Journal of Quality Measurement and Analysis *JQMA* 7(1) 2011, 1-16
Jurnal Pengukuran Kualiti dan Analisis

POPULARISATION OF MATHEMATICS*

(Pempopularan Matematik)

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ABSTRACT

Mathematics is generally regarded as the most dry subject at school, made up of routine, difficult, boring, arcane and irrelevant calculations which have nothing to do with discovery and imagination. You may have noticed how terms in mathematics have an unnerving effect on most students as well as the public. “Dull” and “Urgh” are the most common epithets often used to describe the subject. Whether we realise it or not, mathematics is around us, in our everyday life, and we are using the subject. Mathematics exists in nature. Mathematics is used in the kitchen; when we do our shopping, build a house, travel on the highway, and in whatever things that we do. Even then, whenever we talk about mathematics, many fear the subject; they have the mathematicophobia, and try to avoid the subject. The fact is that, mathematics is a part of our life. We have to make the public aware of this. This is the duty of mathematicians or mathematical scientists. Popularisation of mathematics could be done at various levels in the society, young and old, and wherever we are; at home, nurseries, schools, universities, offices, supermarkets, and on the highways. In this paper we will discuss how this could be achieved.

Keywords: Mathematicophobia; popularising mathematics; various levels in the society

ABSTRAK

Matematik pada umumnya dianggap sebagai mata pelajaran yang amat menjemukan di sekolah, yang terdiri daripada penghitungan rutin, susah, membosankan, penuh misteri dan tidak relevan, dan tidak kena mengena dengan penemuan dan khayalan. Mungkin anda sedari bagaimana perkataan matematik mempunyai kesan negatif pada kebanyakan pelajar dan juga orang awam. “Membosankan” “Urgh” dan “Alamak” adalah kata-kata lazim yang dikaitkan dengan mata pelajaran ini. Sama ada kita sedar atau tidak, matematik berada di sekeliling kita, dalam kehidupan kita seharian, dan kita menggunakannya. Matematik wujud secara semula jadi. Matematik digunakan di dapur, semasa kita membeli belah, membina rumah, melalui lebuh raya, dan dalam apa jua yang kita lakukan. Namun demikian, apabila disebut sahaja mengenai matematik, ramai yang takut akan mata pelajaran itu, matematikofobia, dan cuba menghindarinya. Hakikatnya, matematik adalah sebahagian daripada hidup kita. Kita perlu menyedarkan masyarakat mengenai perkara ini. Ini adalah tugas ahli matematik atau ahli sains matematik. Pempopularan matematik boleh dilakukan pada pelbagai tahap dalam masyarakat, kanak-kanak hingga dewasa, dan di mana sahaja kita berada; di rumah, tadika, sekolah, universiti, pejabat, pasar raya, dan di lebuh raya. Dalam makalah akan dibincangkan bagaimana perkara ini dapat dilaksanakan.

Kata kunci: Matematikofobia; mempopularkan matematik; beberapa tahap dalam masyarakat

* This paper has been presented as the keynote address at the 2nd International Conference on Mathematical Sciences (ICMS2 2010)

1. Introduction

Mathematics is generally regarded as the most dry subject at school, made up of routine, boring, arcane and irrelevant calculation which have nothing to do with discovery and imagination. You may have noticed how terms in mathematics have an unnerving effect on most students as well as the public. "Dull" and "Urgh" are the most common epithets often used to describe the subject. But for researchers in mathematics, it is an adventure in the world of form in which the search for relationships among forms is the main goal of the trade, and in which known mathematics is the craftsman's tool (Brown & Robinson 1989). Whether we realise it or not, mathematics is around us, in our everyday life, and we are using the subject. Mathematics exists in nature. Mathematics is used in the kitchen; when we prepare our food, we must put in enough amounts of salt and spices in the curry, otherwise it will be too hot, tasteless, or very salty. To build a house we need mathematics for its shapes and to estimate the cost needed. We need mathematics when we go shopping, and when we are on the highway. Even then, whenever we talk about mathematics, many fear the subject; they have the mathematicophobia, and try to avoid it. The fact is that, mathematics forms part of our life. We have to make the public aware of this. This is the duty of mathematicians or mathematical scientists. Popularisation of mathematics could be done at various levels in the society, at home, nurseries, schools, universities, offices, supermarkets, highways and elsewhere. In this paper we will discuss how this could be achieved.

