FabEd Workshop for students of secondary schools

TCTD center and Vigyan Ashram

2015

This report is about the workshop on 'Digital Fabrication' conducted for Secondary schools' (9th class) students. 16 students and 4 Instructors from rural and tribal schools of Maharashtra used advanced workshop tools like laser cutting machine, 3D printer, etc. to work on their project. Though they have limited knowledge about computers, they have mastered use of drawing tools & machines in short time. This was the first workshop on Fab Lab in education held in collaboration with TCTD and VA Schools are supported by Praj Foundation under its 'Model IBT School' project.

Vigyan Ashram
At Post: Pabal, Tal: Shirur,
Dist: Pune- 412 403
www.vigyanashram.com
Mob: 9730005016
Contact: 02135-292326

FabEd Workshop for students of secondary schools by Tata Center for Technology and design (TCTD Fab Lab) & Vigyan Ashram

Duration: 2nd- 6th Oct 2015 (Residential)

Participants: 4 rural schools, 16Students, 4Instructors, 5VA members, FAB LAB TCTD center staff.

Methodology: Design thinking & Learning while doing

Fab Lab: Fabrication Laboratory is a collection of commercially available machines and parts linked by software and processes MIT (USA) has developed for making things. Fab Labs is kind of distributed international network of scientific researchers and community inventors. More @ Fab Lab on www.fabfoundation.org and Fab Lab in Education i.e FabEd program on http://www.fabfoundation.org/ fab-education/

FabEd Workshop:

Vigyan Ashram is working with secondary schools through its program 'Introduction to Basic Technology (IBT)'. The program is based on the philosophy of 'Learning while doing' and 'Learning through socially useful productive work'. Students in IBT program are already creating stuff to solve local community problems. IBT schools are equipped with traditional tools viz. fabrication, electrical, carpentry, agriculture etc.

VA is trying to introduce digital fabrication in IBT schools and to explore possibilities of using Digital tools in secondary schools. VA and TCTD organize first FabEd workshop at IIT, Mumbai.

Objective of FabEd workshop:

- To explore idea of using Fab Lab in school education
- To link fab tools to IBT program
- To use Fab machines to build school projects
- To develop methodology to conduct such workshop in future

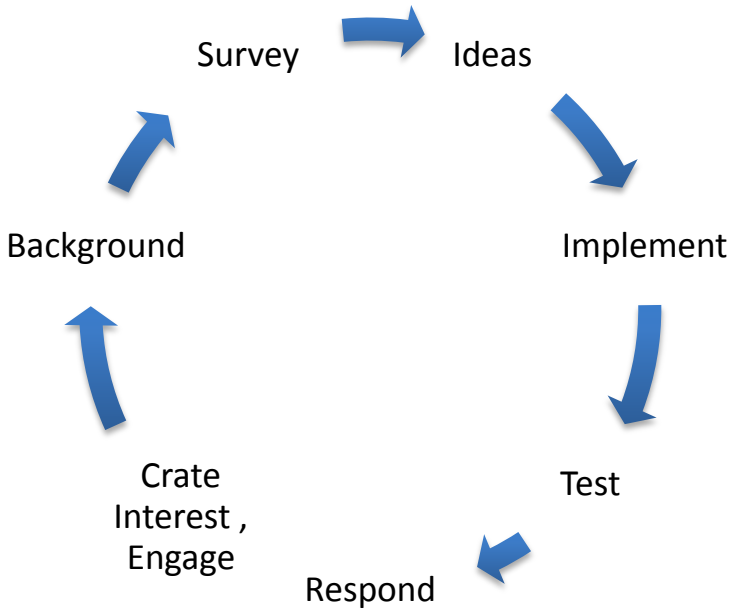
Selection of Schools:

Selected schools and students are from rural and tribal background. They have very limited knowledge of English and computer operations. They already used traditional fabrication tools in their school. Name of the schools are:

1) Hirakani Vidyalaya, Gawadewadi
2) Shri Pandharinath Vidyalaya, Pokhari
3) Pragati Highschool, Mukhai
4) Dnyan Sanwardhini vidyalay, Shirwal

Methodology:

IBT schools are conducting IBT project using following design thinking steps. These 7 steps are as follows:-



We have followed the same steps for the FabEd workshop.

