Field Guide to Creating a

MAKING SPACE

in your School

Karkhana
Samuha

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01
What are Making Spaces?

Children should engage in tinkering, engineering, and making because they are powerful ways to learn.

Making spaces are collaborative working spaces that allow students to turn their ideas into tangible products through making, tinkering, and engineering. These spaces put student agency and interest at the center, asking students to become aware of the design of the world around them and begin to see themselves as people who can tinker, make, and improve that design.

NIMS Making Space

Panchakanya Making Space
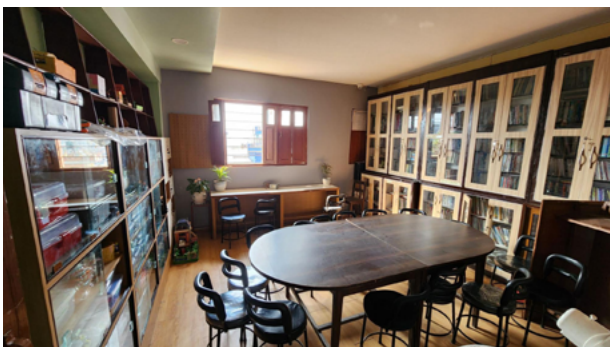
Saraswati Niketan Making Space

How is it different from a science lab?

A typical school science lab is designed for disciplined, and scripted experiences in which students are guided towards the re-discovery or verification of a unifying principle. The science labs are designed to facilitate this process of coming to a common conclusion and understanding of a scientific process. In contrast to that, Making Spaces is designed to allow and encourage students to come up with diverse/multiple solutions when presented with a problem or a prompt

Theory

Our Making Spaces are inspired by the works of Jean Piaget (Constructivism) and Seymour Papert (Constructionism). Papert built on Piaget's constructivist theory of emphasizing learning by actively constructing knowledge through the act of making something shareable. This shareable construction may take the form of a robot, paper crafts, poem, conversation, or any other project..

The spaces are also inspired by The Reggio Emilia Approach, which is highly sensitive to local culture and community, and respects the rights, needs, talent, and questions of children. The approach believes that educational activities emerge from the interests of children, and the environment is "the third teacher," after the parent and teacher. The making spaces are designed to give students agency to pursue their interests.

Skills to focus on in a Making Space

FINDING AND GATHERING INFORMATION
» Searching for information, and tutorials on the Web, using reference guides, datasheets, and product manuals.

OBSERVATION
» Ability to carefully watch, learn from, and analyze components as well as information and their functionality

PROTOTYPING AND ITERATING
» Value "Building and Testing" over "Thinking and meeting"
» Sketch ideas and visual representations

» Create prototypes to test ideas, designs, and assumptions and make improvements over multiple iterations.

COMMUNICATING WITH OTHERS FOR HELP, PROVIDING AND SEEKING CONSTRUCTIVE FEEDBACK.
» Help includes providing or seeking assistance to complete a task or series of tasks that one could not do alone.
» Constructive feedback includes providing or seeking useful advice and suggestions for improving their work.

MAKING REAL-WORLD CONNECTIONS
» Apply the knowledge they've acquired during the learning phase to create things contextual to the real world.

DOCUMENTING AND SHARING MAKING PROCESSES AND PRODUCTS
» Photographing, writing about, or recording the steps, processes, and output of a project for oneself or as a reference for others. Documentation can take the form of photos, videos, blogs, instructions, or any other forms that capture and communicate the process of making.
» Sharing the documentation across different platforms
» Students can post their project details on different social media platforms. This allows other students to get ideas, continue creating new things, and copy the projects.

02
Setting up your own Making Spaces

Setting up and running a Making Space may seem daunting initially, but starting from scratch is unnecessary. You don't require a large budget or an expansive space to create a Making Space; it's more about resourcefulness. Here is how Karkhana Samuha co-designed Making Spaces at different schools with limited resources, space, and budgeting. With proper planning and repurposing of existing spaces and resources, making spaces can thrive in modest environments.

