South East Asian J. of Math. & Math. Sci. **ISSN : 0972-7752**
Vol.12, No.2 2016, pp. 107-114

MATHEMATICS UNDERSTANDING: INITIATIVES AND OUTREACH

Indu Puri

Department of Science and Technology,
Government of India, New Delhi, India
E-mail: indub.puri@nic.in

Dedicated to Prof. A.M. Mathai on his 80^{th} ***birth anniversary***

Mathematics is the fundamental science which is often considered mother of all sciences. It has components of, "Method of Science"– based on logical reasoning, analysis, observation, null hypothesis, data collection, data interpretation and drawing inference. Mathematics exists in nature, shape of earth, stars, crystal lattices, shape of trees, leaves pattern, floral patterns and many more all have mathematical arrangements. Each snowflake exhibits six fold radial symmetry, seeds of many plants(for e.g Sun Flower) exhibit Fibonacci numbers pattern (i.e, 1, 2, 3, 5, 8, 13, 21..), amazing hexagon pairs in honeycombs which optimizes storage of honey in an efficient manner, bilateral symmetry in human face are all such examples.

To popularize Mathematics among the various target groups, various agencies within and outside government have taken steps. The academic and scientific agencies support training workshops, field programmes, quiz, audio, visual programmes, etc.

Present paper aims at assessing the various initiatives undertaken recently (since 2012) on declaration of National Year of Mathematics and its outcome. Area of assessment are programmes undertaken by the National Council for Science & Technology Communication, Department of Science & Technology, GOI, New Delhi.

Initiatives & Community Outreach

NCSTC

National Council for Science & Technology Communication(NCSTC) is an apex body in the Department of Science and Technology, Government of India which

endeavors to communicate science & technology (S&T), stimulates scientific and technological temper and coordinates & facilitates the initiatives at various levels. The Council has a mandate of popularizing and communicating sciences including Mathematics amongst varied target groups to enable informed decision-making at grass root level. It takes S&T among various target groups and encourages intelligent debates on topical & developmental issues, which need S&T based information.

The Council recently took several initiatives to popularize Mathematics and remove its phobia from the students. Hon'ble PM of India had declared 2012 as the National Mathematics Year, in recognition of Ramanujan's contribution to mathematics, further the government decided to celebrate Ramajuans birthday (22 December) as the National Mathematics Day every, year.

Department of Science and Technology celebrated "Ramanujan -Chandra Legacy in Science" to commemorate 125th year of birth of Sri Srinivasa Ramanujan and 100 years of noble laureate Dr. S.Chandrashekhar. Several activities were planned to celebrate the event and popularize and communicate mathematics in an informal manner. Several workshops, radio, television programmes, exhibitions and rallies were organised to commemorate the occasion.

Observance of the National Mathematics Day

In December 2011 at the launch of Ramanujan Centre for Higher Mathematics at the Alagappa University, Srinivasa Ramanujans birthday, December 22 was declared as the National Mathematics Day(Source the Hindu). The initiative was undertaken to promote mathematics in India. NCSTC since then observes National Mathematics Day through various State S&T Councils, programmes are catalyzed and supported nationwide. The grant is given according to the number of districts in various states and other parameters. Many states like Karnataka, Uttrakhand, Punjab, Nagaland, Mizoram, Chhatisgarh, etc. promote mathematics through National Mathematics Day, but others are slow to take off. Many Schools, colleges, universities throughout the country are now observing National Mathematics Day, to promote Mathematics and remove its phobia.

National Year of Mathematics-2012

The Vikram Sarabhai Community Science Centre, Ahmedabad organized programmes to popularize Mathematics, catalyzed and supported by the National Council for Science & Technology Communication (NCSTC). Under this a four day "Mathemagic" event was organised around National Mathematics Day on topics like "Omnipresent Pi", "What is 100?", etc. There were mathematics painting

competitions where drawing was done using only geometrical shapes, line segments, ray segments, triangles, etc. B.Ed and PTC students participated in the competition for preparation of Teaching Learning Materials(TLM). Further during the "Mathemagic" an attraction was "Question of the hour". Wherein a mathematical puzzle was displayed for an hour inviting answers, the correct answers were rewarded. As part of the Mathemagic events a four day exhibition of nearly 150 exhibits, TLM, games and puzzles were displayed and explained by the student volunteers.

Besides these two workshops for the teachers of primary as well as secondary level were organized during July, 2013 and August, 2013. Wherein number of non formal teaching aids were used. Resource persons, explained factors, HCF, LCM, their properties and learning of mathematics through paper folding, divisibility rules and their proofs.