The following was an introduction to a booklet produced under an EC Contract at Bangor, North Wales, in World Mathematics Year 2000 (WMY 2000), and which was distributed at the European Mathematical Congress 2000 with a CD-ROM of John Robinson sculptures (Brown 2007).

"Raising Public Awareness of Mathematics is probably the most important goal originally set for the WMY 2000. And there are good reasons for that. The role of mathematics in society is subtle and not generally recognised in the needs of people in everyday life and most often it remains totally hidden in scientific and technological advancements. The old saying: "The one who lives hidden lives best" is not true in present day society. If a subject becomes invisible, it may soon be forgotten and eventually it may even disappear. Mathematics has such a prominent place in school curricula all over the world that probably nobody can imagine such a fate for this subject. But if we do not constantly care about the image of mathematics, we will see continuing pressure to lower the amount of mathematics at primary schools, secondary schools and at the university level. Mathematics is exciting to many people but at the same time is considered difficult and somewhat inaccessible by many more. Since mathematics is the fundamental cornerstone in many diverse areas of society, it is important for civilisation as a whole that mathematicians do their utmost to help explaining and clarifying the role of mathematics."
[Van Lundsgaard Hansen, Chairman of the World Mathematics Year 2000 Committee of the European Mathematical Society]

If it was not for the mathematics of error-correcting codes, we would still be listening to vinyl, as there would be no CD players. As for travelling by aeroplane, forget it – without the mathematics of air flow the only way to go to East Malaysia would be by boat. And, as Archimedes realised while wallowing in the bath tub, even that mode of travelling is reliant on various mathematical principles. Behind the automation of washing machine, automatic transmission, automatic braking system, air conditioning system, video camera, and light rail transit system, lie a fuzzy system.

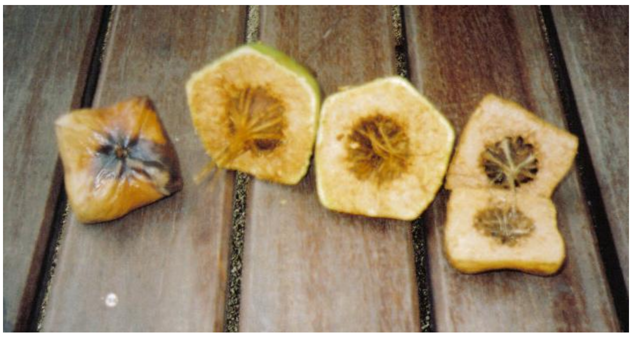
2. Mathematics in Nature

Mathematics exists in nature. The mathematical element, symmetry, exists in natural objects such as snow flakes, honeycombs, insects, leaves, flowers, butterflies, fish, sea shells, crabs, and starfish (Figure 1), and also in man-made objects such as carvings on wood or ceramics, woven straw for food cover (Figure 2) and motifs in songket weaving (Figure 3).

a. Butterfly

b. Sea shell

c. Leaves

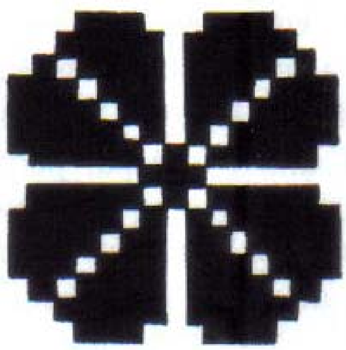


d. Sea coconut

Figure 1: Natural symmetry

Figure 2: Woven straw for food cover

a. Pucuk Rebung
(Bamboo Shoot)



b. Tampuk Manggis
(Mangosteen Stalk)

Figure 3: Motifs in songket weaving

3. Multiplication Table and Mathematical Songs

A multiplication table is easily memorised if it is sung. During our time, primary school children read or memorised multiplication tables (in the Malay language) by singing them. For example,

dua kali satu, dua two times one is two	$2 \times 1 = 2$
dua kali dua, empat two times two is four	$2 \times 2 = 4$
dua kali tiga, enam two times three is six …	$2 \times 3 = 6$ …
dua kali dua belas, dua puluh empat two times twelve is twenty four	$2 \times 12 = 24$

If the children forgot the verse (the multiplication table), they went on by humming its melody. It could also be sung in the English language. For instance, for the multiplication table, they use the melody for the "Happy Birthday" song, and for "*Subtraction up to* 1000," they use the melody for "*A thousand legged worm*". It is really interesting when all the children sing together.