Making Space Design Guide

The most important thing is that the Makerspace is **welcoming and accessible** to the community of Makers who use it, making it easy for them to engage in creative, empowering activities and projects. While no two Making Spaces look alike, you'll notice a lot of similarities between spaces.

While there is much more to Making Space design than laying out a space, it is important to anticipate the overall area needed so it can be included in the facility layout. Within that space, many issues will influence the layout - the size of the space, its purpose, locations of doors and windows, access to electricity and ventilation, plumbing, and even old furniture. Some of the spaces could be shared or even situated in common spaces. It is important to plan a detailed layout. Here are some examples of layout of different making spaces.

NIMS Making Space

Shramjit Kishwor Making Space layout

Saraswati Niketan Making Space layout

🔗 More Making Space Layouts we've designed

It is important to include different stakeholders - people with diverse skills and perspectives in the design process. Make sure to co-design the space with teachers, school leaders, administrators, and students. Here are some examples of how Karkhana Samuha co-designed making spaces with school leaders and teachers.

Some Design Rules

» Define your themes, goals, and experience: It's important that you define your theme and goal for the space. Identify your audience and the types of activities that you expect to happen in the space. Also, it's important to think about what kind of experiences students want to have. Does the space want to foster skills like collaboration and creativity among students? Does the space want to support experiences with the latest technology or it wants to encourage playing with local materials? Here is a short interview of how our architect designed a making space considering the students' experience.

» Make the space flexible: Making spaces work best when they are flexible. A making space needs to take into account the diverse needs and interests of the students and teachers, hence it needs to allow for the space to be easily reconfigured for various activities and projects. This means using modular and light furniture that can be moved around and using multipurpose materials and furniture. The layout should facilitate collaboration and experimentation, with zones for group work, individual work, and dedicated stations for certain activities. Here are some ways Karkhana Samuha

designed the furniture in Shramjit Kishor School to ensure the space has flexibility.

▶ We have developed a table that is both foldable and movable to conserve space.

» Leave room for new equipment & resources: Start simple and build up the functionality (available tools and materials) over time. It can easily take 2 -3 years for a making space to become a regularly used asset in a school, and for students and teachers to develop a good "flow" that everyone has become familiar with. Add equipment over time as needs arise and as the curriculum is developed.

» Design with safety in mind: From the layout, and material selection to material use, every aspect of making space should be designed to mitigate risks. It's important to have proper safety guidelines displayed and ensure comprehensive training in safety procedures for both students and teachers. Take ventilation and noise into account when designing the space. By prioritizing safety in design, making spaces can provide a secure foundation for exploration and innovation.
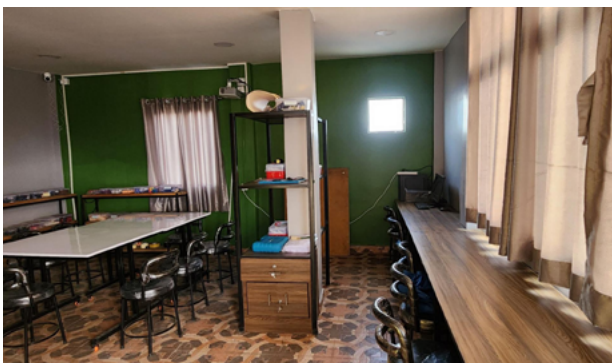
The central furniture houses all the safety equipment, including a first aid kit, goggles, gloves, and an apron. Its central location ensures easy access from all workstations.

Inventory Management

One of the biggest challenges in running a making space is managing the inventory. Making Spaces is resource intensive, and one of the primary difficulties is maintaining an accurate record of materials, tools, and equipment due to the dynamic nature of the spaces. Ensuring that the inventory is well stocked while avoiding waste is another challenge. If the inventory is not properly managed then the making spaces easily turn into a mess with materials lying all over the place.