These were followed by 21 outreach workshops in places like Ahmedabad, Gandhinagar, Anand, Surendranagar, Surat, Valsad, etc. The workshops titled "Joy of Mathematics" were aimed at orienting teachers in using non-formal, activity based learning for the teachers at DIETS, schools, etc. More than 900 teachers benefited from these workshops.

PSGR Krishnammal College for Women, Coimbatore organized series of programmes catalysed and supported by NCSTC, as part of celebrations of the National Year of Mathematics(2012).

Another organization, Association of Mathematics Teachers of India(AMTI), Chennai oragnised three workshops for popularization of mathematics amongst teachers which in turn will lead to mathematics popularization amongst students. The workshops, national level were held zone wise for southern zone in Chennai, for eastern zone in Bhubneshwar and north-eastern zone in Guwahati. Topics like "Art of Constructing Non Routine Problems", "Stories based on Mathematics", "Fun with Mathematics" etc. were discussed during these workshops. Concepts of fractions, comparison between fractions, etc. was nicely put forward through story telling.

During March 2013, a workshop was organized for the mathematics teachers from various districts of Punjab. There were sessions on number systems, model making of algebraic identities, Napier strips, recreational mathematics, mathematics and biology, visual kits for geometrical theorems, etc. National Year of Mathematics.

The Punjab State S&T Council, Chandigarh organized 10 workshops all over the Punjab State for popularization of Mathematics especially Geometry in Punjab.

To enhance visual understanding and verification of the proofs of the geometrical theorems during these workshops, models made from low cost materials were used. Theorems on circles, triangle, quadrilaterals, parallel lines, etc. relationship between areas of different geometrical shapes were explained to teachers with the help of simple models, leading to better understanding of the basic concepts. The workshops also focused on the art and science of making these simple yet effective working models with simple acrylic sheets, scales, protractors, nut bolts, etc. Such experiments can lead to a better and clear understanding of the fundamental theorems of geometry. The trained teachers will create a ripple effect and will in turn teach students.

Celebration of Ramanaujan Chandrasekhar's Legacy in Science

Shri Vijaysinha Yadav Arts & Science College, Peth Gaon(Kolhapur) organized State Level Science Exhibition, State Level Debate Competition, Teachers Training Programme, State Level Elocution Competitions, etc. during January 27-31, 2014 as part of celebrations of Ramanujan Chandrasekhar Legacy in Science. Students participated in various competitions in English, Hindi and vernacular mediums also. The programme helped in developing scientific temper of Maharashtra region, innovative ideas were encouraged from students. The programme started with "Science Rally".

Such programmes provide a wide spectrum of activities for a wide target group. There were three groups of students, 5th-8th standard students, 9th-12th Standard students and students learning at undergraduate and post graduate levels including professional courses. The programmes enabled spread and outreach of popular science & mathematics among masses.

Ganit Yatra

Year 2014 was 900th birth anniversary of the renowned mathematician Sri Bhaskarachrya who was from Dhulia district of Mahrashtra. To commemorate the event a mega field experiment was organised during September-October, 2014 in more than 20 districts of Maharashtra including tribal areas with the help of local NGOs, educational institutions and science based agencies.

"Ganit Yatra was a unique outreach experiment. The programme was catalyzed and supported through the Jidnyasa Trust, Thane, a science based NGO of Maharashtra. There was brain storming cum conference to commemorate 900th Birth Anniversary of Bhaskaracharya, publications in Hindi/Marathi and English, posters, DVDs to highlight Mathematics and its applications. Teachers training workshops, drama competitions, mathematics in every day life, fun with mathemat-

ics and many such events were also organised. More than 3000 teachers and 68,000 students were the direct beneficiaries of this mega field experiment. Yatra was successful in terms of production of educational software, books, kits, etc. Three books were published for distribution, namely - Basic of Mathematics, Friendship with Mathematics, and Fun with Mathematics and puzzles. Posters, kits were also distributed to the teachers and students during the course of Yatra.

Figure 1: Ganit Yatra

Mathematics popularizationCommunity Radio

The National Council for Science & Technology Communication(NCSTC) has been supporting number of programmes under the initiativeRadio Mathematics, more than – community radios have propagated Mathematics in daily life for industrial workers, small time shopkeepers, housewives, vendors, etc. Programme series of 30 minutes slot is broadcast through community radio, which has a reach of 15-20 km radius. More than 100 episodes are broadcast through each of the stations catering to the specific need of a particular community. Main objectives of propagating Mathematics through community radio are: To increase the basic level of knowledge of the targeted community in Mathematics related to their day-to-day work; To create interest in Mathematics of the target group like children to

reduce school drop out rate; To help in building the strong Math foundation for usage in everyday life, etc.