Mathematical game or song such as "*Pukul berapa Datuk Harimau*?" (What is the time Mr. Tiger?) attracts the children's interest. Other mathematical songs are "10 *Budak Hitam*" (10 Black Boys) and "*Anak Ayam Turun* 10" (10 little chicken) which are suitable to be sung or played when the children are on a long excursion trip, just to keep them occupied, rather than letting the time goes by without doing anything. For a longer journey, for instance from Kuala Lumpur to Kuantan, the song "10 Black Boys" could be lengthened or extended to "20 Black Boys". This will then needs the creativity of the children to arrange the verses; in order to match with the words nineteen until eleven. For the Malay version, they have got to match *sembilan belas* until *sebelas* with words ending with "*-as*" such as *batas, cantas, deras, kapas, kertas, lemas, malas, palas, pantas, paras, pentas,* and *tetas*. For a simpler song, which does not need variation of words, they could try the following rhyme:

> N bananas on a box
> N bananas
> Take a banana, give it to your friend at the back
> $N - 1$ bananas.

They could begin the song with $N = 10$, 20 or up to 100 (see Renteln & Dundes 2005).
The song "*Anak Ayam Turun* 10" is more difficult and challenging, since the children have to be more creative, especially if they sing "*Anak Ayam Turun* 20".

Mathematics can be both enjoyable and interesting. Rather like completing a word puzzle, there is a great deal of satisfaction in working your way through a mathematical problem and coming up with the correct solution. There are no grey areas to worry about – you are either right or wrong. Of course, a lot of the popularity of mathematics depends on how it is taught, since a lack of enthusiasm and inspiration often reflects in how effectively the subject is received by the students.

4. Teaching in schools

The teaching of mathematics in school should not only consist of the "must know". That is teachers do not only teach the topics in the syllabus. It should also consist of the "should know" and the "good or nice to know" (Abdul Razak 2007). These three things could make mathematics not a boring subject, interesting to learn and the students want to learn more about the subject. For instance, if in school students are taught about even and odd numbers, tell them also about the existence of other numbers such as perfect numbers, amicable numbers, square numbers and cubic numbers. In school students are taught

The "*must know*":

$$\text{If } x + 3 = 8 \tag{1}$$

$$\text{then } x = 8 - 3 = 5. \tag{2}$$

Students are not taught how they really get the second step.
This is the "*should know*":
Actually to get the second step, that is to make x the subject of the equation, we have to eliminate 3 from equation (1) by adding –3 (negative 3) to the equation.

Adding –3 to equation (1):

$$(x + 3) + (-3) = 8 + (-3)$$

Then we use the associative law for addition of numbers:

$$x + (3 - 3) = 8 - 3$$

giving $x + 0 = 5$.
Since 0 is the identity with respect to addition, thus we have $x = 5$.

The "*good or nice to know*": Students will be interested to know that actually we can use our fingers to do multiplication of numbers, to learn about magic square; that they can use mathematics to do magic: guess a car registration number, a birthday date, identity card number or the amount of money your friend has in his pocket.

When teaching algebraic equations (linear, quadratic and cubic equations), it might be an inspiration to the students if the teacher tells them that these equations lead to the discovery of group theory which they will be studying if they do mathematics in the university (see also section 5 below).

5. Lectures

Pure mathematics courses such as Linear Algebra, Abstract Algebra, Analysis and Topology are often treated by students as abstract, difficult to understand and boring. It is normal and standard that the structure of these courses consists of Definitions, Propositions, Lemmas, Theorems and Corollaries. Often, mathematics is presented as something whose development has been unrelated to the activities of human beings. The questions which motivated the whole theory in the first place are often simply omitted, and students are asked to appreciate the methods and the theory without context, without relevance to other mathematical or scientific activity, one might even say, without meaning. For example, how many books on group theory are there which mention the range of applications of group theory, from crystallography to modern physics, and which show how the exposition given fits into the wide mathematical and scientific context? The dehumanising of the presentation of mathematics has gone very far (Brown & Porter 2008).

