

# Science Technology Engineering Mathematics (STEM) land at Isai Amabalam school

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## Introduction:

The purpose of education should be more than fitting in – getting a job and being a good citizen, it should even be beyond standing out – being good at a profession and being an independent/critical thinker. Education should help us know ourselves and lead a life without inner conflict. STEM (Science Technology Engineering Mathematics) Land is a conscious response to the belief to provide children with an education that lets them fit in, stand out and discover themselves.

*EBD: The short definition of Education By Design is: “a classroom dynamic that guides the thoughtful design of learning experiences for students. In an EBD classroom, students frequently work collaboratively to achieve desired results as they develop knowledge and understanding, critical skills, and vital habits of mind”/ A mouthful, yes, but what does this mean in practice?*

We work with 3<sup>rd</sup> to 7<sup>th</sup> grade children at Isai Amabalam school. We looked at EBDs and real life challenges that they could address to engage with them. We hope even children who are not engaged in the classrooms to be more engaged through solving real life problems.

## The name STEM land?

**STEM** are interrelated disciplines of Science, Technology, Engineering and Mathematics to an approach to problem-solving, tinkering (playful pursuit of understanding by changing things and discovery), as engineering (rigour in learning deeply and being able to predict results, making (creating something).

**Land** describes a space where these are the norm. This was based on Seymour Papert indication that children would learn Mathematics naturally in Mathland. Much as children can learn English naturally in England. We hope children will learn STEM naturally in STEM land (Mathland).

## About STEM land - Aura Auro Design

STEM land - Aura Auro Design is a research sub-unit of SAIIR (Sri Aurobindo Institute of International Education and Research) and includes 7 engineers and some volunteers. The engineers volunteer in schools 3 hrs a day and work on technology 5 hrs a day. STEM land-AAD is a learning organization whose motto is **learn, grow, work, teach**. Learn is an unending education where as engineers and teachers we are constantly learning new things. Grow is our commitment to unending progress and growth as human beings. We put what we learn in action through Work. Teach is to share what we learn and practice. Our partners Aura Semiconductor Pvt. Ltd. provide us technical challenges and support our work.

## Context:

We are a team of engineers who teach and are presenting our observations in rural STEM centers run in two outreach schools of Auroville – Udavi School and Isai Ambalam School. Both schools aspire towards holistic development of the child and the managements are progressive. The children attending come from villages surrounding Auroville.

Udavi School follows state board syllabus and we work with 47 children from 7<sup>th</sup> to 9<sup>th</sup> intensively for 6 hrs/week for all their Mathematics (Math) classes. Isai Ambalam School follows the central board syllabus and we work with 48 children from 3<sup>rd</sup> to 7<sup>th</sup> grades intensively for 6 hrs/week during the Environmental Sciences (EVS) and Math classes. In demographics, the occupation of parents in both schools is unskilled labor (35%), skilled labor (55%) and salaried workers (10%). The predominant community accessing Udavi School is MBC (Most Backward Caste) and accessing Isai Ambalam School is SC (Scheduled Caste).

### **OUR CORE VALUES:**

Core values of the organization are

Equality	: My ability to see and treat everyone with respect
Responsibility	: Take charge of my learning and growth
Courage to create	: To create alternatives

### **PHILOSOPHIES UNDERLYING STEM LAND**

The philosophy underlying the approach for STEM land is based on the principles of progressive and constructivist thinkers like Jerome Bruner in the United States, Sri Aurobindo and Mukunda in India and many others briefly described here.

Constructivist Education Theory (Bruner, 1960) indicates that knowledge is not delivered into the learner (whether child or adult) but recreated by the learner on his or her own. Children actively construct their knowledge by connecting new knowledge to what they already know.

In India, Sri Aurobindo (Aurobindo, 1910) says that nothing can be taught, but the teacher can guide, support and encourage a child in the process of learning, enabling them to evolve towards perfection. More recently, Mukunda (Mukunda, 2009) describes the three aspects of learning that are relevant to schools – conceptual knowledge, procedural knowledge and higher order reasoning. Conceptual knowledge (and change), she states, greatly benefit from constructivist approaches.