MATERIAL STORAGE

Material storage in Making Space is an essential aspect of maintaining an organized, efficient, and safe environment for creativity and innovation. Given the diverse range of materials used in these spaces—from wood, metal, and plastics to electronic components and textiles—effective storage solutions are crucial.

Proper material storage involves categorizing materials by type and size, and using clearly labeled bins, shelves, and drawers to ensure easy access and inventory management. Organizing materials in a logical manner not only streamlines the workflow but also minimizes waste by preventing damage and making it easier to locate and use existing supplies.

Additionally, fostering a culture of tidiness and responsibility among users is essential. Educating members on proper storage practices and the importance of returning materials to their designated places can significantly enhance the efficiency and safety of the space. By prioritizing organized material storage, Making Space can create a more sustainable and conducive environment for innovation.

TIPS FOR EFFECTIVE AND EFFICIENT MATERIAL STORAGE

» **Arranging Materials**
Arranging materials is crucial for fostering an organized, efficient, and safe environment conducive to creativity and productivity. This process involves categorizing materials based on their type, size, and frequency of use, and then systematically storing them in clearly labeled bins, shelves, or drawers. High-use items should be placed in easily accessible locations to streamline workflow, while rarely used or hazardous materials should be stored securely and safely. Implementing color-coded labels and signage can further enhance organization and ease of locating materials. Regular audits and inventory checks help ensure that materials are kept in their proper places and that stocks are replenished as needed. Encouraging students and teachers to adopt a culture of tidiness and responsibility, by returning materials to their designated spots after use, is essential for maintaining order and maximizing the efficiency of the space.

Karkhana Samuha's Inventory uses open shelves for materials and primarily uses transparent boxes for storage.

The arrangement is divided into two different sections, each designated by opposite wall shelves for different types of materials. One section contains all the stationary and consumable materials, while the other is for electronic materials.

To assist in navigation, we've created a digital map showing the location of these materials. Furthermore, in Samuha, we've established the rule that everyone should return these materials according to their designated locations on the map.

Laptop Box		Disposable Camera	Laptop Bag		Paper Pouch		Paper Cup	Board Member Visiting Card	Marker Ink
	KS-FF/I-002				Rack No- KS-FF/I-003				
Sikaru Saathi Repair Kit bag	Binder Clips/Thumb pin	Cotton String	Marker	Pencil	Glue Stick	Food Stick /Tooth pick	Water Colour/Pencil Colour	Marbel/pin/Google Eyes	Fishing thread/Pearl
	Cotton Stick/Cotton	Paint brush/Gun Sticks	Scissors	Sing Pen/High Lighter	Sticky Notes	Oil Pastels	Ballons	Bottle Cap/Clay	Paint Pallete
	Popsicle Sticks	Straws	Paper Cutter	Erasier/Sharpner	Ball Pen	Rubber Bands	Big Size Rubber Bands	Food Color	Gliters
					Stationery Items				
All Types of Tape	All Types of Paper		Hot Glue Gun	Aluminium Foil/Gun Stick	Arduino Kit / Arduino Kit / Arduino Kit	Adapter / Handi Camera/Recorder/Gopro	Standaed Charger / Mic	Video Light / Tripod	DSLR Camera/ / Camera Stand
Cutting Mat / Soldering Mat / Lego Mat	Zip Lock Bags / Safety Gloves	Cotton Gloves / Safety Gloves	All Brochure (Sikaru Saathi)	Ks Brochure	KS Diary	Kheldai Sikdai Book	Bagh Chal	Stickers / Pencil Pouch	Tote Bag
PVC Pipes Box	Hand Saw	Old paper	Net Wire / Egg Crate / Kheldai Sikdai Flex		Makey -Makey &Micro bits Box	Sikaru Saathi Kit Bag	Sikaru Saathi Kit Bag	Sikaru Saathi Kit Bag	Sikaru Saathi Kit Bag