Even though each concept that has been introduced is followed by a few examples, students still find difficulty in understanding the examples given because they do not really understand the concept just introduced. To grasp the theorems (and the proofs) that follow will be more difficult. To lessen the students' difficulty and boredom, at least we try to include some historical background of the subject and its applications in our daily life or in culture. This might help to bring the students closer to the subject, and help them to a better understanding of the course.

5.1. *Abstract Algebra*

At Universiti Kebangsaan Malaysia I have tried to make this transformation from the traditional way of teaching the course on group theory (Abdul Razak 2009b). We begin by discussing the development of group theory from the activity of solving algebraic equations (linear, quadratic, cubic and quartic) by radicals, since the Pharaoh. The solution of quadratic equations had been known to the Greeks (Hero, 1st century), ancient Chinese (until 3rd century) and Indian (Brahmagupta, 7th century). Muslim mathematicians such as al-Khwarizmi, Thabit ibnu Qurrah, al-Haitham, al-Karkhi and Umar Khayam, also contributed in solving the algebraic equations (from 8th until 12th century). Western mathematicians, particularly from Italy, such as Ferro, Fontana (Tartaglia), Cardano and Ferrari obtained radical solutions to cubic and quartic equations (from 15th until 16th century). The next challenge was to obtain the solution of quintic equations and those of higher degrees radically. There was no development in the next two hundred years. Suddenly in 1824 a young mathematician from Norway, Niels Henrik Abel declared that quintic equations and those of higher degrees could not be solved by radicals. In 1829 a young French mathematician, Evariste Galois, managed to link algebraic equations with what was known as a group. His discovery stated that an algebraic equation is solvable radically if its associated (Galois) group is solvable. As applications we discuss the Malay number system as an application of the group of numbers, application of the symmetry group to songket weaving and batik design, application of the permutation group or the symmetric group to kinship structure and geometric patterns, and application of the group integer modulo *n* to the writing of dates (the small daur) in the Malay culture, and to ISBN. The course will be more interesting if we could use computer softwares to compute or to illustrate some group concepts.

To understand fully certain mathematical rule, we could relate it to our daily life situation (Abdul Razak 2009a). For example take the property of group elements, $(ab)^{-1} = b^{-1}a^{-1}$. Some students write $(ab)^{-1} = a^{-1}b^{-1}$ which is true only when the group is abelian. In order to understand it well, we call it *the rule of taking off the shoes*. Suppose *a* is the operation of wearing the socks, and *b* is the operation of putting on the shoes. Then *ab* will be the operation of wearing the socks followed by putting on the shoes. The reverse process or the inverse of the procedure, $(ab)^{-1}$, is surely to take off the shoes first and then take off the socks, which is $b^{-1}a^{-1}$. Thus if someone writes $(ab)^{-1} = a^{-1}b^{-1}$, this means that he is trying very hard to take off his socks before taking off his shoes. This is ridiculous.

5.2. *The Group of Integers Modulo n*

We give two applications of this group, namely the writing of dates in Malay culture and the International Standard Book Number (ISBN).

In Malay culture, normally all letters, manuscripts and inscribed stones must end with a *termaktub*, that is a closing statement consisting of the date, place and time they were written (Gallop 1994). An interesting part is the date writing using the *daur kecil* (small daur). According to al-Attas (1988), daur kecil, is a time cycle of eight years, consisting of the following Arabic alphabets:

Alif, *Ha*, *Jim*, *Zai*, *Dal*, *Ba*, *Wau* and *Dhal*.

Al-Attas claimed that the small daur started in the Malay Archipelago, and the calculation of the cycle started from the first year of Hijrah. To determine the name of a Hijrah year, we use the arithmetic of *integer modulo* 8. The Hijrah year is divided by 8, and its remainder, which consists of integers 0 until 7, will determine that particular year (Table 1).

Table 1: Small Daur used in the Malay world

Year	1	2	3	4	5	6	7	8
Remainder	1	2	3	4	5	6	7	0
Year's name	*Alif*	*Ha*	*Jim*	*Zai*	*Dal*	*Ba*	*Wau*	*Dhal*

For example, this year, 2010 is 1431 Hijrah. Dividing 1431 by 8 we get 178 with remainder 7, which is the year of *Wau*.