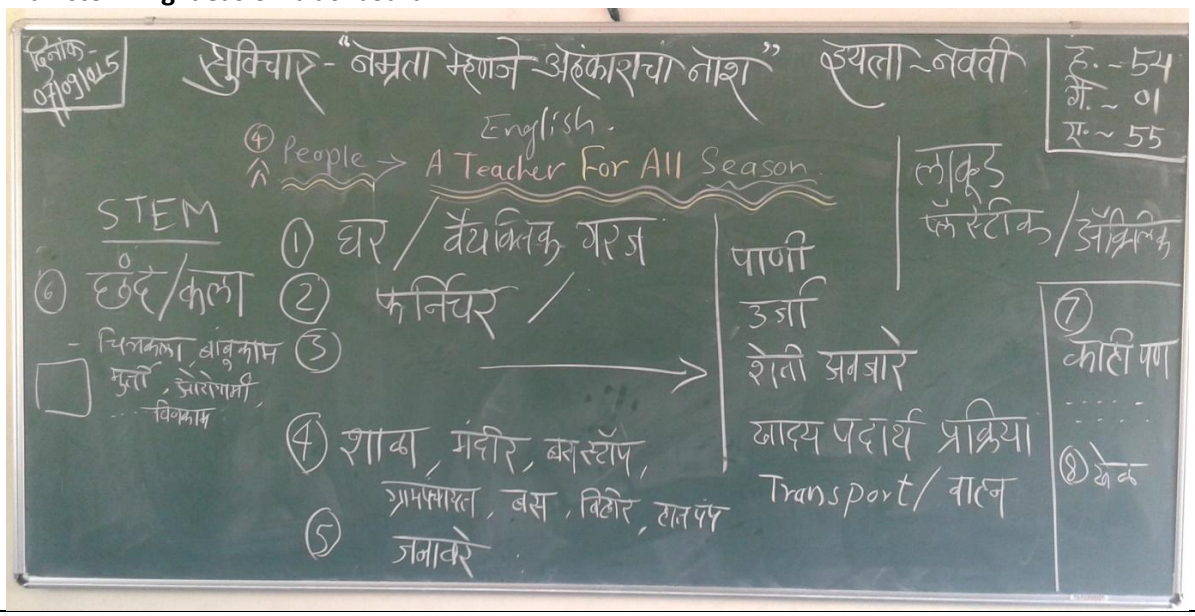
A] Idea Generation:

Since we can only accommodate few students at Fab Lab. We have decided to select the students with best ideas. A brainstorming session was conducted in all 4 schools. Vigyan Ashram's team members conducted the session. Students were asked to list problems and ideas surrounding them. They were also discussing the problems in ground. Each one individually writes down their project ideas.

Problems / Ideas for technical solutions		Examples of ideas came from students
i)	Problem faced by you personally for which you need to make something!	- Need carrier for bicycle to fix school bag.
ii)	Problems faced by you at home which you want to solve.	- Cow dung plaster machine - Dish cleaner machine - Cloth drying machine - Floor cleaning machine - Multipurpose stool, table and furniture - Gas tank trolley
iii)	Problems faced by you at schools which need to be fixed.	- Automatic school bell - Ready to cook mid day meal - Automatic duster without dust - Carrier for chalk, dusters, pen etc. - Smart ID card for attendance - Locker for study bench

		- Comfortable bench cum chair
iv)	Problems faced at community places like bus stop, temple etc.	- Waste collection in temples so we can make compost or any fertilizer - Mosquito repellent - Leopard protection alarm - Trolley for transport almost everything
v)	Problems observed by you facing elderly people, animals or anybody in your surrounding	- Solar battery operated chair with wheel for Grandfather - Support stick for older people - Device which will engage older people like radio or anything interactive thing - Alarm for taking medicine on time - Siren Stick for blind people - Animal cleaning machine
vi)	Anything which you want to make for yourself!	- Jumping shoes as we have to walk far for going to school - Automatic Pen with memory card which can store written thing - Robot which can give everything in hand. - Bangle, Mobile stand/ Jewellery box

Brainstorming ideas on blackboard:



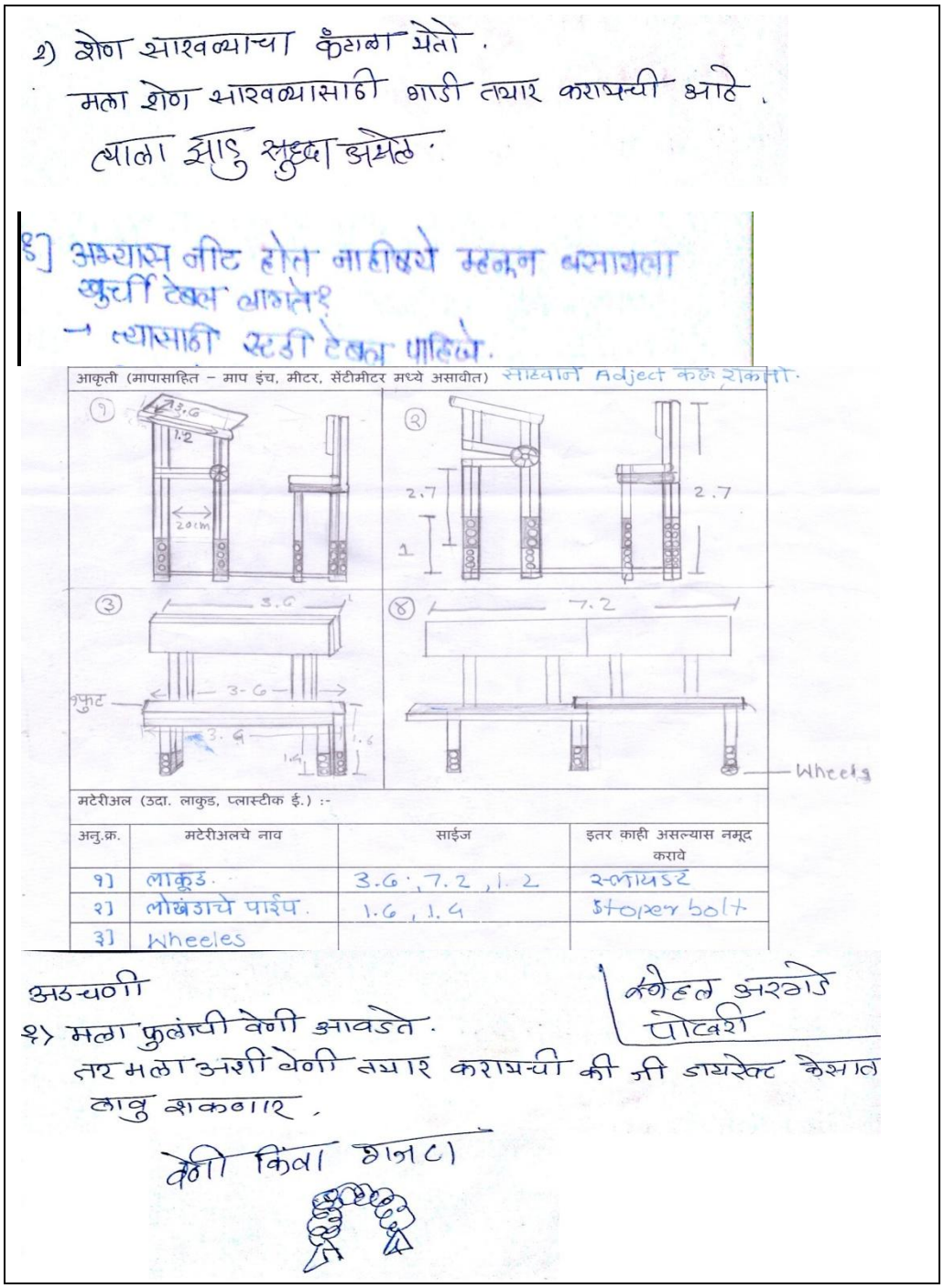
B] Short Listing of Ideas

Through all these 4 workshop session, we got 360+ ideas from 120 students.

We have shortlisted the project on following criteria:

- ➔ Limitation of machines
- ➔ Usability of idea

➔ Feasibility of completing it in given time.



We have communicated best feasible ideas to schools and student list. School management selected 4 students from the list and one instructor for the workshop from each school. Now we have 16 students from IX std and their 4 IBT instructor i.e. 20 participant for the workshop. We asked them to submit revised drawing and dimensions for their project.