Thermocol Sheet Box	Ribbon	Wio	Desktop	Old Paper/Document		Laptop Box
			Rack NO KS-FF/I-004			
Electrical Switch/Two pin Plug	UNO Arduino/Motor Driver	Type c	Micro.Bit	Wire Stripper/Tester	LED,Buzzer	Bread board
Wires, Holders Switches	Alligator Clips	LED Bulb	Motor Wheels,Drivers	Barrery	Matrix Boards	Light Sensor
Ardino Sensor	Jumper wires/Ardino Cable	Charger USB Extension	Pot, Soldring tin	Digital Multimeter	ON/OFF switch	Light Sensor
Servo,Anolog Servo	Wio Terminal	Weight Machine	A4 Paper	Cobra File		Small File
Battery Holders,Caps	Smart Moters Case	Weight Machine	A4 Paper	Cobra File		Small File
3D Printer Materials	KS Smart Motors	Register	A4 Paper			
Chart Paper	Newsprint Paper	Projector / Speaker	Laptop	Laptop		Old Document
				Standies		
KS Old Document	KS Old Document	KS Old Document	KS Flex	KS Flex		Standies Cover

A beneficial aspect of this arrangement is that we've color-coded the map to match the corresponding shelves. Also, When selecting colors, ensure they are friendly for colorblind individuals.

To keep track of these materials, we've developed a basic inventory management system. Here's a video of how you can recreate this system

[Inventory Management (Using Google form and Sheets)](#)

» **Repurposed storage or shelving**
- When selecting storage or shelving for your materials, we recommend choosing options that are open or made from see-through materials like glass or acrylic.

- The reasons behind this option are as follows: First, it allows students to easily see the available materials, **creating a welcoming environment that encourages use**. Second, if the storage units have doors or covers, the materials inside are protected from dust while remaining visible.

- We don't necessarily have to buy all the furniture while making space, you can also use the existing furniture of the school. These materials could be schools existing tables and chairs, storage furniture, or even whiteboards.

Existing Metal Racks which weren't being used at NIMS were converted into storage space for ongoing projects

At Panchakanya School we took an unused cupboard and modified it so that we can provide a space to store inventory.

Tables used for normal classrooms were converted into soldering and cutting stations at Shramjit

» Pegboards

- Every bit of space matters when organizing storage, and a pegboard can play a significant role, especially when utilizing walls for storage.
- A pegboard is beneficial because it offers a flexible and customizable solution for organizing and storing tools, supplies, and other items. It can be easily affixed to a wall, thereby freeing up floor and drawer space. The board's holes allow the attachment of hooks, baskets, and other holders, which can be rearranged as required. Furthermore, a local carpenter can easily construct a pegboard, making it a cost-effective storage option.
- The size of pegboards can vary depending on your needs and the available space in your workshop. However, we recommend a size of 3 feet by 4 feet for basic tool organization.
- If you have basic skills in using a drill, saw, and measuring tools, you can create your own pegboard.

▶ How to make a pegboard

A pegboard at Saraswati Niketan. Given the lack of space in the school's making space, this has been a huge help in storage

- For safety reasons, we recommend not storing heavy and large tools at the top of the pegboard.
- You can also organize the materials based on height for child-friendliness. Smaller children don't need access to heavy tools from the pegboard, so keep these separate and at a safe, higher distance.

» Boxes

- For a Making Space project, various types of boxes can be useful for organizing, storing, and transporting materials. We have used transparent boxes of different sizes in our making spaces, depending on the materials to be stored. Using a box with a lid is highly recommended.

- When students work in the making space, they often need to access materials quickly. If the boxes aren't well-labeled, this can cause chaos. Hence, we recommend labeling the boxes and using appropriately sized containers for each material. For instance, you don't need large boxes for storing LEDs, while larger boxes make sense for motors.