Another application of integer modulo n is the International Standard Book Number (ISBN) that is used for every book that is published. The number is a sequence of nine digits $a_1a_2...a_9$, where each a_i is one of the ten numbers 0, 1, 2, …, 9 together with a *check* or *control digit* which is one of the eleven numbers 0, 1, …, 9, X (where X represents 10). The last (tenth) digit is inserted in order to check that the nine digits before it are correctly written. According to Humphreys and Prest (1991),

$$a_{10} \equiv 11 - (10a_1 + 9a_2 + 8a_3 + 7a_4 + 6a_5 + 5a_6 + 4a_7 + 3a_8 + 2a_9)\ (\text{mod } 11)$$

Let us check the book by Cordier and Porter (2008), ISBN-10: 0-486-46623-X (ISBN-13: 978-0-486-46623-1). Following the above formula we have

$$10(0) + 9(4) + 8(8) + 7(6) + 6(4) + 5(6) + 4(6) + 3(2) + 2(3) = 232 \div 11 = 21 \text{ remainder } 1.$$

Thus the check digit is $11 - 1 = 10$.
The following method straight away gives the check digit:

$$1(0) + 2(4) + 3(8) + 4(6) + 5(4) + 6(6) + 7(6) + 8(2) + 9(3) = 197 \div 11 = 17 \text{ remainder } 10.$$

Since 1 January 2007 ISBN is a 13 digit number. The formula for the check digit is given as follows (Wikipedia):

$$a_{13} \equiv \left[10 - (a_1 + 3a_2 + a_3 + 3a_4 + a_5 + 3a_6 + a_7 + 3a_8 + a_9 + 3a_{10} + a_{11} + 3a_{12}) \bmod 10\right] \bmod 10 .$$

$$\begin{aligned} a_{13} &\equiv \left[10 - \{9 + 3(7) + 8 + 3(0) + 4 + 3(8) + 6 + 3(4) + 6 + 3(6) + 2 + 3(3)\} \bmod 10\right] \bmod 10 \\ &\equiv \left[10 - (119) \bmod 10\right] \bmod 10 \\ &\equiv 1 \bmod 10 \end{aligned}$$

The 10 digit ISBN consists of four components: group identity, press identity, number of publications and the check or control digit. On the other hand, the 13 digit ISBN consists of five components, namely code of book industry (978 and 979), and the four components are as for the 10 digit ISBN. We list some group identities (Wikipedia):

0	UK, USA, Australia, New Zealand and Canada		
1	South Africa, Zimbabwe		
2	France, Belgium, Switzerland		
3	Germany, Austria, Switzerland		
4	Japan	967	Malaysia
5	Russia	974	Thailand
6	China	979	Indonesia
81	India	981	Singapore
89	South Korea	983	Malaysia
962	Hong Kong	9971	Singapore

6. Mathematical Humour

Normally, in a lecture, especially in Abstract Algebra or Analysis, the students get bored and sleepy. This is the time to crack some jokes or humour, if possible, mathematical jokes or mathematical humour. According to Renteln and Dundes (2005) most mathematical humour are based on words involving standard mathematical concepts. Most of the humour involve food, which indicates the existence of mathematical concepts that are difficult to digest or swallow. Consider the following humour.

Q: *What's purple and commutes*?
A: An abelian grape.

Note: In abstract algebra, if the binary operation on a group commutes, then the group is called an abelian group. Grape sounds like group.

Q: *Why did the mathematician name his dog "Cauchy"*?
A: Because he left a residue at every pole.

Note: In complex analysis there is a result called Cauchy Residue Theorem.

Q: *Why can't you grow wheat in* $\mathbf{Z}/6\mathbf{Z}$?
A: It's not a field.

Note: Of course wheat can only be grown in a wheat field. In abstract algebra $\mathbf{Z}/6\mathbf{Z}$ is not a field, it is only an integral domain.

Q: *What is grey and huge and has integer coefficients*?
A: An elephantine equation.

Note: We have diophantine equation in number theory.

Q: *What do you get if you cross an elephant and a banana*?
A: $\mathbf{elephant} \times \mathbf{banana} = |\mathbf{elephant}|\,|\mathbf{banana}| \sin\theta$

Note: In linear algebra we have cross product between vectors **a** and **b** defined by the following equation: $\mathbf{a} \times \mathbf{b} = |\mathbf{a}|\,|\mathbf{b}| \sin\theta$, where θ is the angle between the two vectors.

