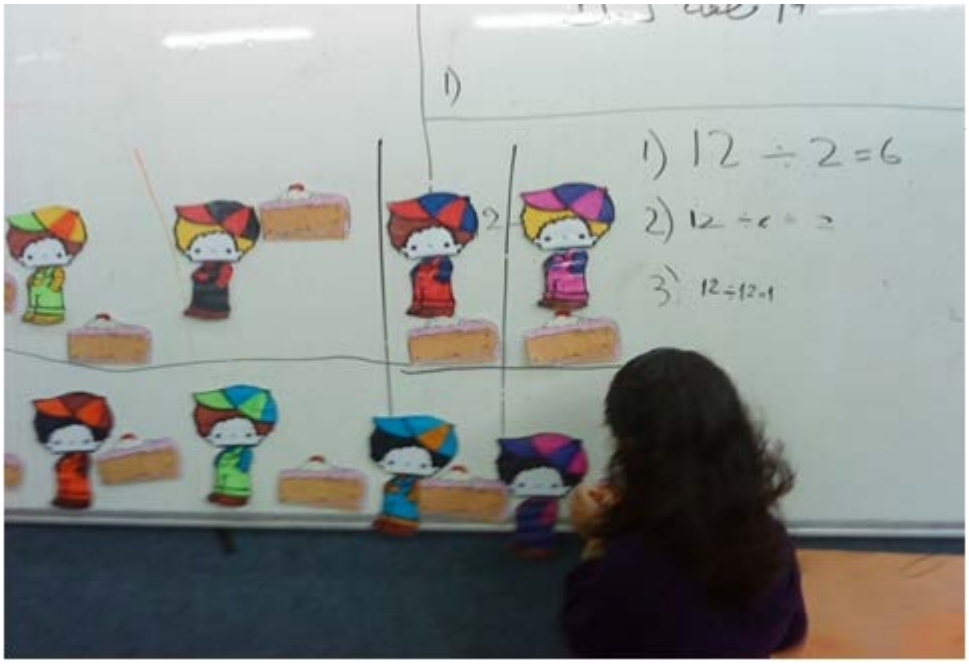

Figure 1. A student solves an exercise on the whiteboard, using a story

Bijection, Set (mathematics), Slide symmetry, Reflective symmetry, Rotational symmetry and many other concepts. All through stories from the daily lives of students or folklore stories from their own culture. Stories can be used in math instruction for various didactical purposes, as a means to improve the students' attitude to mathematics and their achievements in the subject. In other words, the purpose of the literary "cover" of mathematical subjects is to take advantage of its potential to make math problems closer and more relevant to the students, to reduce their anxiety towards these problems and increase their motivation.

An Example of a Folk Story that Contains Mathematical Values and that can be used to Aid the Instruction of Math

"On Hasan's birthday, his grandmother cut 12 pieces of cake, after he told her that he had invited twelve friends. However, only two friends arrived on time and the rest came later".

Question: if Hasan wishes to divide the 12 pieces of cake between his friend Amar and himself, how many pieces of cake would each receive?

Question: If we had 16 pieces of cake and four boys, can we divide them equally between them?

Question: As we have 6 friends and 12 pieces of cake, how many pieces does each child receive?

Figure 2. An example of using a story as an instructional aide in teaching division

THE FOLKLORE BEDOUINS GAMES

Games are susceptible to mathematical and logical analyses, hence, play is an activity integrally connected to cultural heritage and to the world that surrounds the players. Many games induce competition, along with a drive to improve one's play, and as a result, players may apply analytical thinking to further their understandings of games for which strategy might be possible. Games may relate to players' cultural heritage, which is an integral part of the society to which they belong. Various games played by the Negev Bedouins, elders and children's alike are a major part of leisure culture in the desert. Some of these games include mathematical values that help to develop mathematical thinking and can be integrated and used as a teaching strategy in the process of mathematical education. Here are two examples of the Bedouin folklore games that include mathematical values:

