REFLECTIONS ON THE PEDAGOGIC POTENTIALS OF KERALA CULTURE WITH SPECIAL REFERENCE TO MATHEMATICS EDUCATION

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Abstract

Mathematics is the study of numbers, sets of points, and various abstract elements, together with relation between them and operation performed on them. Mathematics deals with size, order, shape and other relationships among quantities. Mathematics is variously considered as a language, an art, a science, a tool and a game. This mathematics can be transacted to the new generation in a more meaningful way if we attempt to correlate it with the life experiences gained from one's own culture. This paper is a reflection on some experiences the principal author received from the childhood in Kerala, which is being analysed as a teacher educator to search for the pedagogic potentials of these experiences. Meaningful Mathematics learning that helps to realise the cultural aim of education is the theme on which the paper is focused.

Mathematics

Mathematics is the study of numbers, sets of points, and various abstract elements, together with relation between them and operation performed on them. Mathematics deals with size, order, shape and other relationships among quantities. *Mathematics* is variously considered *as a language, an art, a science, a tool and a game. (Lexicon Universal Encyclopedia)*

It is a language because it has its own symbols or sounds to express size and order. Equations and statements of inequalities are mathematical sentences. Mathematical elements such as constants and variables are analogous to parts of speech. (Lexicon Universal Encyclopedia)

It is seen as an art, as notions of artistic beauty and harmony exist in the patterns, relationships and symmetries of arithmetic and geometry (Lexicon Universal Encyclopedia).

Mathematics is also considered as a science of logical reasoning in which conclusions are arrived at. It involves a search for truth (Lexicon Universal Encyclopedia).

Math is a tool in that it contains the skills of problem solving, organizing, simplifying, interpreting data and performing calculations that are necessary in other subjects (Lexicon Universal Encyclopedia).

Mathematics is a game as one can create a set of consistent rules and regulations and proceed by logical reasoning resulting in inventions. They enjoy challenge of developing new mathematics (Lexicon Universal Encyclopedia)

Mathematics is the science that deals with the logic of, shape, quantity and arrangement. Math is all around us, in everything we do. It is the building block for everything in our daily lives, including mobile devices, architecture (ancient and modern), art, money, engineering, and even sports (Elaine J. Hom)

Role of Reflection in Teaching- Learning

Confucius, famous Chinese philosopher and teacher reminds us of the ways in which humans *learn to attain wisdom*, simplest way of which is imitation, experience being the bitterest and *reflection being the noblest*. Imitation is a social form of learning where we pick up from one another by observation and modeling. Experience enables each one of us to go through different transformations which remain unique and challenging. *Meaningful reflection*, being the noblest way to attain wisdom, helps to connect different concepts to already established theories, stimulates various insights, thereby, strengthening ones capacity to absorb and learn. We learn from *reflecting on experiences. Every research* and an investigation in the field of education *is a process of learning or acquisition of new knowledge, rooted in the investigators life experiences enriched by meaningful reflections.*

Kerala Culture

Kerala, a beautiful land on earth, in the southwest part of India, between Western Ghats and Arabian Sea, is very famous for its *rich history of art and cultural heritage* (Kerala tourism statistics, 2009). Former Prime Minister of India, Shri Atal Bihari Vajpayee's inaugural speech at the Global Investor Meet in year 2003, included reflections on Kerala thus; "Kerala has always fascinated me. This strip of verdant land between the blue sea and green mountains has a richness that is divine to any eye. I see Kerala's greatness in the gopurams of its temples, the spires of its churches, and the domes of its mosques. What a glorious tradition of peace, harmony and social reform you have inherited". The name *Keralam* is believed to have been originated from the word *kera* and *alam*. Kera means coconut and alam means land or location - Thus it is meant *The Land of Coconut Trees (*A social history of India, 2000). The development of *Malayalam* took place and Kerala became a linguistically distinct region in the early 14th century. The mother tongue of Kerala is *Malayalam* and the natives are known as *Malayalees*.

The richness of the Kerala culture is manifested in the dance forms, music forms, design making, painting, drawings, architecture, martial arts, dress patterns, handicrafts, wood and metal carvings, sports, festivals and celebrations, agriculture etc. Among the various art forms of Kerala, Kathakali and Koodiyattom have intrigued people worldwide. UNESCO brought to light, Koodiyattom, and declared it as one among the "Masterpieces of the Oral and Intangible Heritage of Humanity". (18 May, 2001, UNESCO). The essence of 'Kerala culture' is the sum total of the marvelous achievements of the people in the past acquired through religions, festivals, folklore, dance, theatre, painting, music, architecture, sculpture, handicrafts, education, libraries, agriculture, newspapers and other media, ayurveda, literature, spirituality and the like. It is the prime duty of our state administration and the generation to which this wealth is bequeathed to, to preserve the cultural identity of this land and transfer the noble elements of it to other people who come here as tourists. The mix of various castes and communities, even in terms of their settlements is one of the hallmarks of Kerala Culture" (K.N. Ganesh, 2007).