Q: *What does an analytic number theorist say when he is drowning*?
A: Log-log, log-log, log-log, ...

Q: *What does a topologist call a virgin*?
A: Simply connected.

Q: *What is sour, yellow, and equivalent to the Axiom of Choice*?
A: Zorn's lemon.

Q: *What is yellow, linear, has a norm and complete*?
A: A Bananach space.

Q: *Who is a topologist*?
A: Someone who could not differentiate between a doughnut and a teacup.

7. Mathematics Competition

Mathematics competition is one of the ways of popularising mathematics. Its presence encourages students to widen their knowledge and sharpen their mathematical thinking. The Malaysian Mathematical Sciences Society has been organising the National Mathematics Olympiad for more than thirty years. There are three levels of candidates, namely Senior (aged 17 – 19 years), Junior (15 – 16) and Young (13 – 14) where each level comes from more than 300 schools in the country. Each level is classified into the categories of individual and team. Our students also take part in the International Mathematics Olympiad since 1995.

Recently the School of Mathematical Sciences, Faculty of Science and Technology, Universiti Kebangsaan Malaysia organised an Essay Writing Competitions for school students, in celebrating the 40th Anniversary of Universiti Kebangsaan Malaysia (UKM) and the Mathematical Sciences at UKM.

7.1. *Mathematics Masterclasses*

To inculcate mathematics awareness in society, the School of Computer Science at the University of Wales, Bangor, United Kingdom has been organizing the Royal Institution Mathematics Masterclasses for Young People in North West Wales, since 1985. The participants are taken from school year 9 aged 13 – 14 years old.

8. Mathematics Exhibition

Mathematics exhibition is one of the ways to present mathematics to as wide as possible an audience, and as a stimulus and focus to a range of activities. It could be put up in school, university, and an art gallery. An exhibition should convey some flavour of the real achievement of mathematics. If instead it simply presents an assortment of, for example, strange polyhedra, and states that these are the wonderful things mathematicians study, then it will be very easy for the public to be convinced that mathematics is hard or weird or both. Each exhibit should have a mathematical point and should explain its relations with other parts of mathematics and with other disciplines. Surprising applications are also important for conveying some of the excitement of mathematics. Figure 4 shows a Möbius band, a mathematical object which is a surface with only one edge and only one side. To make a Möbius band, you have to take a long strip of paper, and glue the ends together, but with a twist through 180 degrees. The result is something like the one in Figure 4.

Figure 4: The Möbius Band – a surface with only one edge and only one side

Möbius bands had an important industrial use when heavy machinery was driven by belts from a central power source. These belts could be made to last longer by making them in the form of a Möbius band.

Mathematics could also be presented as a sculpture made from metal, ceramic, glass or wood. For example the sculpture of a Möbius band (Figure 4) and a trefoil knot (Photo 1) made from a wide brass, which has been exhibited at the National Art Gallery and at an exhibition in UKM (Abdul Razak 1999).

Photo 1 Trefoil knot at an exhibition

Recent applications of knots are to knotted orbits in weather systems, and to knotted DNA (Brown & Porter 2008).

It is said that a topologist could not differentiate between a doughnut and a teacup. This is because both objects are topologically equivalent. To visualise this, imagine a doughnut in the form of a plasticine, which could be transformed into a teacup in a few steps. This transformation can be presented in ceramic forms (Abdul Razak & Faridah 1999) which could help the public understand the process involved (Figure 5).

Figure 5: From doughnut to a teacup

9. Sculptures and Mathematical Paintings

Mathematics is not only to be studied or memorised. It could be presented as a sculpture made from metal, ceramic, glass or wood. These sculptures could be used to decorate the surroundings of our university campus, for example the sculpture of a trefoil knot (Brown & Robinson 1989, Photo 2).

Photo 2
A brass sculpture of a trefoil knot
Topologist Emeritus Professor Ronald Brown and sculptor the late John Robinson
Source: Brown & Robinson 1989.