Mozkat - 5 Stone Game – (Game description)

The players use their judgment to discriminate between "little" and "large," comparatively sized as in the photo. The game is intended for two or more players, each of whom, in his turn, throws the Mozkat and distributes the little stones according to the rules of each stage. The description below applies to two players, but by turns it can include more than two players. The objective is to do two things simultaneously: catch the Mozkat and arrange the stones, each stage offering different combinations. Each player tries to go through all the six stages, and if the player accomplishes them successfully, he wins 4 points. The winning player is the one who scores the most points. Before they begin the game, the players decide on the winning number of points.

Game objectives in the area of mathematics

1. Counting and adding of numbers. 2. Grouping the four pebbles into possible, allowable permutations, which are a subset of the complete set of partitions that sum to 4. Obviously, this game requires considerable concentration ability

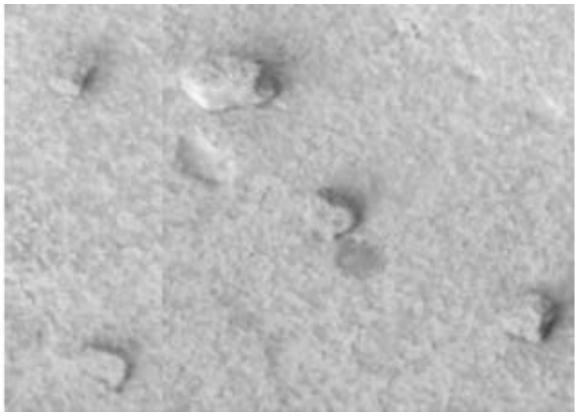

Figure 3. 5 Stones in "Mozkat" Bedouin Game

Figure 4. A sand board for (folklore) Seega game

Figure 5. The modern Seega game

Seega Game

Here we will just remember the Mathematics objectives of the game

1. Finding the center square on the board; and understanding horizontal, vertical, and diagonal directions.
2. Thought development in the form of logical reasoning and thinking ahead.
3. Strategic thinking aimed at optimizing opportunity to "eat" the opponent's pieces.
4. Development of winning strategies by playing multiple times & reflecting.
5. Communicating their thinking.