C] Background work by Fab Lab team at VA

Following background work was done by VA team before the workshop –

i) We know that our students are not good in making design on computers. Therefore we have decided to make basic CAD files ready. So that students can use it during the workshop. They can modify and give final touches during the

workshop. We also listed possible modification to be made during the workshop in consultation with students.

ii) Make a list of material required and send it to TCTD for making them available.

iii) Following is the list of basic design made by Fab team.

Laser Cutter	3D Printer	Shopbot	Modella Machine
- Bangle Stand - Jar stand - Ruler (for grid) - Key chains - Certificates for schools	- Key chain - Jewelry (necklace, nose ring, earring) - Bracelet - Flower holding clip - Deepmal (Lamp) - Memento - Pen drive holding hairclip - Color pallet	- Trolley (spread cow dung to plaster floor) - Chair (foldable chair for study) - Ladder holder (easy climbing and stepping down)	- Seal - Medal Mold

D] Bring Dream Ideas into reality:

Following was the schedule of the workshop.

We divide students in four groups, each group having student from different school, they gave name to their group such as- Einstein, Newton, and Dr. APJ Abdul Kalam, Robert Hook.

Schedule is as follows:-

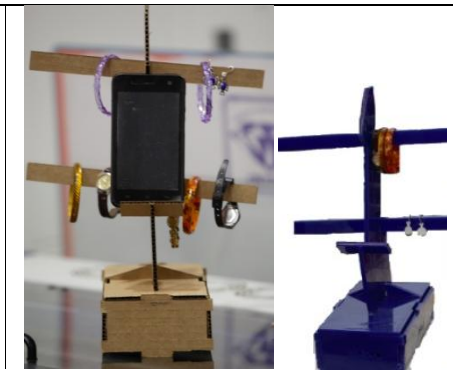
Date	Group I – Einstein	Group II- Newton	Group III- Dr.APJ Abdul Kalam	Group IV- Robert Hook
2nd Oct 2015	Introduction to Digital Fabrication, machines, Safety, Rules in the Fab lab, sharing of project ideas	Introduction to Digital Fabrication, machines, Safety, Rules in the Fab lab and project ideas	Introduction to Digital Fabrication, machines, Safety, Rules in the Fab lab and project ideas	Introduction to Digital Fabrication, machines, Safety, Rules in the Fab lab and project ideas
3rd Oct 2015	9-10am : Agenda sharing for the day 10-6pm: Assignment on Laser Cutter 7-8pm :Review	9-10am: Agenda sharing for the day 10-6pm: Assignment on Modella machine 7-8pm: Review	9-10am: Agenda sharing for the day 10-6pm: Assignment on 3D printer 7-8pm: Review	9-10am: Agenda sharing for the day 10-6pm: Assignment on Shopbot Machine 7-8pm: Review
4th Oct 2015	9-11am: Documentation 11-6pm: Assignment on Modella machine 7-8pm: Review	9-11am: Documentation 11-6pm: Assignment on Shopbot Machine 7-8pm: Review	9-11am: Documentation 11-6pm: Assignment on Laser Cutter 7-8pm: Review	9-11am: Documentation 11-6pm: Assignment on 3D printer 7-8pm: Review
5th Oct 2015	9-11am: Documentation 11-6pm: Assignment on 3D printer 7-8pm: Review	9-11am: Documentation 11-6pm: Assignment on Laser Cutter 7-8 pm: Review	9-11am: Documentation 11-6pm: Assignment on Shopbot Machine 7-8 pm: Review	9-11am: Documentation 11-6 pm: Assignment on Modella machine 7-8 pm: Review

6th Oct 2015	9-11am: Project writing 11-1 pm: Time to finishing of all projects 2-6 pm: Exhibition of all projects, Certificate distribution ceremony	9-11am: Project writing 11-1 pm: Time to finishing of all projects 2-6 pm: Exhibition of all projects, Certificate distribution ceremony	9-11am: Project writing 11-1 pm: Time to finishing of all projects 2-6 pm: Exhibition of all projects, Certificate distribution ceremony	9-11am: Project writing 11-1 pm: Time to finishing of all projects 2-6 pm: Exhibition of all projects, Certificate distribution ceremony

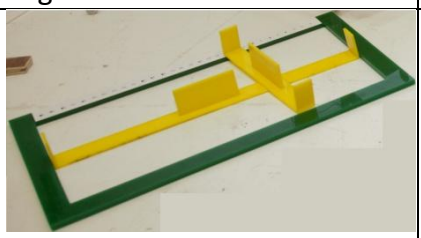
Projects done during workshop:-

Jewelry and 3D printed Dome
Features : It is Indian traditional jewelry viz. Nose ring, bracelet, necklace, ear rings

3D printed Deepmal
Feature: It can glow with single light source. Easy to replace bulb.

