The Perspective of Mathematics in Traditional Malay Society with the Ethnomathematics Approach

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ABSTRACT— *This paper demonstrates the fundamentals of understanding mathematics within the traditional Malay culture. Western scholars have labelled the Malay community as those who are not able to evaluate the accuracy of mathematics. However, it is obscure to accept that the mathematical ideologies of Malays are merely based on their close observations of nature. In this respect, the study of ethnomathematics is relevant to analyse the mathematical ideas of traditional people, which were initially used in the discipline of Anthropology. Literary works are a reflection of the mind and culture of a society. Thus, this paper analyses three works of Malay oral literature; The Tales of Awang Sulung Merah Muda (Hikayat Awang Sulung Merah Muda), The Tales of Terung Pipit (Hikayat Terung Pipit) and Raja Donai Bahtera Kulit Kacang; all of which were basically presented by Malay storytellers. Each set of Malay mathematical ideas are interpreted based on a matrix system that is parallel to the thoughts and views of the Malays. Several mathematical techniques are used actively in the text; for instance, in the determination of the length, weight, predictable time and other such calculations. Indirectly, this analysis proves that the traditional Malay community is capable of assembling their mathematical ideas perfectly and in harmony with their perception of culture.*

Keywords— Ethnomathematics, traditional, oral literature, Malay, word-view

1. INTRODUCTION

Studies of traditional Malay literature have predominantly been done by Western scholars since the beginning of the British colonization. British and Dutch scholars, like W. E. Maxwell, Roorda van Eysinga, R. O. Winstedt, R. J. Wilkinson and H. Overbeck are some of those who have contributed greatly to the study of Malay manuscripts; from the process of collection until the review of the texts. Most are products of European romanticism that analysed the works of colonized people from their perspective as colonials. This is why they were always sceptical about the work of colonized people and most often rejected the mathematical ideas of the Malays, as they considered them to be inaccurate. Ethnomathematics are mathematical ideas that emerge and are utilized in the life of a traditional society [1]. Mohamad Zain [2] defines ethnomathematics as a taught, enunciated, utilized and written idea of mathematics in the Malay language according to Malay values. In fact, the Malay community has known the term 'mathematic' or *'ilmu hisab'* or *'kira-kira'* since the advent of the Hindu-Buddha's period. The influence of Hindu-Buddhism introduced the Sanskrit language into the Malay world as early as the 3rd century AD. This is proven through the inscriptions of Talang Tuwo (684 AD), Telaga Batu and Kedukan Bukit (683 AD), Karong Brahi and Kota Kapur (686 AD). Initial research of Malay ethnomathematics was done by Mohd Zain [2, 3,4,5,6] and Abdul Kadir [7], although their study only focused on the epistemology of numbers in the Malay society. Since then, no further studies using Malay literary works have emerged as a source of understanding the view of the Malay world and culture. Hence, this paper will analyse three stories told by traditional Malay storytellers to unlock the perspective of Malay ethnomathematics and scrutinize this traditional community in terms of how they tolerate and express their calculation methods and views in their humble lives.

2. WHAT LIES BENEATH': ETHNOMATHEMATICS IN THE ORAL MALAY TRADITION

Folk literature is an oral literary product owned by a group of people who have inherited it from generation to generation. These people are a minor group within a large community, who live in uncomplicated, traditional civilization,

and strongly adhere to old cultures. Oral literature strongly survives even within a community of written tradition. This results in a parallel relationship between these two genres in the development of Traditional Malay Literature [8]. For instance, the *Tales of Awang Sulung Merah Muda (Hikayat Awang Sulung Merah Muda)* and *Tales of Malim Deman* (*Hikayat Malim Deman)* are still classified as oral literature even though they have been written in the 1960's. As stated by Sweeney [8], *"[...] since the advent of writing in the Malay world, the development of neither tradition has been independent of or even parallel to the other."* This study will analyse three such stories of Malay oral literature which highlight the concept of ethnomathematics in the community as represented through their literary works. The limited use of 'numbers' by the Malay community also represents the confinement of knowledge regarding the numbering systems. As stated by Ascher [1], '*Different cultures make different use of the counting facility; some generate lots of number words and a very few generate almost none. How many words are generated does not reflect the differences in capability or understanding; it reflects the degree of number concern in the culture'*.