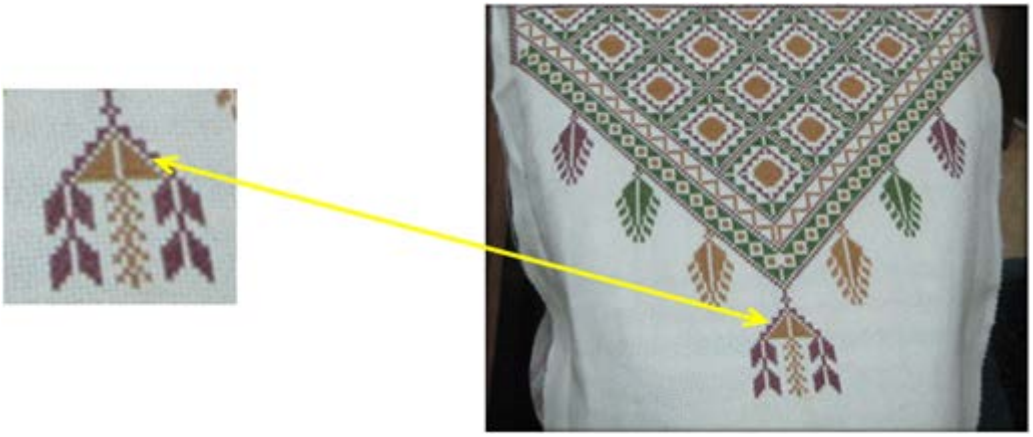

Figure 6. The right triangle embroidered on a Bedouin dress

Figure 7. An example of Bedouin handmade knitted decoration

GEOMETRY AND PATTERNS OF EMBROIDERY IN BEDOUIN FOLKLORE CULTURE

Embroidery in Bedouin folklore is hand-crafted by Bedouin women and embodies various mathematical values. Therefore, including it as an instructional aide can enable students to become familiar with and experience various mathematical and geometrical subjects. In math, these would include addition, subtraction, division, and multiplication, and in geometry this would include geometrical shapes and their properties (triangles, squares, lines, symmetry). At the same time students learn cultural terms used in Bedouin embroidery such as "Seif", "Arg", "Banaig", and Sidriyah", their meaning and uses. For instance, children learning about the right triangle will first learn the theory of the geometrical properties of triangles and then experience embroidering a right triangle using cultural methods and tools used in Bedouin embroidery. This way the material is simplified for the students, made more interesting for them, thereby increasing their chances of properly understanding it. In addition, their sense of belonging to their society and culture is strengthened.

An Example of Integrating Bedouin Embroidery in Math Instruction

In one exercise, the students will receive a work sheet constructed from small squares made especially for work in Bedouin embroidery. Using it, the students will be asked to:

1. Form a right triangle using a descending numerical series
2. Measure the length of the sides in centimeters, using a ruler
3. Draw a triangle using the same data used for the embroidered triangle

UNITS OF LENGTH AND WEIGHT IN BEDOUIN FOLKLORE

Bedouin folklore includes mathematical values in the form of units of length and weight, which we recommended using for math instruction, following our research on the subject (2015). In this scenario, students are required to implement and solve problems using both universal and traditional Bedouin cultural units of measure, while comparing the two. For instance, students would have to use a tape to measure the length of the class while also using the traditional "hutwa". This way the students learn both universal units of measurement (cm, km) and weight (gram, kg) as well as traditional cultural units of measuring length (baa, dera'a) and weight (rital, wakiah)

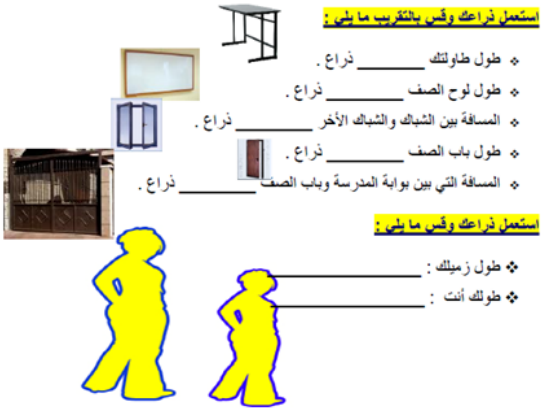

Figure 8. Conducting measurements using dera'a

Figure 9. Using retel to calculate an objects' weight

Example 1: In the following exercise the students are asked to use their own "dera'a" to measure the length of the bodies in the exercise

Example 2: Units for Measuring Weight

In this exercise, the students are asked to measure the weight of the bodies in the picture using the traditional tool "retell".

وأيضا :

الرقم	الموزون	وزن بالوقيه	الوزن بالرطل	الوزن بالكيلو غرام
1	وزن بطيخة كبيرة		16	
2	وزن مربي الصف			60
3	وزن سيارة متوسطة			1000
4	وزن كيس قمح	16		
7	وزن حاسوب بيتي		3	
8	وزن حفنة ذهب			1/4

الرقم	المقاس	القياس بالذراع	القياس بالباع	القياس بالقدامة
1	طول باب صفك.	8		
2	طول النوافذ الخارجية لمدرستك .			5
3	طول الشجرة الطويلة في ساحة المدرسة.		8	
4	طول الساحة التي تقع أمام الصف.	80		
5	مساحة غرفة المختبر الموجود في الصف .		6	
6	مساحة بيت الشعر عند البدو.			4
7	طول المسافة بين السيارة التي تركت في ساحة المدرسة وبين المدرسة .	12		

Figure 10. Exercise for using and comparing several traditional units of length

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