

# Learning Science through engaging with Life

Even with the significant advance in science and technology we still the world gripped in many social issues. Hence, technical advancement is insufficient for human and planetary well-being. The role of education hence is not only the advancement of scientific thinking and critical thinking in children, but also their agency – to care deeply for the world and their ability to act on it. With this perspective learning science should be through engaging with life and the world around us. Children should be able to make an impact locally in their school and community and at the same time develop a broad perspective.

STEM land works with over 300 rural children in and around Auroville on inculcating a sense of responsibility, equality and the courage to create using technology. In this article we capture some engagements at Isai Ambalam school where we work with around 80 children in bringing EVS (science and social science), Science, and Math alive. We will look at three themes - water, food, and India and Indian democracy that were carried out by children from 5th to 8th grade.

## Theme Water

A few years back when there was limited rain the water table had gone down significantly and there were difficulties of water in the region. The children attempted to understand the problem and did many projects related to this.

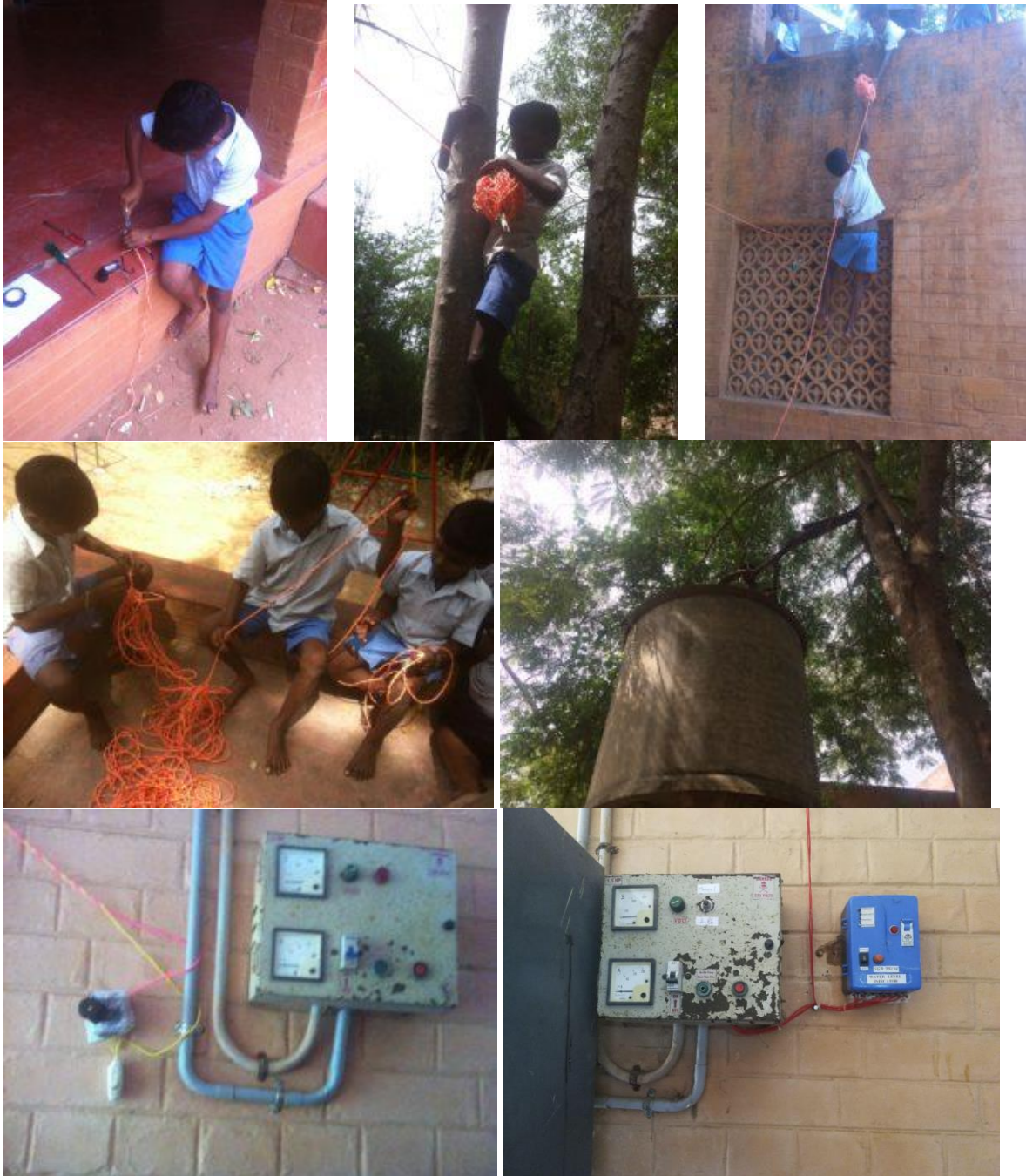
### Water depth measurements

To measure and document the groundwater level the 7<sup>th</sup> grade children built a small circuit and used cables that they lowered in the borewell pipe to measure the water depth. They had a simple circuit with LED where the water resistance completing the circuit would make an LED glow. While the process was cumbersome as the children need to pull out the full length of the cable measure it with a tape. It introduced children to long measurements in a context of the depth of our aquifers.

### Avoiding tank overflow

The concern on the water conservation was brought up by 4th and 5th graders who noticed that when the tank fills up it tends to overflow. They decided to make a buzzer-based circuit to sound an alarm when the tank was full so it could be turned off.

Initially, the experiments were started out in a water bottle. They were aware of the LED based water depth measurement, but waiting and watching for an LED was as good as noticing that the water was overflowing. The student felt that a buzzer that would make a sound would be better when the circuit was completed, children took responsibility to fix it from the tank to the motor box. Children got feedback from those in the school if their solution was acceptable and modified it so it does not come in the way of someone. The test of turning on the pump and waiting for the buzzer to turn on was a trilling waiting exercise and the children and teachers were satisfied when it worked and saved overflow water.



Even though the school finally adopted a professional water level controller, the children were the first to think about it and do something about it.