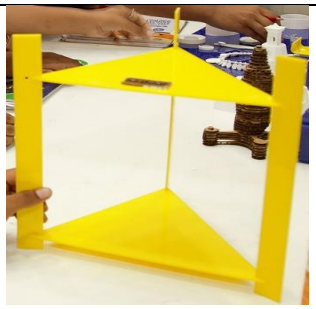


Jewelry stand
Feature: It can hold bangles, wrist watch, earring, necklace, mobile, etc.

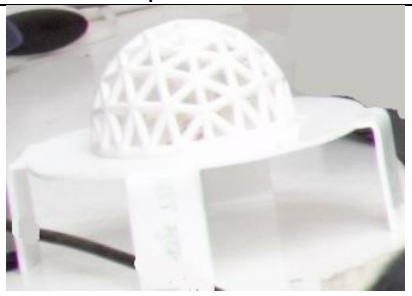


Ruler
Feature: to draw accurate grid on blank surface, easy to carry, light weight, it has vertical strips to hold it

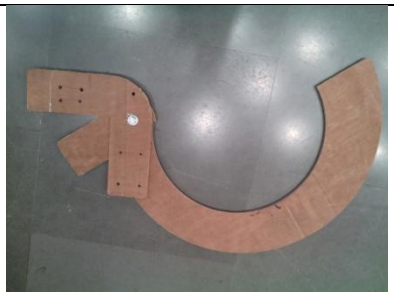
Foldable Study chair
Feature: Just by folding it can be bench for one, stool, chair



Jar stand
Feature: It can be use in kitchen or bathroom to put soap case, etc

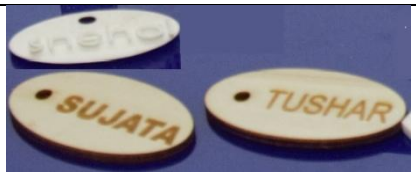
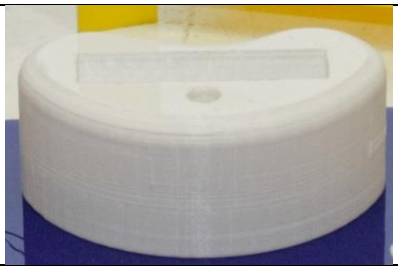


Memento to TCTD
Feature: four legs of it has



Safety ladder attachment
Feature: Easy to fix, carry,

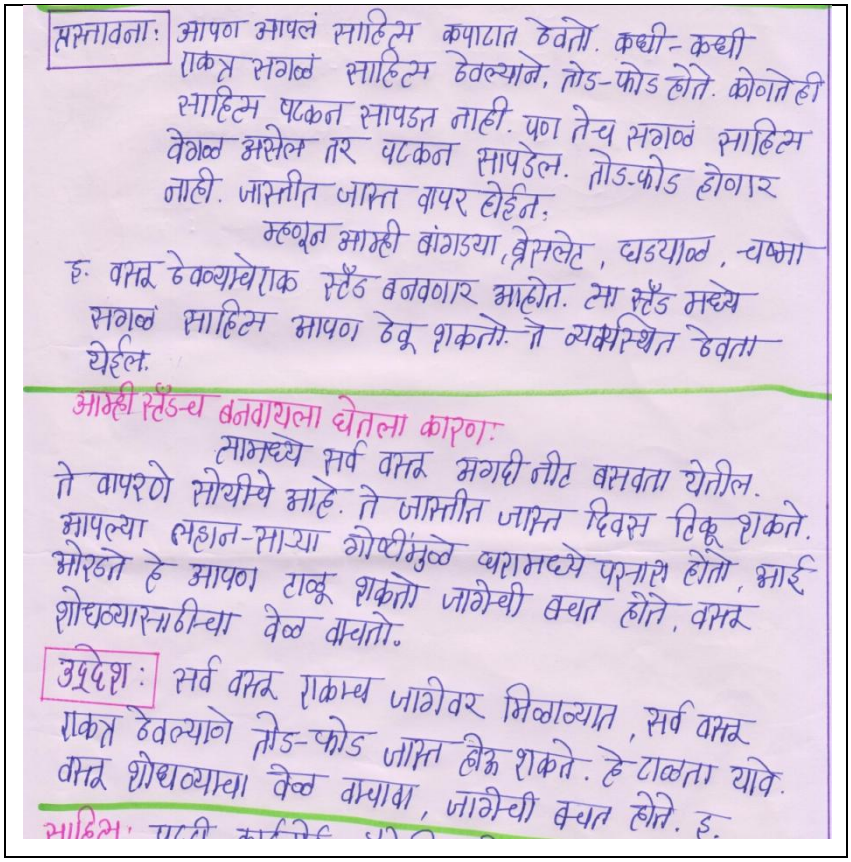
Mobile stand
Feature: One can easily carry it

