

Report of RAA Interaction Meeting

On
13th February 2016

At
IIT Kanpur

RAA Meeting with Government school teachers on 13th February 2016 went very well. As the Board exams were close, teachers had lot of work in their schools and at the BSA/DIOS offices. Even then a large number of them carved out time to attend RAA session at IIT Kanpur.



As usual teachers started coming around 10:00 AM and straight away joined the TEA/SNACK corner. This is a good time where teachers and resource persons interact freely and in most informal way. Many of the experiences of teachers get narrated to us in this period.

1. Initial meeting



Teachers assembled in L-13 Lecture Hall at 10:30 AM. They expressed their joy of coming to IIT Kanpur and interacting with team here. Most of them talked about their busy schedule of examination and how they managed to come here. Especially teachers coming from remote areas had lots of difficulties in time management.

After initial talks by Dr H C Verma, teachers were divided in groups and the corresponding resource persons took them to respective lecture halls for subject specific interaction. The groups were

- (a) Junior High School Science and Maths
- (b) High School and Inter Physics
- (c) High School and Inter Chemistry
- (d) High School and Inter Mathematics
- (e) High School and Inter Biology

2. Group Interaction Meetings

(a) Junior High School



Dr Raghunath Tiwari, from Computer Science Engineering Department, gave some interesting Mathematical insights of Probability, Pythagoras theorem, Prime numbers and interesting fractions. He gave several methods to prove that there are infinite numbers of prime numbers. He also suggested several games with tossing of coins and throwing dice that can be done in classrooms with students. The teachers participated in the discussions by asking questions and even suggesting some innovative ideas.

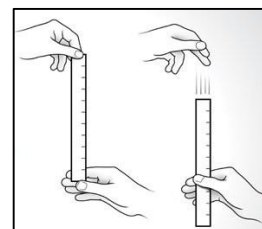
After Mathematics, science experiments were shown and discussed by Mr. Amit Kumar Bajpai, Shiksha Sopan, IIT Kanpur. The first experiment was on Reaction time of a person and the next was on CO₂. We give below the background and a short description of these experiments.

(i) Reaction Time

We, the human being have limitations regarding responding to a situation. Truly speaking, we all have some delay time, however small it may be but it is. Reaction time, we may define as time taken by a person after noticing a situation, to think and act in response to it. For example, we take some time to apply brake when we observe an obstruction ahead on the road when we are driving a bike. Of course reaction time varies with the circumstances and also from individual to individual. By practicing and being alert, one can reduce reaction time.

Experiment

The demonstration consists of holding a meter stick vertically from the top while a volunteer stands ready to catch it between the thumb and fore finger. Keep the fingers opposite the 0 cm mark. The volunteer is asked to “catch” the stick as soon as he/she “sees” it falling. Now the meter stick is dropped at a random time. The scale reading at the position of the fingers when the meter stick is caught is observed.



This gives the distance the meter stick fell before the volunteer could react. The time is then calculated from $t = \sqrt{\frac{2d}{g}}$ where $g = 9.8 \text{ m/s}^2$ and d is the distance dropped (in meters).

The discussions were very fruitful as teachers made mistake in units of distance while calculating time. They themselves realized that the calculated time was much longer than the actual time in catching the scale. Later when they corrected the units things came out well. It not only gave them a practice of using right units but also made them realize that experiments are more reliable and should be used to monitor calculations.

(ii) CO₂ from soft drink bottle

The most exciting and hit experiment of the session was taking out CO₂ from a soft drink bottle. The needle of a syringe was injected in a fresh soft drink plastic bottle near the neck above the liquid. Because of high pressure inside, the gas got collected in the barrel of the syringe. This should be done skillfully as the pressure inside is quite high and the piston can be knocked off with great speed.

To confirm that the gas above the drink in the bottle is CO₂, the needle was dipped in Lime water and the piston was pressed. The gas in the syringe was bubbled through the lime water which immediately became whitish.

A good discussion on the chemistry of lime water, CO₂ took place after the demo.

(b) High School and Inter Physics

Dr Anshu Gaur of Mechanical Engineering Department and Dr Manoj K Harbola of Physics Department conducted the session in this group. In the first part, Dr Harbola gave session on the basic concepts in Electrostatics including some historical background on verifying inverse square law of forces between charged particles.

In the second part several demonstrations were performed on capacitance. Capacitors were made by using pencil graphite as the conductor and paper as the dielectric. A difference between H pencils and HB pencils were brought out from these experiments. Also the thickness of the paper used was estimated from these capacitance measurement. Capacitance between two plastic covered household wires was measured. Most amazingly, when water drops were put in between the wires, the capacitance increased many fold. This showed that water has high dielectric constant. Several other similar demos were conducted.

Shree Deepak Mishra of Shiksha Sopan assisted in performing the demos.

(c) High School and Inter Chemistry

Resource persons for Chemistry group were Ms Piyali and Dr Madhav V Ranganathan from Chemistry Department. They conducted the group session for Chemistry. The number of participant teachers was low and it was mostly explaining some chemical structures with the help of diagrams on a Laptop.