Learning Mathematics using Origami

Origami is another tool for learning Mathematics in an easy and interesting manner. Problems of area, surface, volume etc., concepts of mensuration, quadratic equations, fractions, etc. can be easily understood by Örigami". In this through paper folding, mathematics is conceptualized. Mathematics is being popularized nation wide through targeted Origami workshops.

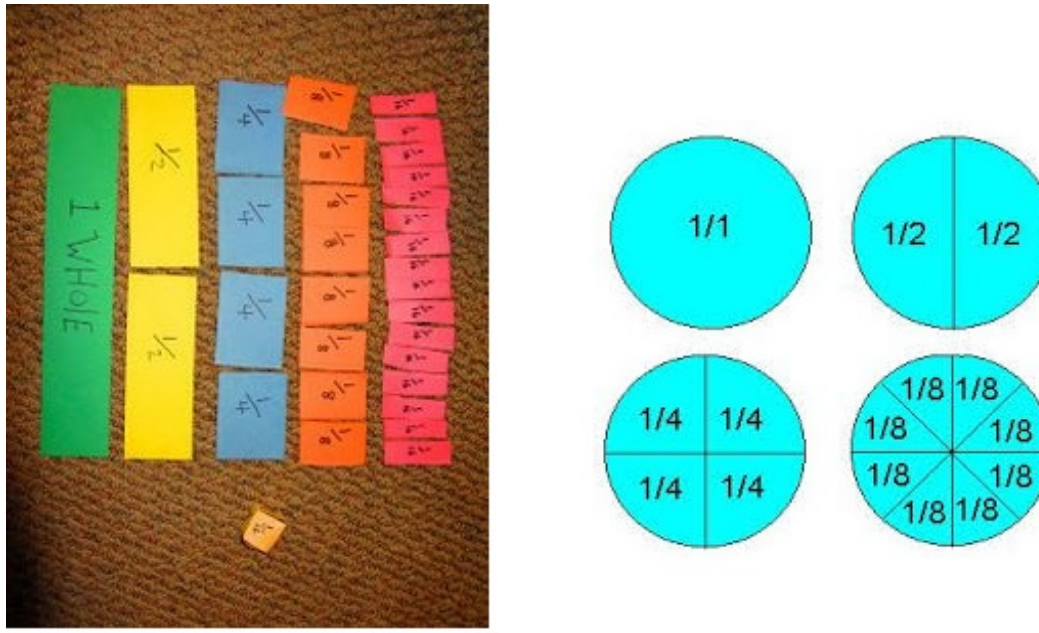

Figure 2: Learning Mathematics using Origami

Efforts Outside

To popularize Mathematics, world over popularization is done through exhibitions, centers, etc. A few are being described here: Germany celebrated 2008 as the Year of Mathematics; Mathematikum is a mathematical museum in Giessen (DE) which offers a large variety of hands on experiments; The Italian exhibition Il Giardino di Archimedes pays attention to mathematics in history, play, and every days life; In Portugal, the Atractor Association is involved in both physical exhibitions but also in virtual aids like GeCla, a DVD and website with interactive possibilities to play many mathematical puzzles, and experiment with symmetry. World over

initiatives have been taken to popularize Mathematics as it is considered difficult and has a certain phobia attached to it among students.

Impediments

Mathematics teaching and learning is considered difficult world over in general and particularly in India. Many reasons are sighted for the same like too many students in a class or unfavourable teacher-student ratio. Focus is more on Mathematics as an abstract subject rather than its application resulting in disinterest among students. In order to popularize Mathematics more efforts are needed to teach Mathematics and its branches in a popular manner through teaching learning aids, mathematical toys, popular lectures, etc.

Way forward

India has a great history and legacy of Mathematics. Earliest known usage of Zero is credited to Indian civilization, As we all know, Zero plays the central role in Mathematics. The concept of zero as a number and not merely a symbol or an empty space for separation, is attributed to India. The Indian scholar Pingala, used the Sanskrit word "Shunya" to represent Zero in fourth Pingala Sutra. Not only this, some of the games like chess or chaturang also originated in our country. The application oriented learning of Mathematics and other sciences will make it more interesting and popular.

References

[1] Project Completion reports of various programmes catalysed and supported by the NCSTC for mathematics popularisation;

[2] timesofindia.indiatimes.com/home/...../news/2012-year-of-mathematics;

[3] www.firstpost.com/India News

[4] www.planetdolan.com/15-beautiful-examples-of-mathematics-in nature.