2.1 Measure of Size

The measuring process involves determining the height, size, width, length and distance between one place and another using a specific measuring scale. Unfortunately, these measurement tools are unfamiliar to the traditional Malay society. Nevertheless, they are still capable of formulating an assessment of measurement in accordance with their own perspective, based on their observation of the environment.

2.1.1 Height and Length

Height is the measure of the distance from top to bottom. *The Tales of Awang Sulung Merah Muda* [9] describes the strength of his kicking ability as the height of young coconut palms. Using the matrix system as a source of standardized measurement, '*pohon kelapa belia'* or young coconut palms are estimated at around 4 to 6 metres in height, whereas a mature coconut tree grows up to 15 meters, depending on the type of species. On the other hand, the weight of the stone itself is one *pikul* (100 *kati* or 50 kilogram). Therefore, it's difficult to judge the strength of Awang Sulung as a normal person. It shows that the Malay storyteller has enlarged the exceptional ability of a very special character in the tale.

The length is the measure of distance between two points. Remarkably, the Malay community measures distances according to the length of the parts of their body. In *The Tales of Awang Sulung Merah Muda* [9], the axes and hatchet worshiped by Awang Sulung Merah Muda came to life and built a boat which was required by Datuk Batin Alam, at the length of '**seven depa sehasta sepeliuh sepelembai'** [9]. It is a common phenomenon for the traditional Malay society to call upon their ancestors' souls and spirits in order to help them when facing difficulties in life. Initially, the primitive man believed in a force of power known as '*mana'* [10]. The Hindu-Buddhist influence on the Malay world introduced the term 'magic' (*sakti*). A magical prowess owned by a certain individual increases his ability to resolve any work entrusted to him. For example, Hang Tuah, as the Malay national hero, attributed his strength to his *keris* of Taming Sari. *Keris* should be showered with lime and smoked with incense at a certain time of day in order that the spirit will still remain strong within. As such, Awang Sulung Merah Muda succeeded in building the boat with '**seven depa sehasta, sepeliuh, sepelembai**' using his extra-ordinary tools [9]. The definition of '*depa'* from *Kamus Dewan* [11] is the measure between two straight arms, which is estimated at around 62 inches or 1.56 metres for a normal adult. '*Hasta'* is the measurement of length from the elbow to the middle finger, which is estimated at 43.5cm or 0.44 metres. Whilst '*sepeliuh'* is similar to '*sedepa*', around 62 inches, '*sepelembai'* is the distance that can be achieved with one's hands (half of *sedepa*), which is estimated at 0.78 metres. Based on the four types of measurements, the approximated length of the boat was **seven depa** = 7 x 1.56 metres = 10.92 metres; **sehasta** = 0.44 metres; **sepeliuh** = **sedepa** = 1.56 metres; and **sepelembai** = 0.78 metres. Therefore, the total length of the boat made by Awang Sulung Merah Muda was 10.92m + 0.44m + 1.56m + 0.78m = 13.7 metres. This shows the remarkable abilities of this character, who made such a big boat using only an axe and a hatchet.

2.1.2 Large and Width

The traditional Malay society believes that all natural phenomena, such as floods, volcanoes, large trees and stones etc., are all overshadowed by a power that must be worshiped in order to guarantee the well-being of life. Animistic beliefs practiced by the Malays before the introduction of Hindu-Buddhism and Islam are practiced by many primitive societies in the world. Moreover, animism as a form of universal cultural beliefs has influenced their thought on the supernatural elements. Thus, if they face any weird happenings or phenomena in their life, they spontaneously believe that a supernatural power lies behind it. For instance, it took half a day to walk around a huge tree that was found by Awang Sulung Merah Muda [9]. The Malays refer the term '*hari'* as 'day', i.e. from sunrise to sunset. Hence, 'half a day' meant that 6 hours was required to walk around the said tree. It is not a surprising phenomenon, simply because it is known to be the style of Malay authorship - exaggerating any event which had a significant effect on the main character. *The Tales of Raja Donai Kulit Kacang* [12] reflects the estimated size of a cannon ball as the size of a coconut (**sebesar**

buah nyiur). Perchance, this cannon ball is likely smaller or larger in size than a coconut. This proves that the Malay community triumphs in making an estimation based on their observations of the environment rather than referring to precision. Basically, the diameter of a coconut is determined by its grade; a high grade of coconut has a diameter larger than 40cm while a low grade coconut measures less than 40cm. Considering that a normal sized coconut has a diameter of 40cm, rationally the possibility of the size of the artillery is less or more than 40cm.