### **Groundwater model**

As part of learning about the importance of water the children decided to learn about groundwater. They built a model of the groundwater using an aquarium and placed three bricks inside the aquarium to hold an iron mesh. They left space at the bottom for the aquifer. They put a layer of pebbles and layers of soil to get a sense of how the earth acts as a natural filter that collects the ground water in the aquifer.



They also poured dirty water on top and found that this acts as a filter as it seeped through the layers. They were thrilled to see water drops being collected at the bottom which gave them some idea of groundwater, aquifer and water collection.

## Theme Food

### Vegetable garden

The children had learned about farming and wanted to know how farming could be done with limited water. They had also studied about vegetables and wanted to grow a few vegetables on their own and see if they taste better than vegetables from the market.

To understand more about seeds, permaculture and irrigation methods, we visited various Auroville farms. They learned about raised bed, mulching, irrigation, compost and indigenous seeds. They decided to execute the permaculture in our school using raised beds and trench and created six raised beds. Each bed consisted of 8 layers and the dimensions are 15'x 3'x 2'. It took 3hrs per day to complete one raised bed. We took 5 days to complete all six raised beds. To avoid the raised bed from disassembling they used wooden pieces and cement slabs. This learned us to use materials available around us. After creating raised beds, we dug a trench on one side of the garden in order to save the top soil from the erosion and harvest the rainwater in consultation with a soil scientist.

For lower use of water the children used a combination of drip irrigation and sprinklers. To grow saplings they created a mother bed with seeds of Tomato, Brinjal and Chilly.



For other vegetables like cluster beans, flat beans, ladies' finger, cow pea, etc we directly sow the seeds on the raised beds. The creepers were sown near the fence.

### Harvesting



They harvested the vegetables in 4 months and gave what they harvested to the kitchen at the school. The children even ate raw beans and relished its taste.



Through this exercise students learnt about farming, soil fertility, mulching, composting, rainwater harvesting, seeds, water conservation, the use of available resources, estimation, perseverance, time management and teamwork which are very important in our life.

### **Medicinal Garden**

After attending a session on Siddha Medicine they proposed to make a medicinal garden in the school to cure small illnesses and create an inventory of their own medicine. This would also be something for the younger children when they graduated. They planned to use the kitchen handwash water. The work began by creating a fence for the garden, to protect it from unintentional damage from objects as it was adjacent to the playground.