### **ACTIVITIES AND EBDS (EDUCATION BY DESIGN) AT STEM LAND IN ISAI AMBALAM SCHOOL**

STEM land is a dynamic space that is constantly consciously responding to the learning needs of students, facilitators and youth. We presented the work with 7<sup>th</sup> -9<sup>th</sup> graders in Udavi school in our last presentation at Sinthanai Snagamam. In this paper we primarily focus on Isai Ambalam school where we were given an opportunity to create such a space for 3<sup>rd</sup> -7<sup>th</sup> graders at Isai Ambalam.

### **EBD (Education by Design):**

#### **1. Honey bee**

4<sup>th</sup> graders did an EBD about honey bees with the question, ‘Can honeybees create a forest?’ This included studying about the honey bees way beyond what is expected of them visits to apiaries and creating charts, materials to display their learning including this large model of a honeybee.



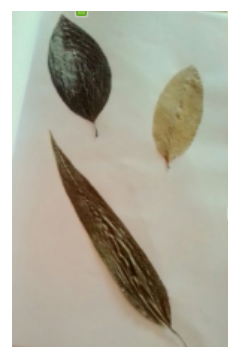
Here are some reflections from the children:

Harish: I feel really happy. Want to do the same kind of project. Want to grow honeybees. I want to tell what I learned about honeybees to everyone. I learned how to make projects. Learned what honeybee gives us and its importance and its threat. It is used for medicines also. I learned how to draw and do honeybees and where they live. Honeybees can create forest.

Mithrasri: It was fun. I learned how honeybees collect nectar, and how honey is produced and stored. I learned about life cycle of honeybees and types of honeybees. How many eyes a honeybee has. Honeybees can create forest.

## 2. Leaves and Plants EBD

There were some common questions about leaves that we as a class didn't have answers for questions like why leaves change color, why leaves fall from tree? As a class we watched videos on why the leaves are green, why they become yellow and fall. We also watched a video about different parts of a plant. We did activities like counting the different varieties of trees in the campus. After splitting into 2 groups, the children were able to find 27 different varieties of trees. We also collected all the leaves from the campus, we grouped the similar leaves groups based on shape, texture, size, edges, color.



We also had a field trip to the Botanical Garden in Auroville along with 5th graders. There a person named Sathiyamoorthy explained about the plants. He talked about their survival techniques, leaf structure and provided names of the trees and plants. There they learned about different types of plants. Finally they made a herbarium book.



## **Real life EBD (Education By Design):**

### **1. Building pond**

As a school Isai Ambalam faced many challenges and we engaged the children in small real life challenges. This allowed them to take responsibility for their school and surroundings. As an example, the school faced a water issue and the children started exploring and understanding water. They built an instrument to measure the water level of the bore-well and track water depth. They also created an overflow alarm system for the tank to avoid wastage of water due to overflow. The children also felt that the sense of scarcity could be transformed into a sense of abundance if there were a pond and over time they worked over breaks, lunches and eventually stayed overnight for a couple of days at the school to create a pond. The children of 3<sup>rd</sup> and 4<sup>th</sup> grade worked together as a team and learned estimation, areas, ratios in cement mixing, etc while creating the pond.



When the students inaugurated the pond by putting fishes in the pond even parents who had otherwise expressed unhappiness that their children were working with their hands in their breaks and sleepovers and coming home with dirty clothes were thrilled to see what their children had created.

We felt that even though our approach with younger children had been quite different we were still looking at inculcating values of responsibility, equality and courage to create alternatives in them.

### **2. Capsule (Old to New)**

The transformation of old capsule into a beautiful clay room was one of sustained effort and brought in the aesthetics of transforming every space in the school into something beautiful.