2.1.3 Distance and Weight

Kamus Dewan [11] definition of 'distance' (*jarak*) is the space (distance) between two places, things and so forth. In *The Tales of Raja Donai Bahtera Kulit Kacang* [12], the distance of '**seratus tanah' (one hundred steps)** was taken by the Hulubalang Tengah when carrying Tuk Bidan, who is large in size. Probably, the Hulubalang Tengah took short steps due to the heavy burden he had to carry. Thus, it can be estimated that a normal step of a normal adult male who bears a burden is approximately 1.5 feet or 0.46 metres. Moreover, '**seratus tanah'** = 1.5 feet (0.46 meter) x 100 = 46 metres. *A Tales of Terung Pipit* [12] specify the concept of weights used by the Malay community. '**Eighteen tahil nine bahara**' refers to the weight of mast (of a ship) taxable by authorities. *Kamus Dewan* [10] definition of '*tahil*' is a weight of 37.8 grams (for goods). Whereas, '*one bahara*' equals 205 *kati*. Weight measurement according to the matrix system is 1 *tahil* (goods) = 37.8 grams. Thus, 18 *tahil* = 37.8 x 18= 680.4 grams. Nine *bahara*= 205 *kati* x 9 = 1845 *kati* = 922.5 kg. Hence, the total tax is 680.4 gram + 922500 gram= 923.18 kg.

2.2 Time Estimation

The concept of time for the Malay community is broad and relative. Their observations of, and sensitivity to the changes in natural phenomena inspires the concept of time. For example, the rising sun in the morning is associated with the cackle of cock and the chirping of magpie-robins (**ayam berkokoklah dan murai membaca kicak-kicau bunyi suara**) [14]. A quiet night is symbolized by 'the kids were awakened twice from their night's sleep, youngsters returned from their night out and old people stirred in their sleep' (**Budak-budak dua kali jaga, orang muda balik bertandang, orang tua beralih tidur**) [12]. The period of pregnancy too is symbolized with associations to changes in the environment; i.e. 'the incubating time for a hornbill, a time for papaya and rambai to bear fruit (**selama enggang mengeram, selangkas betik berbuah, semasak buah rambai)** [9]. Thus, the reference of Puteri Helang Bakau's pregnancy was a long time (approx. 12 months), as compared to a normal delivery, she was impregnated by the very special Awang Sulung Merah Muda. Moreover, the preparation for the circumcision ceremony of Awang Sulung Merah Muda was too long in time; beyond the period of 40 days and 40 nights. The ceremony was referred to as, 'the boiling water flows through the river, the rice crust turns into small mound, the eggplant ripen at the beam house, the turmeric grows over the kitchen shelf, the lemongrass grows on the stove and the buffalo's head turns into a kitchen stove' (**air didih menganak sungai, kerak nasi membusut jantan, terung berbuah di gelegar, kunyit berhimpang di atas para, serai beranak di atas dapur, kepala kerbau dibuat tungku**) [9]. Thus, a big feast was made to celebrate the circumcised prince. On the other hand, the feast involved almost all ranks of society, from the highest to the lowest, from the immediate surroundings of the palace to the most remote areas furthest away. People came from across the state, crossing fields and rivers for many days. They came with the whole family, bringing with them their cattle and other requirements. If the feast only took a day, it was not deemed worthwhile for the people who have struggled to honour the invitation of the king.