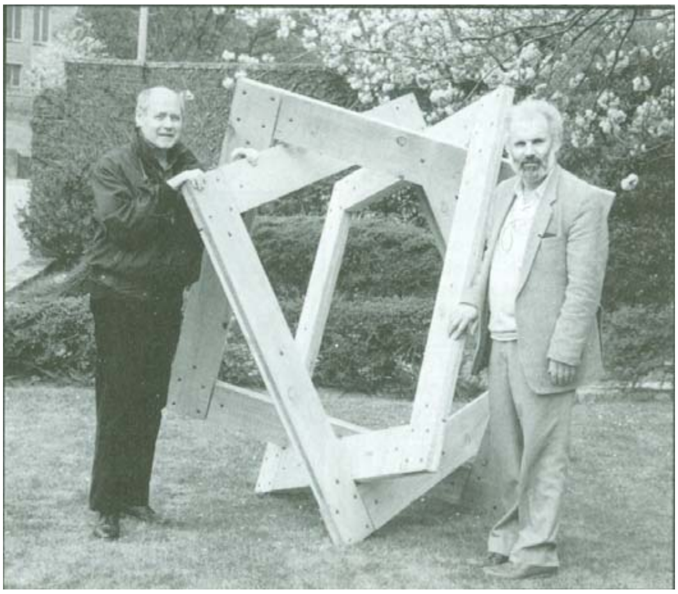


Photo 3
A wooden sculpture could also decorate the campus surroundings

At the Fields Institute in Toronto, Canada, there are two pieces of geometric art which were clearly initiated and encouraged by the well known mathematician, Harold Scott MacDonald Coxeter (1907-2003). The combination of the symmetries of triangles that are inter-connected decorate the foreground of the institute, and the three-dimensional projection of complicated and movable four-dimensional polytopes, hung from the ceiling of its hall (Ellers *et al*. 2003).

Many are not aware that mathematical elements such as symmetry, geometric figures, tessellations, commutative diagram, and topological spaces, can be presented in the form of drawing. Mathematicians look at them as mathematical objects, whereas artists look at them as abstract drawings (Hofmann 2002, Figure 6 and Figure 7).

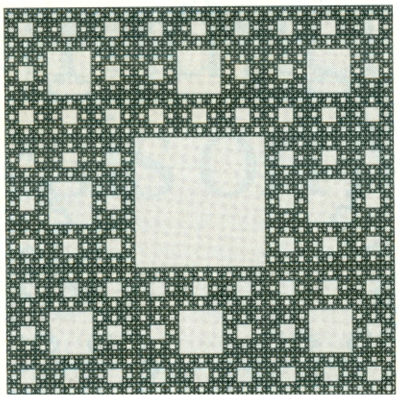


Figure 6: Sierpinski Carpet

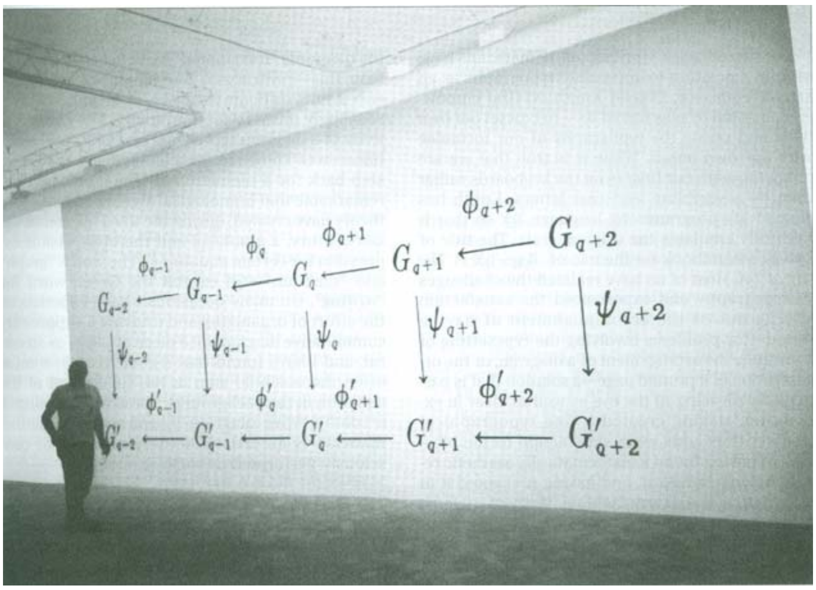


Figure 7: Commutative Diagram

10. Mathematical Theatre

In Malaysia, the development of mathematics as a culture is very slow and limited. In western countries such as England and the United States, the development of mathematics is more advanced that stories related to mathematics are also being staged and dramatised. For instance, *Alice in Wonderland*, *Breaking the Code*, *Proof*, and *QED*, and are also being filmed, such as *A Beautiful Mind*, and had won few awards (Jackson 2002; Butler 2002).

