2nd Kolkata workshop of the APU-RMS Report

The 2nd Kolkata workshop of the APU-RMS series was held on 8-9 Nov 2014 at Calcutta International School. Sabyasachi Mitra, Krishnendu Saha, Siddhartha Chattopadhyay and Mahan Maharaj shared the RMS sessions while Swati Sircar facilitated the APU ones. There were 30+ participants on either day from 20 schools and resource organizations. A class 11 student also took part! The workshop went from 9:30 to 5:00 on day 1 and almost 5:20 on day 2. Each day the 4 sessions alternated between APU and RMS starting with the former.

Day 1, session 1 was based on the article "Un-folding" with a lot of practical hands on activities on folding and connecting those with the geometry involved as well as demo with a sari and a petticoat. Teachers participated quite actively.

Day 1, session 2:
Mr Krishnendu Saha, Senior School Teacher at the Calcutta International School, gave a talk on Pythagorean triplets. Concepts covered included the ones outlined below.
  - A construction problem to start with which requires the idea of the
  Pythagorean Triplets
  - Discussion on what are Pythagorean Triplets and its definition
  - Discussion on Pythagorean Primitive Triplets
  - Identification of the form of the generating Pythagorean Triplets observing the pattern in some already known Pythagorean Primitive Triplets and hence proving the conjecture
  - Discussion on some very interesting properties of Pythagorean Primitive Triplets which can be easily identified by observing the table of Pythagorean Primitive Triplets
  - Idea of Unit Circle, rational points and connection between them and Pythagorean Triplets
  - An interesting problem on the concept of rational points
  - Finding the inradius of a right triangle using Pythagorean Primitive Triplets.
  - Connection with Complex Numbers

Day 1, session 3 started with was making a set of pentominoes and then tetro-tro-do and mono-minoes per school. Then we delved into the possible activities we can do with these. The highlight however was the inductive proof that all the polygons generated by such n-minoes will always have even number of sides. Prof.

Pradipto Bandyopadhyay attended this talk and pointed out an omission in the proof.

Day 1, session 4:
Sabyasachi used the Ptolemy's Theorem and the Brahmagupta-Mahavira Identities dealing with the relation of the diagonals of a cyclic quadrilateral to the lengths of its sides to discuss applications of school mathematics that are on the one hand challenging, but on the other requiring no extra concept that needs to be acquired...and hence representing the ideal types of problems that can push children to thinking beyond procedures.

The fact that there are multiple proofs of these properties also brings out the interconnectedness of the various streams of Mathematics. An interesting aspect of two proofs of the Brahmagupta-Mahavira Identities that was discussed was how in one the Ptolemy's Theorem was used to prove the identities, while in another the identities were proved using high school trigonometry, and from the identities the Ptolemy's Theorem was deduced.

Another proof of Ptolemy's Theorem, where a construction based on the 'givens' in the Theorem would make the proof of the same evident, was discussed as an exercise in enabling children to logically argue and learn to write their proofs.

The proofs also used the idea of symmetry in an implicit way, and this aspect was highlighted.

Day 2, session 1 was based on the article "Learning Mathematics through Puzzles". It was a great illustration of a game that stimulated speculating hypotheses, testing them and proving statements.

Day 2, session 2 was a "conical" delight where Mr Siddhartha Chattopadhyay of BD Government School, Kolkata led us through proving the equivalence of getting ellipse-hyperbola, first as sections of cone and then using their focus-focus properties respectively. For parabola focus-focus property was replaced by focus-directrix one. The session also included construction of these 3 conics using focus directrix and focus-focus properties. For quite a few teachers working on the focus-directrix and the focus-focus graph papers were a first.

Day 2, session 3 was based on making a set of tangram pieces from one A4 sheet and the mathematics involved. This was based on "Teacher's Diary on Classroom Assessment III" also from the Jul 2014 issue.

The final session by Mahan Maharaj on hyperbolic geometry was a real treat for all. He led us through the 5 postulates of Euclidean geometry and how and why it took almost 2000 years to understand the problem with the 5th one and to get to an alternate consistent structure of hyperbolic geometry.

During the workshop, to fill in gaps during changeovers between the main sessions, Sabyasachi also discussed the square-root algorithm and why it works, thus showing an area in middle-school mathematics where one can see how arithmetic, algebra and geometry are related. Further, an exercise highlighting the application of transformation geometry (rotation, to be more specific), and a very brief discussion of the Euler's formula and the properties of polyhedra using the Jodo Straws were carried out.

The participants were clearly delighted to be part of such a workshop. A couple of them have also exhibited their interest in taking sessions in workshops to be held in the coming years.

Support Given by the Calcutta International School: The school provided technical support in the form of the Venue, Projector and a technical person to handle it on both the days (including a Sunday), Tea/Coffee and refreshments and a person to take care of the same on both the days, lunch for the participants and the resource persons on both the days, Stationery requirements in the form of markers, sketch pens, writing and printing paper, rulers, pencils, erasers. Besides our Facility Manager was there through both the days to ensure smooth functioning of all the arrangements.