2.3 Age Calculation, Multiplication (X) and Summation (+)

Awang Sulung Merah Muda tells his age to his youngest mother as, 'I do not know the custom, I am just as old as a year of corn, my bloodspot's as big as a betel nut, grown under swaying bananas, under a large circle of sugar cane' (**Anakanda tiada tahu akan adat, anakanda baru umur setahun jagung, darah setampuk pinang, besar di bawah pisang goyangan, besar di bawah tebu melingkar**) [9]. In fact, corn, bananas and sugar cane are short term crops which take less than 12 months to harvest. The term 'a year of corn' means a young individual; raw, with lack of knowledge and experience. This is the uniqueness of the Malay community - their ability to symbolize the changes of human age using their harvests for reference. Indirectly, it proves the close bond the community bears with the agriculture sector. *The Tales of Raja Donai Bahtera Kulit Kacang* [12] introduced the element of multiplication 'darab' (x) as cited in the tales, 'in approximately two times seven days, Donai's cuts will be cured' (**lebih kurang dua kali tujuh hari, sembuhlah luka Donai**). Thus, two times seven (2x7) is 14 hari or two weeks. The element of summation (+) was presented when the King's shaman wanted to give him the medicine, 'previously for three years of time, then add three more years, but if it is not cured again, additional for another three years. So nine years together, my Lord' (**tambahnya tiga tahun lagi, dan jikalau tidak baik juga, tiga tahun lagi. Jadi sembilan tahun semuanya, tuanku)** [12]. This means that the King Donai should have his medical treatment for a total of 9 years (3 +3 +3 = 9 years).

3. CONCLUSION

The close relationship that the Malays bear with nature is what influences them to use it as their way of expressing their idea of ethnomathematics. Moreover, the beautiful language and style used by the storytellers add to the uniqueness of the tales. Inserting Malay proverbs as a scale to measure the concept of time enhances the understanding of a Malay's view point. In fact, this study proves that several tools used for estimation by the Malays are still acceptable once they are converted into a matrix system. Only a few measurements illuminate the Malays' beliefs and mind-sets. The emergence of Hindu-Buddha and Islam in the Malay Archipelago embellished the concept of 'mathematics' among the people. Furthermore, the expansion of Western colonialism, especially British and Dutch in the 17th and 18th centuries, introduced the concept of 'realism' to the Malay community, which emphasised on fact and accuracy. Gradually, it successfully changed the Malays' view of mathematics and helped absorb the inherited ethnomathematics. However, many challenges need to be addressed by Malaysian ethnomathematics researchers and scholars in order to intensely scrutinize the knowledge of the community.

4. REFERENCES

[1]   Ascher, M. A Multicultural View of Mathematical Ideas. Chapman & Hall/CRC: Boca Raton, 1991.
[2]   Mohamad Zain, S. "Etnomatematik Melayu", SARI, 20, pp.97-112, 2002.
[3]   Mohamad Zain, S. Matematik dan Tamadun Islam: Pembinaan Sistem Angka. Badr Kubra: Bangi, 1985.
[4]   Mohamad Zain, S."Sistem Angka Melayu Sebelum Kedatangan Islam". Laporan Cuti Sabatikal, Bulletin of Malaysian Mathematical Society, 23 (1), pp.1-34, 2000.
[5]   Mohamad Zain, S. and Salleh, A. R. "Sistem Nombor Melayu". Jurnal Bahasa, 3, pp.423-443, 2001.
[6]   Mohamad Zain, S. "Etnomatematik Melayu". SARI, 20, pp.97-112, 2002.
[7]   Abdul Kadir, M.A."Etnomatematik dan Bahasa Melayu". SARI.2005; 23, 37-46.
[8]   Sweeney, A. A Full Hearing. Orality and Literacy in the Malay World. University of California Press: Berkeley, 1987.
[9]   Pawang Ana and Raja Hj. Yahya. Hikayat Awang Sulung Merah Muda, Petaling Jaya, Malaysia: Penerbit Fajar Bakti, 1985.
[10]   Mitchel, G.D. A Dictionary of Sociology. Routledge & Kegan:London, 1968.
[11]   Kamus Dewan. Dewan Bahasa dan Pustaka: Kuala Lumpur, 2007.
[12]   Hitam, Z. Raja Donai Bahtera Kulit Kacang. Muzium Sultan Abu Bakar Pahang: Kuantan, 1987.
[13]   Panglima Hassan, P. A. M. Hikayat Terung Pipit. Penerbit Fajar Bakti: Shah Alam, 1998.
[14]   Ahmad, J. Hikayat Parang Puting. Dewan Bahasa dan Pustaka: Kuala Lumpur, 1980.