Each child selected one medicinal plant and researched the beneficial values of it. They searched online about their plant, they took notes based on what kind of disease it cured, and any special needs to grow the plant. We mixed jelly, cement and sand to make the foundation of the bamboo poles strong.

After creating the fence, children made raised bed within based on their past experience of the vegetable garden. They required no help from the teachers, they themselves took initiative to build the bed. The entire activity was completed in half a day after they planned everything. They dug a bed of one foot by 32 feet. Initially they put sticks then dry leaves. They added cow dung and mixed jaggery and applied it on the dry leaves. Then they covered it with sand, and they repeated this process for about 8 times. Then planted the medicinal plants on the bed and started the garden.



## India and its Indian democracy

We might wonder what learning about India and its democracy might have to do with science or STEM. However, we found that the process creating a project brings up interesting design and science challenges and integrates various kinds of learning.

### INDIA MAP – EBD

The first challenge was to build a large topological three meters length map of India on the ground. Further the goal was to represent to some degree of precision not only the heights of plateau and mountains, but also the need to represent the kinds of soils found in different places in India. One goal was to correlate the different kinds of soils, access to rivers, height and climate with what could be expected to be the crops, etc.

Students from 6th and 7th graders made the India map using red soil, clay, bricks, pebbles, sand, alluvial soil, black soil. Each student was given different parts of the country to draw. Using graph sheets to scale, they drew and built the map of India.



Students then made the structure of India using clay. However, the clay cracked as it dried up. And there wasn't enough clay to make an India map of the size they had in mind. We decided to use red soil as the base.

By using bricks and red soil students-built mountains. In order to differentiate between desert, mountains and rivers they used different materials. For the rivers they mixed the cement with water and built many rivers in India. For desert, they used sand. In the eastern parts of the

country, they put the alluvial soil since rivers take alluvial soil and leave it in the delta before joining the sea.

The challenge that we faced was rising the height of the mountains. They used broken bricks and then put red soil on top and covered it so that it looked like mountains. They identified and used different types of soil in our school. They learnt about the different soils, climate, vegetables, fruits and crops grown there for example students understood that the soil deposited at deltas are called the alluvial soil. Tasks were properly divided among students, and it took about two weeks for them to complete the map. The final map looked fabulous with details of mountains, rivers and other geographical features. Through this EBD, children learnt the Geography of India.



Ankit was cycling all over India in a year to meet children and help them understand that we are part of a larger country than just their locality. He was surprised at how much the children knew about India and used a map to describe his journey cycling (at that time for 7 months). He could describe the difficulties in some places to cycle as the mountain heights helped children understand these experiences. When he followed up the conversations with photographs from the different places it also gave children a virtual tour of what they built.

At the end of the term students had their assessments in which they built a smaller India Map. They were given 2 hours. The students completed their task even before time. Later they were assessed by their facilitator who gave them feedback and what was missing. The students put what was missing in the remaining time.

## **National Elections**

During the time of the National Elections and the children took up learning about the houses of parliament and how Indian democracy was organized they also decided to engage in a school election. They further understood how the political process in their own villages is corrupted by various biases, cash, alcohol, etc. They dramatized these aspects for their parents and took steps, so their homes are not influenced by these. Here, we focus on a small project of understanding and building their own EVM (Electronic Voting Machine) ...

Whatever children learnt they presented in the assembly for the whole school. The children wanted to conduct an election at their school. They built a voting machine using raspberry pi0. They split the children into three groups like two parties and one election commission. They had three options of either of the parties and one for NOTA (None Of The Above). The parties took an effort to organize the school and talk to children and learn what could be improved in the school.

The project they built allowed for an app for the election controller. Once the controller enabled a user to enter the booth the voter could cast only one vote by pressing one of the three buttons. Each button only updates the corresponding count. Only the final counts were reported.

The election commission team also photographed and designed voter IDs for each child at the school as well as the voter list for verification during voting.



### **Conclusion:**

In an effort to build agency in children we have documented some of the projects they did in the Isai Ambalam School based on not only what they found interesting, but what impacted them and what they cared about. Such an approach to science and integrated learning, not only inculcates interest and scientific thinking, but also agency – caring and willingness to act on what we care deeply about.