name of 4 participated school, dome shape representing Vigyan Ashram's contribution	light weight. Holding it one can comfortably step down.	with charger because of small size, light weight acrylic material
		
Hair clip **Feature:** It can hold USB- pen drive in the hair clip.	**Multipurpose Trolley** **Feature:** It can be use for floor cleaning, cowdung plaster on floor, to spread fertilizer, to bring water container, etc	**Certificates :** Each school group get it as memento for participation in workshop
		
Key chains: children will use it for their cycle keys	**Medal** **Feature:** it can be use as mold also	**Office Accessory stand** **Features:** can put Mobile, Pens, Keys, Charger, sticky notes bunch, etc.
		
Hair clip: One can tuck flowers on it and no need to buy costly Lei (*Gajara)*	**Mobile & Pen Stand** **Feature:** One can use it for mobile, pen, key, etc.	**Bracelet** or can use as *Bajuband*

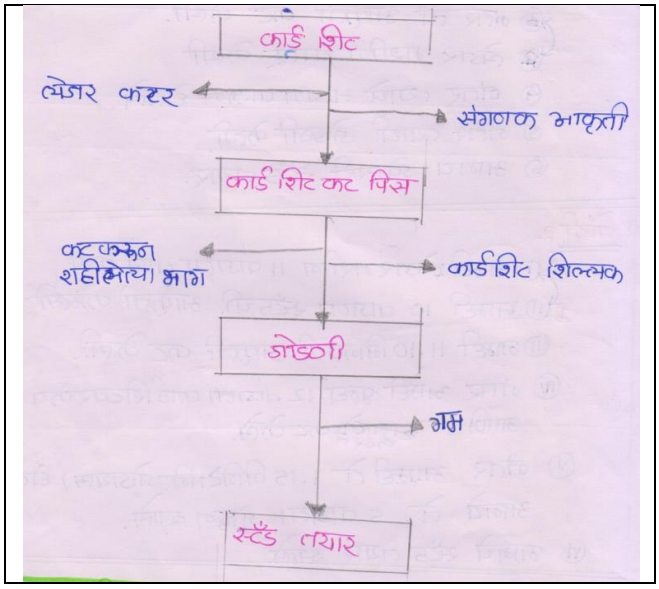
E] Documentation

Students carried out documentation during review session every morning. We insisted to document the following in their report.

1) Objective of selecting the project.
   Why the particular project is chosen?
   Why it is different from other available solutions?

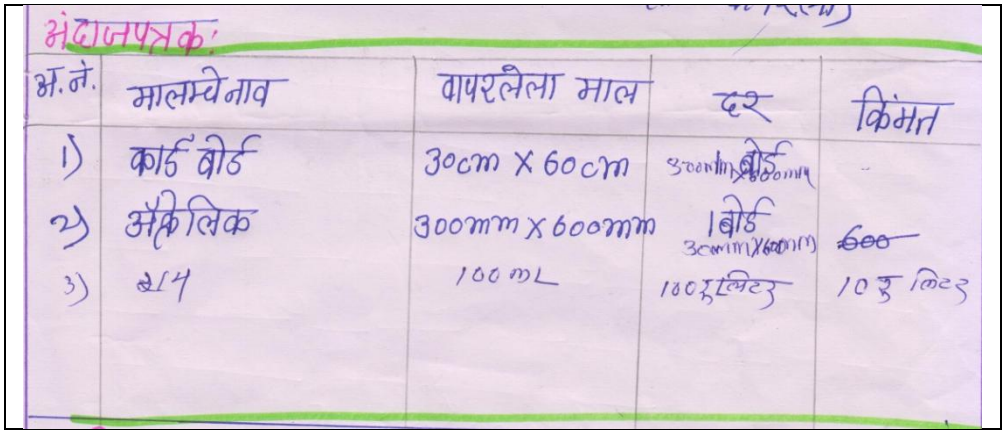


2) Methodology –
   i) Methodology of doing the project.
   ii) They were asked to draw a flow chart of the process of the project.