- Ensure each box has a lid as well. This makes it easier to transport and helps keep materials organized.
- Remember, reusing and repurposing existing boxes can also be a great way to save resources and add an element of sustainability to your Making Space project.

» **Storage of ongoing projects**

- For storing ongoing projects in a Making Space, consider using open shelving units or storage bins. They provide easy access and clear visibility of the projects. Also, repurposing old shelves or cabinets can be a cost-effective solution. For larger projects, consider a designated project area with labels indicating the project's owner and completion date. Remember to keep the space organized and decluttered for efficiency.

NIMS School is utilizing old furniture for project storage. Each storage unit has dimensions of 4 feet in length, 1 foot in depth, and 1.5 feet in height. They have three of these storage units available.

» **Project Display**

- Space is often limited in most Making Spaces. However, if possible, designate areas to display finished projects proudly. It's beneficial to exhibit both successful projects and failures for members to learn from.
- While the final product is important, it's also crucial to showcase the process. Be careful when displaying projects since many activities take place in the Making Space. Over time, numerous projects will accumulate, so it's essential to decide what to keep and what to discard.
- **We recommend you review finished or ongoing projects every 3 months.** This

approach allows you to display projects in exhibitions adequately and also sets a timeline for students to dismantle and reuse materials.

- **Digital documentation** can also be a crucial part of managing completed projects. If storage space is limited, consider asking students to document their process through photos and videos. This way, if other students need parts from the project later, they can disassemble and use them. Additionally, if other students wish to replicate the project, they would have guidance from earlier documentation.

Shramjit Kishwor School uses open shelves to make it easy for students to reach ongoing projects. These shelves are kept 5 feet off the floor to keep them clean and make good use of wall space.

» **Safety**

- Important to have easy access to safety materials like First Aid Supplies, Personal Protective Equipment, and basic safety supplies. A making space should always have basic first aid supplies. Other basic safety supplies depend on the tools you have in the space.

For e.g spaces that do a lot of work with soldering, it's necessary to have good masks. The rooms should be well ventilated and the soldering station if possible should be set up near windows. Also, the space should have clear, age-appropriate safety warning signs on display.

Tracking Materials in the inventory

Once your Making space is operational, a key element to manage is inventory tracking. This process is crucial because it prevents shortages and overstocking.

An inventory system can be as simple as a spreadsheet or a more sophisticated tracking system. It's vital to keep this up to date and make sure everyone involved in the Making space knows how to use it.

We have experimented with two options:

Option 1: Track materials with a physical form. Many schools and Making spaces prefer to physically monitor materials by completing an inventory form, managed by the inventory manager. This method's advantage is that the manager will know when any materials are used or removed when to restock, and can check in with the person for return. However, this method requires a dedicated resource for all check-ins and check-outs.
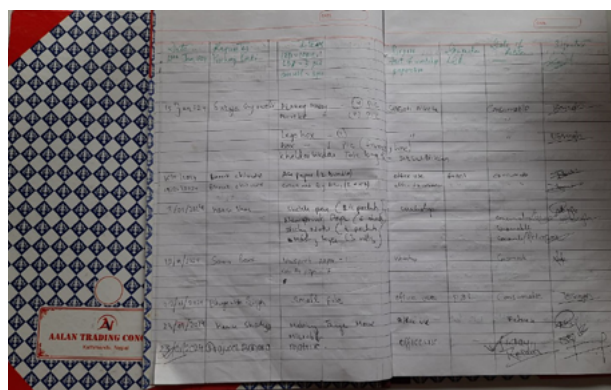
Here is a sample of a simple **inventory form.**

Another simple method is to maintain a checkout registry with the following headings
- Checked out by
- Items checked out
- Quantity
- Purpose
- Date to be returned
- Signature

Headings can be added as per requirements

A simple checkout register that can be used to keep track of materials

Option 2: Use Google Forms and Sheets. This method is effective if you have computers and internet access in your space. Tracking materials digitally offers substantial advantages.