In Malaysia we do not need stories from foreign sources. Our ancestors had folk lores, fantasies, comedies, humour stories such as Mat Jenin, Pak Kaduk, Nujum Pak Belalang (has been filmed by our legend P. Ramlee), Lebai Malang and Pak Pandir, which are without our knowledge already have mathematical content that could be dramatised. Mathematics in the humour stories has been discussed by Hanapi and Shaharir (2000).

11. Open Access

The science plays a crucial role in the modern society, and the popularisation of science in its electronic form is closely related to the rise and development of the World Wide Web. Since 1990s, the introduction of the Web as a part of the Internet, the science popularisation has become more and more involved in the web-based society. Therefore, the Web has become an important technical support of the popularisation of science (Alireza 2008). The overall purpose of web site is to help make Mathematics seem more attractive and useful subject to the general public. Thus the popularisation of mathematics through open access is an attempt to reduce the distance standing between mathematicians and the public.

12. Conclusion

Mathematics Club or Society, and School or Faculty of Mathematical Sciences, play an important role in the popularisation of mathematics to as wide as possible an audience, especially school students and the public. These bodies could organise various activities such as quiz, mathematics competition, mathematics essay competition, mathematics camp, excursion, exhibition, conferences/seminars, sessions on explaining “mathematics behind wonders”, and popular lectures by distinguished or eminent local mathematicians or from abroad.

The academics must write books, and popular articles in magazines or local newspapers. The young kids at home could be attracted to mathematics if this subject is “inserted” in popular television series such as “*Kampung Boy*” and “*Upin and Ipin*”, and in the form of a cartoon series in a local weekend newspaper.

At university level, joint seminars should be encouraged. In Malaysia we have the regular National Symposium of Mathematical Sciences. The Faculty of Science and Technology, Universiti Kebangsaan Malaysia has started and established a joint seminar with Universitas Riau, Indonesia. The Malaysian Mathematical Sciences Society has coorganised the recent International Conference on Mathematical Sciences in Bolu, Turkey (23-27 November 2010).

The National Council of Professors (NCP) of Malaysia has just been established and was launched by The Honourable Dato’ Sri Mohd Najib Tun Abdul Razak, the Prime Minister of Malaysia, on 1 April 2010. The Cluster of Science and Mathematics, as one of the fourteen clusters under the NCP, has the following as one of its three aspirations:

> “Innovative methods for science and mathematics delivery to children and the public so as to inculcate scientific awareness and culture in society.”

I must also mention that we should not forget the contribution of our ancestors to the branch of mathematics called *ethnomathematics*, particularly mathematics in Malay culture. They had contributed to the units of measurement. The Malays have had measurement system different from those used today. The units of measurement were based on their daily experience, the environment, human body etc., such as *sepelaung*, *sepenanak nasi* for distance and time; *jengkal*, *hasta* and *depa* for length; *sekelip mata*, *sekejap*, *sepekan* and *sepurnama* for time; *cupak* for volume; and *saga*, *mayam*, *pikul* and *koyan* for weight. Most of the units of measurement are not being used anymore. Surely youngsters in this era do not realise that this measurement system had existed and had been used by their ancestors once before.

It will be nice if we can set up a Centre for the Popularisation of Mathematics, as a focus and as an exhibition centre for the variety of activities mentioned above.

Acknowledgements

I am thankful to Emeritus Professors Ronald Brown and Timothy Porter of the University of Wales at Bangor, United Kingdom for providing me with their articles and information regarding the Mathematics Masterclasses in North West Wales. Finally, I must thank Associate Professor Dr. Liong Choong Yeun and my daughter, Raznita, for helping me with the editing of the figures and photos, and Professor Dr. Kamarulzaman Ibrahim, Associate Professor Dr. Liong Choong Yeun and Dr. Rokiah @ Rozita Ahmad for proofreading the paper.

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