3) Costing of the project

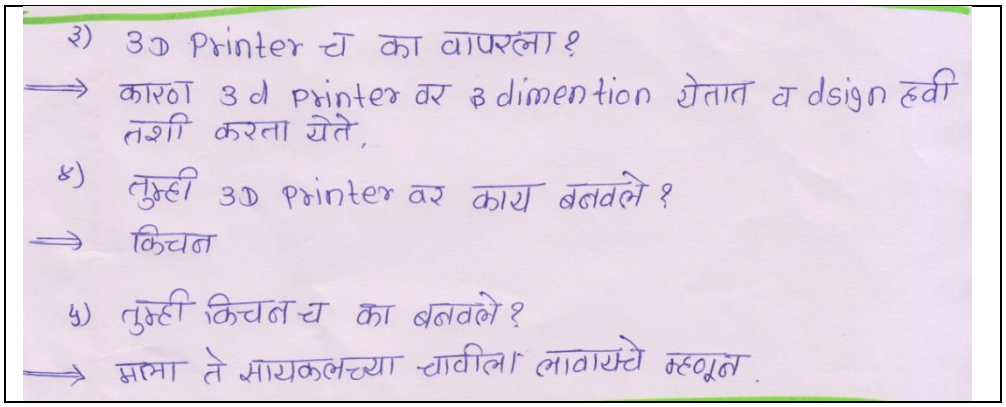
   Costing was done for every job. They were asked to calculate cost of the job they made.



मेटाजनपत्रक:

अ.नं.	मालाचे नाव	वापरलेला माल	दर	किंमत
1)	काई बोर्ड	30cm X 60cm	30cm X 60cm बोर्ड	
2)	ॲक्रेलिक	300mm X 600mm	1 बोर्ड 30cm X 60cm	~~600~~
3)	डिंक	100 mL	100 मिलिटर	10 रु लिटर

4) Brainstorming on the problem faced?
Students listed the variety of problems 'What, Why, Where, When and How?' and try to answer them. This was important to do the work with understanding. This also helps in learning academic concepts.



३) 3D Printer चे का वापरला?
⟹ कारण 3d Printer वर 3 dimention येतात व design हवी तशी करता येते.
४) तुम्ही 3D Printer वर काय बनवले?
⟹ किचन
५) तुम्ही किचन च का बनवले?
⟹ आमचा ते सायकलच्या चाकीला लावायचे म्हणून.

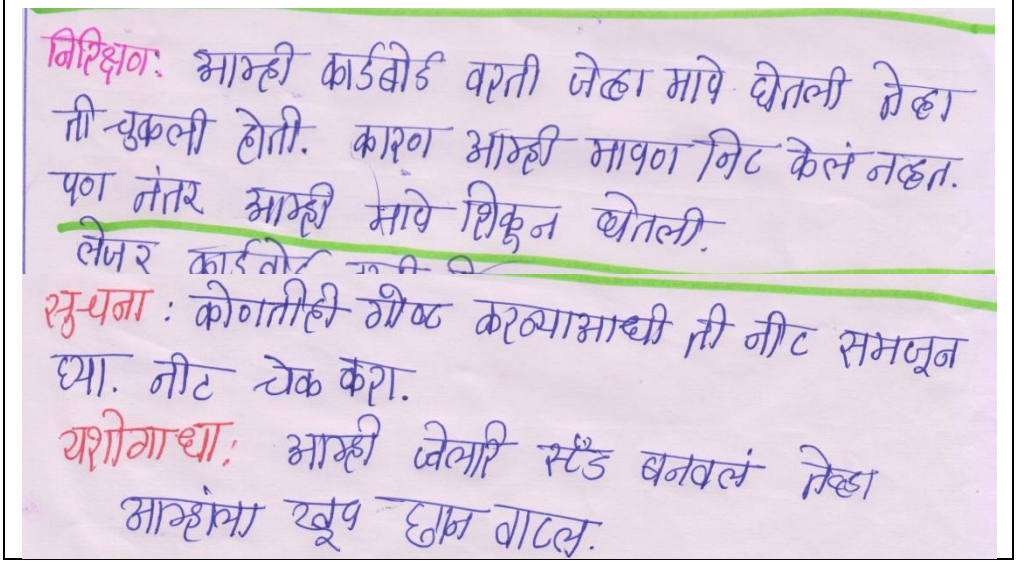
5) Linkages to curriculum topics: Students made various articles during the workshop. This helped to use concepts from curriculum. Due to time constraints, we have not gone into details of the subject areas. Following are the linkages of the activities from the curriculum topics. We have referred to Introduction to Basic Technology-(V1) [Multi skill foundation course L1&L2] syllabus.