(d) High School and Inter Mathematics

This session was done in three parts. In the first part, Shri Anurag Pandey of Shiksha Sopan gave some interesting exercises on Prime numbers. It was to find all sets of 4 prime numbers which add to a given number, 50 in this case. All teachers were fully engaged in working out a solution and once someone found such a set, he/she would be very excited like Eureka Eureka. The problem became more interesting and diverse when Mr Pandey allowed repetition of numbers in the set of four adding to 50. There were many more solutions and teachers were happy to find such sets more frequently.



Mr Arunedra Nath Rai, an IIT Kanpur graduate in Mathematics gave a short session on connecting various concepts and identifying the underlying unity of seemingly diverse areas. He narrated what concepts from school Maths teachers could equip the students better to learn Maths during higher studies. He emphasized the role of Mathematics as a language helping people from diverse disciplines to express their contents. He also talked about how mathematicians tackle problems.

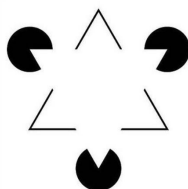
The last part was taken up by Dr Bhaskar Dasgupta. In his characteristic humour loaded style, he made the audience feel by heart several mathematical procedures.

(e) High School and Inter Biology

The Biology session was very interesting this time. Dr Nitin Gupta came with his 5 PhD students. During the interaction it came out that lab facilities in the school are almost non-existent because of poor maintenance. Dr Nitin Gupta's team demonstrated several experiments related to Biology that teachers can do at their end without much of equipment needed. We give below a short description of these experiments.



- **Chromatography experiment:** A leaf is rubbed on the bottom of a filter paper strip which is then kept vertically in a jar of spirit or ethanol (or nail polish remover). Within a few minutes, solvent rises up the paper and creates different colored bands. These bands show that the color of the leaf is produced by different components (such as chlorophyll a and b) which have different colors.
- **Optical illusions:** In the first illusion, two lines of the same length are shown but with arrowheads facing inside or outside. The line with arrowheads facing outside appears longer than the line with arrowheads facing inside. In the second illusion, a white triangle is perceived when there is none. These illusions explain that the perception of objects depends not only on the signals coming to the eye, but also depends on our prior expectations.



- **Blindspot experiment:** A cross and a circle are drawn on the screen, and the viewer focuses at the cross with one eye closed. The circle is usually visible but disappears at a certain distance from the screen. This happens when the image of the circle forms at a certain part of the retina where the optic nerve passes through the retina (called the blindspot). This illustration is useful for making students interested in the anatomy of the retina.
- **Osmosis experiment:** A raw potato and a boiled potato is taken. A hole is created inside them and filled with salt, and then the potatoes are kept in a plate containing water. The raw potato collects water in the hole while the boiled potato does not. The collection of water in the raw potato happens because of osmosis through the walls of living cells but the boiled potato is not able to collect water because its cells have been damaged.
- **Depth perception:** Keep a pen in one hand and its cap in another hand. Expand your arms, and then bring them closer to put the pen in the cap. This is easy to do with both eyes open but difficult with one eye closed, and demonstrates the role of the two eyes in depth perception.

The most exciting part of this RAA session was “Make your own Microscope” workshop. All teachers of Biology group made a microscope under guidance of Mr Ranjit Kumar from Shiksha Sopan. A short description is given below.

Make your own microscope

Microscopes need two lenses, one of high power and one of high focal length. Distances are to be suitably adjusted to obtain magnified and well resolved images of tiny objects. One can make a microscope of reasonably good quality (better than usual lab microscopes in school labs) using a lens from cheap laser pointer and a smart phone and some arrangement to change distances. At Shiksha Sopan Lab, we made arrangements using mica boards to place the sample, the first lens (taken out from a used laser torch), and the phone. With the help of long screws, the distances between the boards could be gradually changed. A white LED light was fixed at the bottom plate to illuminate the sample on a glass slide.



Teachers were given the boards and a finished design for guidance. They themselves drilled proper holes with required alignment, fixed the lens at proper place, fixed the LED and made the stand. They used the camera lens of their own phones as the second lens. When a biological sample on a glass slide was placed in the slot and adjustments were made, beautiful images were seen on the phone screen. The zoom available on the phone enhanced the image further.

Almost all the teachers saw a magnified, well resolved images of hydra, Amiba, Algae and internal part of hibiscus in a microscope, that too built by themselves. So far they had only seen such things either in the textbooks or on internet (few of them). This exercise was so exciting that they were jumping with joy.

3. Some Highlights

*Teachers took home their own microscopes and were thrilled to tell all about their unique experience.

*Some of the teachers were absent in the previous RAA interaction on 9th January. But they were keen to ask their fellow teachers about the activities and learnt that water pumps were demonstrated during the sessions. These teachers repeatedly asked us to show the design and working of these pumps. We promised them to show it in the next session in April.

*Teachers are taking the learning during RAA sessions to their students in the schools. Large number of teachers do activities with students and send the videos on whatsapp.

* Teachers in Junior Science/Maths group proudly told that they tried with students mathematical content that they learnt in the previous RAA interaction (9th January) and students greatly appreciated these new things.

*Efforts are on to create a webpage exclusively for RAA on IIT Kanpur website so that information can be shared by all other RAA Mentor Institutions.

4. Concluding Session

After the group sessions were over, teachers again assembled in L-13. After a nice discussion about the content and experiences, the date of next such session was discussed. Though all of them wanted more frequent interaction sessions, March being the month of examinations, it was decided to have the next session in April.