- In our sample, we created a Google Form for people to specify the materials they need. This same form is used when returning materials. Additionally, a Google Sheet lists all materials, providing insight into the exact quantity of materials in the inventory.
- Here are samples of the Google Form and Google Sheets.
- Here is a video demonstrating how to create a simple inventory management system using Google Forms and Google Sheets

 Inventory Management (Using Google form and Sheets)

Making Tools and Materials

Once you have a space and decide upon the themes and experiences that you want to present to your teachers and students, you can start thinking about the tools, equipment, and materials for the space. It's crucial to keep in mind that making spaces often generates a significant amount of waste, primarily in the form of drained batteries, cardboard cuttings, and straw/stick bits. It's important to have a plan for managing these materials to keep the space organized and sustainable.

There is no such thing as a perfect list of materials and tools for making space. The Making tools and material lists vary from space to space. Here is our recommended list of materials. The list is not exhaustive but has been compiled from our own experiences of co-designing and running making spaces and also taking into account the availability of the materials in Nepal.

Reusable Tools List

Among other materials used in space manufacturing, there are some that are reusable. While they will eventually be consumed over time, they can be used for extended periods. These materials can be utilized multiple times across various projects.

S.No.	Material Name
1	Apron
2	Castor wheels
3	Clamps (C)
4	Cutting mat
5	Drilling Machine
6	First Aid Kit
7	Measuring tape
8	Multimeter
9	Multiplug
10	Nose Plier
11	Plier
12	Safety Gloves
13	Safety Goggles
14	Sand paper (For wood)
15	Saw
16	Scissors
17	Screw Driver set
18	Wire stripper

Consumables

These are those items that get used up or altered during the making process, such as:

S.No.	Material Name
1	Acrylic color
2	Balloon
3	Bottle Caps
4	Cartoon Tape
5	Chart paper
6	Constructions paper
7	Double sided tape
8	Duct tape
9	Eraser
10	Food stick
11	Hot glue stick
12	Masking tape
13	MDF (3mm)
14	Paint brushes set
15	Paint Pallete
16	Paper cups
17	Paper cutter
18	Pencil
19	Playdough
20	Popsicle stick
21	PVC Electrical Tape
22	Rubberband
23	Sharpener
24	Sign pen
25	Straw
26	Super glue
27	Table Tennis ball
28	Thread
29	Wheels

Craft Tools

Craft tools are key components of a Making Space. They're used for cutting, shaping, assembling, and decorating materials in the crafting process. It's important to have a wide range of craft tools available to cater to different project needs and to encourage a variety of crafting techniques.

S.No.	Material Name
1	Acrylic paints
2	Air dry clay
3	Balloon
4	Barrel Screw Clasps
5	Beads
6	Bottle Caps
7	Buttons
8	Candle
9	Cardboard
10	Cartoon Tape
11	Chart paper
12	Chisels
13	Coin cell batteries
14	Conductive thread
15	Constructions paper (Aka hard chart Paper)
16	Crayons
17	Cutting mat
18	Double-sided tape
19	Duct tape
20	Earring hook
21	Earring pata`
22	Eraser
23	Fabric
24	Fabric Markers
25	Fabric paints
26	Fasteners (nails, screws, bolts)
27	Fevicol bottle
28	Food stick

29	Geared motors
30	Gift wrapper
31	Glitter Pens set
32	Glitters Dust set
33	Googly eyes
34	Hand Saw (Mini)
35	Hand-Saw
36	Iron Bending Wire
37	Jewellery pliers
38	LED strips
39	LEDs
40	Lighter
41	Lilypad
42	Masking tape
43	Measuring Tape
44	Multiplug
45	Naked motors
46	Needle packet sets
47	Needle thread set
48	Nepali Paper
49	Nose Plier
50	Nylon threads
51	Packing/Cartoon Tape
52	Paint brushes set
53	Paint Pallete
54	Paper cups
55	Paper cutter
56	Pencil
57	Pliers
58	Polymer clay
59	Popsicle sticks
60	PVC Electrical Tape
61	Quill paper set
62	Rubberband
63	Scissors
64	Screws