Before



After

With regard to the water the children created an instrument to measure the depth of water in our bore well and kept an eye on it often and compared it to the measurements taken by the water group. They keep attempting to refine the measurement to be more accurate and look at automation. The other was working on the overflow when the tank fills up. A small buzzer based detector that indicates when the water is overflowing was built and work on automating the turn off is in progress.

### 3. Clay Oven

Children in Isai Ambalam school made dolls and toys with the clay. They wanted to bake the toys that made. Then we went to a pottery place to get an idea to build the oven. There they explained how to build the oven. During sleep over the 4th and 5th graders went to buy bricks and bought red sand from Matrimandir. We started building our own oven in our school. The pottery person came gave instruction to build the oven. Last month it was raining and it disrupted school as well as the sleep overs and the work is still ongoing.



### 4. Kitchen Waste water treatment plant

Children wanted to make a recycling water system to water the parking garden. We thought of using



the waste water from the kitchen to water the plant since so much of water is daily used to wash the vessels, clean vegetables etc. To know the amount of water used daily for the kitchen we need to know the volume of the tank. We estimated the volume of water that will be available as around 500 L a day.

The design is a two tank filtering system. We dug 4 feet pit to insert the cement ring. What we could not complete we got the help of professionals. We bought motor and PVC pipes for taking the water from the tank and also dug a trench from the pump location to the parking garden. We also built a structure to house the motor so it does not directly get wet in the rain. With the rains easing out we should be able to complete this in the next quarter. What is left is the electrical work as well as working out a filtering system.



## 5. Vegetable Garden EBD

In the previous report we have mentioned that we have made the raised bed. Last 3 months we made a bamboo fence around the garden. We set up a drip irrigation system in the garden using sprinklers. We also started planting some plants in our bed. Children from 6th and 7th graders took responsibility to connect the sprinklers all over the garden. It was a new experience connecting sprinklers and routing the pipe to our garden. We are starting to see plants come up in the garden. Children take turns to water the plants.



## **6. Bamboo Torch**

Children have sleep overs every week. During sleep over children needed a torch when there was no power. They connected a circuit with a switch and 1 watt LED to get maximum light. They used bamboo and coconut shell and made a torch. One of their teacher got inspired and learned to make one by herself. They gifted the torch to some visitors.



## **Activities:**



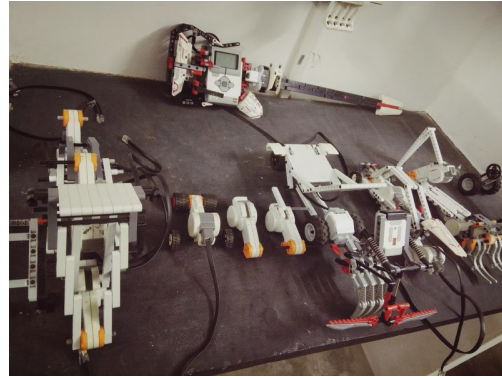
### **Multiplication tables**

We identified multiplication tables as one of the stumbling blocks in children's ability to do calculations. This in turn made children feel they were not good at Mathematics. We attempted to use Vaughn Cube methodology including the videos and soon found that it was exhausting for children. We adapted it by creating laminated sheets for the objects that need to be mastered so children could touch feel and work with the sheets instead of watching videos. We also identified where the children needed help and focused on these. Many children who struggled with the tables have been able to master it now.

### **Sleepovers with robots**

This term with the opening of the iSMART classroom we created enough space to work with the mindstorms robots we also brought out a large number of spare motors, gears and connectors that had been donated to us by Future school. The activity for Isai Ambalam children was kick-started with their interaction with the Udavi 9th graders showing them how to build and use the robots the night before iSMART classroom opening. This has continued into two more sessions going late into the night experimenting and building small creative robots on their own using spare parts.





## Conclusion:

Learning can be fun when children are engaged in real life challenges and we observed that children who are not so engaged in the class room were very enthusiastic building stuffs. From real life challenges children can learn a lot beyond their curriculum.

At Isai ambalam school we learn by engaging with life.

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