	Learning Outcome
L1	• Carry out measurement using instruments such as meter tape, vernier calliper, and screw gauge, spring balance. • Marking of job • Sharpening of tools • Drilling hole in wood/plywood • Finishing and polishing • Draw a flow chart of activity • Carry of Marking for Drilling • Estimating quantity of material required for the job • Calculate the cost of the article prepared • Demonstrate the use of personal protective clothing and equipment • Clean the work area before and after the task
L2	• Made necessary measurement and marking as per the specifications

	• Demonstrate to cut and weld given material for making the object as per the design and specification • Draw plan, elevation and side view of an object. • Selecting scale • Draw drawing using proper Line, lettering and system of giving dimensions in drawing. • Describe component of costing and basis for calculating sales price. • Describe the various types of material that can be used for making objects

6) Lesson learnt

Students also wrote about the 'Lesson learnt' in their report.


निरिक्षण: आम्ही कार्डबोर्ड वरती जेव्हा मापे घेतली तेव्हा ती चुकली होती. कारण आम्ही मापण नीट केलं नव्हत. पण नंतर आम्ही माप शिकून घेतली.

सुचना : कोणतीही गोष्ट करण्याआधी ती नीट समजून घ्या. नीट चेक करा.

यशोगाथा: आम्ही जेव्हा स्टँड बनवलं तेव्हा आम्हांला खूप छान वाटल.

7) Visitors and Certificate distribution

We have invited many people to visit the workshop and interact with the students on the last day. Important visitors are:

a) Mr.Bhutange – Director, Vocational Education & Training, Maharashtra
b) Mrs.Mrunalini Kher , Kherwadi Welfare Association
c) Mr.Rajeev Ahal and Ms Madhu Behl from IL&FS, Mumbai
d) Mr.Amit, Tech Shiksha
e) Mr.Subodh Kembhavi, Educational Consultant

Prof.Dr.Sanjay Mahajani and Prof.Alka Hingorani also met students and discussed their projects.

Certificates were given to all participants and workshop was celebrated.

F] Outcome of the workshop:

a) Students learned how to operate digital machines.

b) It gave boost to their confidence by working in well equipped IIT, Fab Lab.

c) VA team got experience of conducting Design thinking workshop with school children in Fab Lab. We have reasonable got idea of process to be followed, preparation required and time required for the workshop.

d) Students easily started using drawing software like solid works. It is really learning for us. We have underestimated our students.

e) TCTD can help our schools with affordable digital tools. Four instructors who have participated in the workshop are artisan. They expressed need for digital machines in their need. It is decided to hold a workshop in December with selected IBT instructors to identify the need.

E] Our Learning:

a) Need to give more time to brainstorming and conceptualize ideas.

b) Objective of project need to be sharpened in the school itself.

c) 'Why' session to be undertaken at the end of every day.

Participants from School:

Hirakani Vidyalaya, Gawadewadi	**Shri Pandharinath vidya, Pokhari**	**Pragati Highschool, Mukhai**	**Dnyansanwardhini vidya, Shirwal**
1) Prajwal	Rutuja	Suraj	Sairaj
2) Tanvi	Snehal	Saurabh	Prathmesh
3)Nikita	Tushar	Sujata	Siddhant
4) Pratik	Roshan	Vaishnavi	Adarsh
5) N. Bhalerao, Ins	Langhi, Instructor	A.Ware, Instructor	Kokare, Instructor