Introduction

This academic year, Udavi School students were lucky to undertake tinkering activities with experiential educational kits which made the teaching and learning of science engaging and captivating. From September 2016 to March 2017, the “Tinkering Studio” ran successfully with great enthusiasm and a joy for learning and doing. The Studio was seed-funded by SAIIER with a view to creating a new generation of young innovators, utilizing model kits which develop independent learning and creative problem-solving skills.

Setup and use of the Tinkering Studio

We purchased more than 101 different materials and pieces of equipment that included electronic components, tools, science kits, robotic motor engines and other models. Hands-on activities were provided to make learning easier and more interesting. The Studio was designed to accommodate 8 to 10 students in each session, and was offered at primary and upper-primary levels with around 30 students participating over the year.

Sundar and I (Sudhir) were the resource persons present as guides at the lab, and used the facility regularly. We found that the students wanted to be in there often too.

We noticed that whilst in the lab, students were naturally quiet as they concentrated on the resources available to them: they were very much attracted towards the materials available to tinker with, and engaged themselves in various activities. As things moved on, ideas started to flow, and students began to think differently. They began to use their own engineering ideas.

Students’ tinkering projects

Students from grades 6 and 8 used the tinkering lab to make their required science working models and presented these during Open House Day. As a result of the tinkering, it was assessed that the standard of the students’ work had improved greatly as they developed a better understanding of the subject.

- **Bubble gadget:** The 6th standard students had a couple of motors in their equipment stock. They were eager on biasing them, and started with removing the gear from the motor and setting a flan blade to it. The children noticed that wind was only produced in one direction when connected to terminals of a battery: it was either inward or outward. So by changing the polarity, the direction of rotation also changed in the motor. Then came the idea of creating a bubble gadget. At first the students used two of the same kind of motors (same RPM): one for blowing air and the other for creating bubbles on a stick attached to a copper ring made by shaping copper wires into a circle and using a glue gun to stick them on. They discovered that this did not work as both the motors were synchronized together. They got a 100 RPM motor and used it as a substitute, which made it possible to create the bubbles. Then they cut wood to make a platform to support the set-up.

- **Soldering:** The students wanted to learn soldering. They came up with simple circuits connecting LEDs to PCB boards and powering up using batteries. One of them had also seen a buzzer that produced sound when the circuit was completed and wanted to implement it in the tinkering lab.

- **Safety alarms:** Students working in pairs took on a project to make window and door safety alarms. It was a grand success and introduced simple circuitry and measuring of output voltages. The students mounted the components and applied flux and then soldered them to
the PCB. The buzzer is now ready for use as a window safety alarm.

• **Exploring shapes:** Students’ problem-solving skills were further enhanced by using straws to build shapes within provided constraints:
  1. Using 12 equal straws, to build 8 equal squares.
  2. Using 6 equal straws, to build 4 equal triangles.
  3. Using 8 equal straws of one kind and 4 equal straws of another, to build 2 equal squares and 4 equal rectangles.
  4. Using 8 equal straws, to build 4 equal triangles and 1 square.

**Outcomes and reflections**

We believe that true learning comes when it’s being experienced through tinkering activities. At Udavi School, the activities were planned to handle real parts, real science, real engineering by using real tools. Imagine a child being able to use a battery operated screw driver to fix things together, completely independently, in the real world, and be able to say ‘*I have done it*’.

To have a tinkering lab on a school campus is a good way to provide skill-based activities. We find it a very helpful way for young children to explore new ideas and learn through practice and making models from scratch. Some children have a tendency to want to explore ideas of their own, which has not always fit in well with the traditional classroom situation. From this experiment at Udavi, we believe that a tinkering lab provides the perfect educational environment for such children. Tinkering activities change the learning atmosphere, and we find that the students who have this experience are now motivated to learn.

This has been a highly successful learning methodology for both students and teachers. We have all enjoyed the working atmosphere and fun of making different models and exploring ideas together. It has been suggested that a future tinkering lab could be called Auroville Tinkering School and a proposal has been put forward to SAIIEER in this regard. The Tinkering School would be equipped to offer many more hands-on activities to interested teachers and students who wish to tinker within the classroom teaching/learning process. We have a plan to offer this opportunity to the students of other schools in and around Auroville because we believe that every school would benefit from having such a lab where children are welcome to tinker and in the process develop many interesting ideas and activities. Multiple tools, consumable materials and science kits will be purchased for next year, if the project proposal is approved.

As with all new experimental initiatives, there is room for refinement of some issues/processes. We welcome the opportunity to meet that challenge next year. After all our efforts, the tinkering lab has become a learning environment of highly motivated young children and adults as well.

### Successful educational outcomes for students

- Fostered independent learning
- Gave opportunities for creative and analytical thinking
- Encouraged development of problem-solving skills
- Encouraged enthusiasm for experiments
- Fostered teamwork
- Encouraged students to face challenges
- Developed fine motor skills
- Students flourished in the supportive environment

### Areas for improvement / Future challenges

- The Tinkering School will need more physical space, and will need to be improved.
- Outreach schools and Auroville schools will be contacted and the students and teachers encouraged to join in the Tinkering School.
- More sessions will be planned to increase the number of student participants.