S.No.	Material Name
65	Sequins
66	Sewing machine
67	Sharpener
68	Signpen
69	Stapler
70	Straw
71	Super glue
72	Table Tennis ball
73	Watercolor paper
74	Zippers

Electronics & Robotics

It's important to provide a variety of materials to enable students to explore and create diverse projects. The specific materials you choose can depend on the student's age and experience level, the themes of the projects, and your budget. Below are some beginner-friendly electronic and robotic kits for those just starting out in this field.

S.No.	Material Name
1	9V Motor
2	Arduino (UNO)
3	Breadboard (with 30 rows)
4	Buzzer
5	DHT 11
6	ESP 32
7	Fan
8	IR sensor module
9	Jumper wire (MM,MF,FF)
10	LCD screen
11	LDR
12	LEDs (5mm)
13	Lily Pad
14	Motion sensor (PIR Sensor)
15	Motor driver shield
16	Naked motors
17	POT (2 different values)

S.No.	Material Name
18	Push button switch
19	Resistors (220, 1K, 10K)
20	RGB led
21	Servo motor
22	Ultrasonic sensor
23	Wheels

S.No.	Material Name
1	3.7V Rechargeable Battery
2	3.7V Rechargeable Battery Case
3	Alligator clips
4	Battery cap
5	Battery charger
6	BO Motors
7	Breadboard
8	Breadboard Jumper Wires
9	Buzzer
10	Coin Cell
11	DC to DC Buck-Boost Converter
12	DPDT Switch
13	Fan for naked motor
14	Heat Shrink Tube 3 mm
15	Hot glue gun
16	LDR
17	LEDs (Red)
18	LEDs (Yellow)
19	LEDs(Green)
20	LiPo Battery
21	LiPo Battery charger (Imax B3)
22	MOSFET
23	Naked DC Motors
24	On-off switch
25	Potentiometer (1k, 10k)
26	Red Black Wires
27	Relay (5V) module
28	Resistors (220, 1k, 10k)

S.No.	Material Name
29	Soldering Iron (with variable temperature control)
30	Soldering Stand
31	Soldering Tin

S.No.	Material Name
1	LEGO Mindstorm
2	Makey Makey
3	Micro: bit

Documentation

During or after the creation process, we encourage students to document their work for future reference. This documentation could be useful for digital sharing or even for providing step-by-step instructions for new learners. Here are some materials that might be helpful for setting up a documentation station.

S.No.	Material Name
1	Computer/Laptop
2	Gorilla pod
3	Microphones
4	Photo Booth
5	Printer
6	Smart Phone
7	Softwares (Capcut, GIF maker)

Digital Fabrication

Digital fabrication tools are valuable additions and crucial to a Making Space. These tools allow for precise and repeatable creation of objects from digital designs. However, It's important to provide training on the safe and effective use of these tools, and they should be used under appropriate supervision, particularly in a school environment.

S.No.	Material Name
1	3D Printer
2	Laser Cutter & Engravers
3	CNC Machines

Safety Tools

Safety comes first while you are tinkering in a Making Space. Therefore, it's important to have safety equipment readily available. This could include:

S.No.	Material Name
1	Apron
2	Dust Mask
3	Earplugs for noise reductions
4	First Aid Kit [Adhesive bandages (various sizes), Gauze pads, Antiseptic wipes, Tweezers, Medical tape, Disposable gloves, Digital thermometer, Pain relief medication, Eye wash solution, Burn cream]
5	Gloves
6	Safety Goggles