Pedagogic Potentials of Kerala Culture with respect to Meaningful Mathematics Teaching – Learning

Kerala with a cultural identity is manifested with experiences that can be directly incorporated into our classrooms. This can be done by the interlinking of various subjects and their learning, to experiences drawn from our culture. The paper is an attempt to focus on learning based on reflections from our own life/childhood experiences. *Kerala* is a state with *unique cultural assets*; again it is a place with *unique mathematical usages*. For example Malayalis call certain fractions with some special names, like ¼ is *kaal*, ½ is *ara*, ¾ is *mukkal*, 1/8 is *arackaal*, 1/16 is *makani*, 1/20 is *mav*, 3/80 is *mundane*, and 1/80 is *kani*. The term for almost whole is *arackalmakanimundanium* (Encyclopedia of Mathematics, p -467). Leaves of the coconut trees are arranged in golden ratio (Encyclopedia of Mathematics, p -479). Kerala's unique cultural assets and its unique mathematical usages can be used to add new knowledge to the field of Mathematics Education.

A child born and brought up in Kerala should be well aware of our glorious cultural heritage. Such an awareness should be created in the child from the school days itself or to be more precise from the classroom itself. Mathematics is one of the best subjects which can act as a medium for creating such awareness in the child. All people whether literate or illiterate are cultural actors, and mathematics, being a cultural product, is created by humans in the midst of culture; it involves counting, locating, measuring, designing, playing, devising, and explaining, and is not to be restricted to academic Mathematics. The contributions of great mathematicians are worth to be mentioned with this regard. Pythagorus had discovered a fourth series in addition to arithmetic progression, geometric progression and harmonic progression. If four numbers are in the ratio a: 2ab/(a+b) : (a+b) / 2: b, then they are in musical progression. Example numbers *6, 8, 9, 12 are in musical progression*. The sounds of instruments like violin is related to this series (Encyclopedia of mathematics, p-473)

A reflection on childhood experiences received from Kerala had contributed a lot to experiment with different strategies in the mathematics classrooms. Observing the mother doing household works or kitchen activities and imitating her by making use of resources like sand, mud, leaves, flowers, coconut shells and many more such materials taught lessons of co-operation and the importance of collection of available resources from the immediate environment. Many of these resources like coconut shell, banana leaves, plantain stem, papaya leaf stem, etc. were geometrically relevant ones.

Figure1. Coconut shells cut into two halves which are *hemispherical*, which was used as a main utensil in the kitchen games of childhood.

The painting of these coconut shells involved the concept of *curved surface area of hemisphere*. The coconut shells were filled with sand and inverted to make a small dome shape of sand which the children used to say as *chiratta puttu(manappam)*. This included the concept of *volume of hemisphere*.

Figure 2. Manappam formed by filling sand/clay in hemispherical part of coconut shell

Figure 3. Banana (Plantain) leaves used for serving food shows the parabolic shape

The game with a ball and a pile of flat stones stacked (*adiyeru, seventiles*), the game with pattern of rectangles drawn then hoping to retrieve an object that has been thrown somewhere within the rectangle (*akkukali*), other games like *kachikali/ golikali, kuttiyum kolum, spinning of wooden top, hide-n seek,* all provided variety childhood experiences reflections on which helps in developing joyful math learning activities for school children later in the life.

Figure 4. Some childhood games of Kerala

Preparing variety of toys like *olapandhu(ball using coconut leaves), kappathandu mala(garland using tapioca stem), kattadi(improvised model of windmill), weaving of coconut leaves* for making roofs of old houses and the reflections on these led to think about improvised learning aids. All these were good examples of mathematical number sequencing, mathematical patterning and mathematical modeling. The tapioca stem *(kappa thandu)* when observed carefully we can see that the positioning of nodes can be taken as example of number sequencing with a common difference being the distance between the nodes.

Figure 5. Traditional toys made using coconut palm leaves and other leaves like that of jackfruit.

Figure 6. Weaving of coconut palm leaves, beautiful example of mathematical patterning by selecting non-adjacent strands for weaving

Figure 7. Tapioca stems showing the nodes which are examples of patterning and sequencing

The *changadam savari* was a memorable experience worth mentioning here. The elder brothers and sisters enjoy themselves the pleasures nature had kept for them bathing in the *thodu* nearby. They enjoyed making fun of the younger ones who watched them enthusiastically, but having to stay alone staying alone on the banks. Some of the elders were kind and thought about how they could help their younger ones too to get this pleasurable experience, but safely. They searched for *strategies to solve these problems.* A *changadam* was the solution. Material used was *vazhathada (trunk of banana plant).*

It triggered *creative problem solving*.

Figure 8. Cylindrical shaped *Vazhathada*, a few of which is combined together and used for making *changadam* to float in water.

There are many possibilities in our secondary school curriculum, where the topics can be taught in a more meaningful and interesting way, based on Kerala culture. The creation of a mathematically robust lesson with a meaningful cultural background requires an in depth understanding of the culture as well as Mathematics. For example, of all the prisms with same base perimeter and height, a cylinder has the

greatest volume; most of the wells and other water reservoirs in Kerala are in this shape. These two different evident facts can be connected and correlated to learn the concept of *volume of cylinder*.

The major cultural aim of education is to *impart in children the cultural and social heritage.* Education takes responsibility of *preservation* of culture; education helps in the *promotion* of cultural, social and civilizational values. *Cultural evolution* is another important cultural aim of education. The *transmission* or the shift of cultural values from one generation to the next is also a fundamental cultural aim of education. As education enlightens the minds of the individual with rays of culture, education is also responsible for the revival and growth of cultural heritage.

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