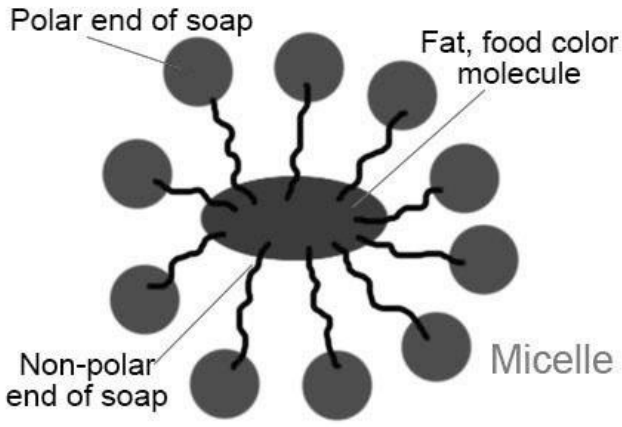
Bringing inquiry-based science teaching to the classroom

The objective was to provide experience of inquiry-based activities in science and emphasize the need to discuss the science behind every activity for better learning. This was done using three simple activities related to the lessons from Term III.

Science of cleaning: The purpose of this activity was to figure out what soap molecules actually do when they clean, and the special features of soap molecules that enable them to clean. We discussed which cleaning agents worked best and worst against stain samples like, dirt (soil), grease, iodine stain, water paint, turmeric stain and markers (non-permanent). Five pieces of cloth each stained with one type of dirt was given to each group. They were asked to remove the dirt from each cloth piece using cleaning agents - water, kerosene only, first kerosene then water, detergent powder, soap (or combination) and then allow them to dry. Based on their results, the groups arrived at the best cleansing agent for particular dirt.

Laundry Experiment

Later, they discussed the reason for the variation in the ability of cleaning agents w.r.t different dirt. For example, grease was removed best with kerosene whereas soil, paint etc, were easily removed with water. Why? Polar solvents dissolve polar dirt and non-polar solvents dissolve non-polar dirt. Some dirt has both polar and non-polar substances mixed in it; in those cases we need a combination of both polar and non-polar solvents. That is what soap does. Soaps have a hydrophilic head and a hydrophobic tail making them better cleaning agents. Thus, what water alone cannot do, soap can.



How Soap Works

Participants had queries like, how could we explain polar and non-polar to 6th std students? – We can explain it as charged and not charged. A thin stream of water is deflected when a charged rod is brought closer to it, whereas kerosene or similar solvents are not deflected. This experiment will also be relevant to the students, as they keep staining their clothes so their understanding of cleaning agents for specific type of dirt will be useful for them in their daily

lives as well. Participants suggested that it would be interesting to share the industrial applications of detergents/soaps and the laundry industry in particular to experience chemistry in action.

Bio-diversity: The next project idea discussed was on the diversity of insects - 'who like flowers ?' The objective of this activity was to focus on measuring the diversity of insects and the role played by insects in the ecosystem. This was done with the wider aim of enabling the learners to understand and appreciate the need for balance in the ecosystem by observing the role played by each and every organism in the ecosystem they are part of.

Students themselves can observe and investigate the types of insect attracted by natural and artificial flowers based on various characters of flowers such as colour, fragrance, nectar etc. There was an elaborate discussion on the characters of flowers pollinated by wind and insects - size, colour and scent of the flowers. Insects are easily attracted to flowers that are big, have coloured petals and strong fragrance. Example: Jasmine, Samanthi etc., The discussion continued on to the characters of local species of insects like leaf cutting bees, sweat bees, bumble bees, digger bees, beetles, wasps, moth etc., (commonly seen in and around Pondicherry), that are involved in pollination and their diversity. It was followed by a discussion on making children do the project, - possible formats for observation and documentation. As there might be a slight difficulty in performing this activity in urban schools, we could use potted flowering plants as an alternative.

Observation Format

Time of Day _____; Temperature _____(^{o}C)

Number of flowers observed:_____

Duration of observation: _____(mins)

Category	Observations			Average
	#1	#2	#3	
Honeybees				
Bumblebees				
Small bees				
Flies				
Butterflies				
Beetles				
Other				
Total				

Calorimeter: The objective of the project is to determine the calorific content of a given food substance by burning the food in a calorimeter.

Energy can neither be created nor destroyed and heat energy gets transferred from one system to another system. By measuring the increased energy in a system (say water) we can determine the energy content of the source of heat (food substance, fuel etc.,)

Teachers were grouped to perform the activity and were provided with the required materials after being shown a model of the experimental setup. The following data were collected: Mass of food substance before burning, Mass of water

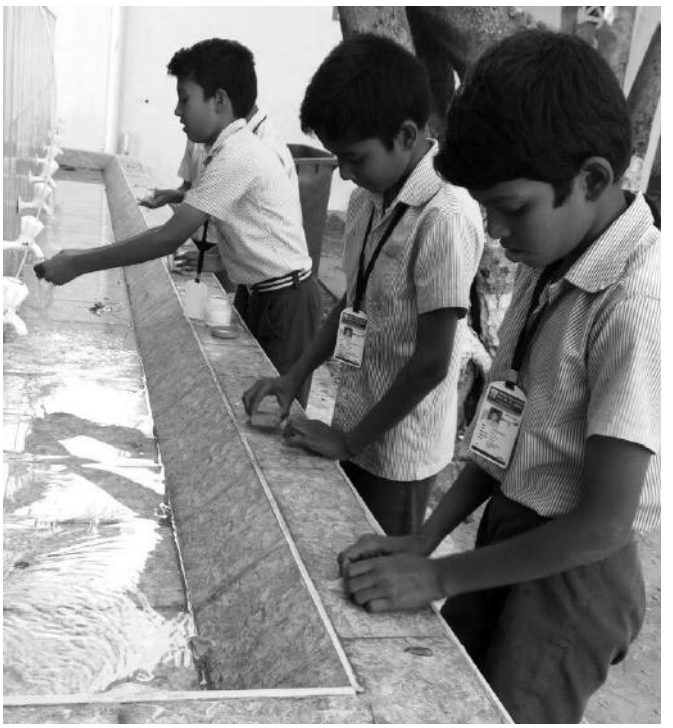
in the calorimeter (aluminium can), Initial temperature of the water, Final Temperature of the water. They calculated the energy content of the food item using the data in both kJ/gram and kcal/gram units.

Why do we consider the mass of water in this experiment? It is because of the specific heat capacity of water i.e. the energy from the food substance is transferred to water as heat, raising the temperature of water. Hence the amount of water being heated should be considered while calculating the calorific value. The limitation of this set up is that some of the heat energy is lost to the surroundings, thus the total energy content of the food substance will not be transferred to water. A Bomb- Calorimeter is used to calculate the calorific content accurately.

The project can be related to children's life through nutritional information provided in the food packets we normally buy and children can be encouraged to analyse the calorific content in different substances. In the curriculum, the calorific value of fuels has also been discussed.

Participants felt that these activities are simple to perform in classrooms and effective in making children understand the science (how & why) behind the phenomenon that they come across in their day to day lives.

The resources required are also easily accessible. They are available in our Teacher Resource centres as well.



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