Recommended List of Vendors

	Vendor Name	Contact information
Electronics	Prasar Technology	9802072529
	Himalayan Solutions	9801045129
	Breadfruit Electronics	01-5455062
	Supreme Light Technology	9860563506, 9841223274
Supplies	Prasar Technology	9802072529
	KitabKalam	9813154985
	Patan Book shop	9841458250
	S.S books & stationery	9841483778
Tools	Prasar Technology	9802072529
	S.S books & stationery	9841483778
Digital Fabrication	Zener Technologies	9815401344
	FabLab	9851278038
Waste management partners	Doko Recyclers	9802044436
	Khaalisisi	01-4426147 / 9869079510
LEGOs	Funstation	9801100888
	The Toy Store	01-5905656
Phones and Laptop	Onin international infosys pvt.Ltd.	9863775014
	Banglamukhi trade link	9818269571
	I-Base technologies	01-4518707

Waste Management

Making Spaces tends to generate a lot of waste, and waste management is a critical aspect of maintaining a clean and sustainable space. Making spaces generates various types of waste, including electronic waste, cardboard, paper, plastics, metals, and many more depending on the activities being conducted in the space. Effective waste management in these spaces involves implementing a comprehensive system that encourages recycling, safe disposal of hazardous materials, and minimizing waste generation through thoughtful design and material selection. A key component of this system is the practice of waste segregation, ensuring that different types of waste are properly sorted at the source to facilitate recycling and safe disposal. Discussions with the making space users are essential to ensure that makerspace users understand the importance of proper waste disposal and are equipped with the knowledge to segregate and recycle materials effectively. Another key component is the conscious selection of eco-friendly materials. You can reduce the use of single-use plastics, and use recyclable, recycled, and biodegradable materials when possible in space. Collaboration with local waste management partners like Doko Recyclers and Khalisisi will help adopt eco-friendly practices, and significantly enhance the sustainability of making spaces, ensuring they contribute positively to the environment while fostering innovation. Your local waste management partner can help you with the proper disposal of the waste being generated from the space, and also be a source of recycled materials.

Budgeting for your Making Space

When it comes to budgeting for your making space, several factors should be taken into account. This includes the size of the space, the type of materials needed, the cost of equipment, and the theme of the space. You should also consider the cost of maintenance and potential upgrades in the future. It's important to plan ahead and allocate funds accordingly to ensure the successful setup and operation of your making space.

Here's an example of potential costs for creating a making space:

- **Space Design** - It's a good idea to invest in an architect or an interior designer or a making space designer if you have the budget. The rates will vary depending on the experience of the designer.
- **Furniture** - Here are some basic furniture that you will need to budget for
  » Chairs, and work tables
  » Material storage - Also need to think about storage of ongoing work & display on completed projects
  » whiteboards, screens, or projectors
  » Fans or Coolers as things need can get hot during the summers

- **Paintwork:** It's always a good idea to repaint the space to make it more welcoming and fun for students. The cost can vary based on the quality and brand of paint you choose. Here are some guides to help you calculate how much paint you'll need:
  » How Much Paint Do I Need?
  » Paint Calculator
  » Paint Calculator - OmniCalculator

- **Laptops, Chromebooks or Tablets**
  » It is nicer to invest in laptops or Chromebooks instead of desktops as they allow making space users flexibility to move around

- **Dedicated Resource Teacher:**
  » Making Space works best if the school can afford to have a dedicated teacher responsible for the space. We recommend that the school budget for that. If it's not possible then budget for additional stipends for teachers if they look after the space in addition to their regular work.

- **Documentation Station**
  » Might include a light, a camera (or a phone), and a uniform background
  » Students should be encouraged to document their process and having a station dedicated to documenting will help them achieve that.

In addition to the materials, consider the ongoing costs of maintaining and running the space:
- **Budget to host exhibits & events**
  » This amount covers food, additional project materials
- **Refill materials: - approximately Rs 5-10k per month**
  » The cost depends on which materials need to be refilled
- **Project Budget for students & teachers**
  » This can include scenarios where students wish to experiment with new materials and work on specific projects

Here is the breakdown for one of the making spaces that we created:

Shramjit Kishwor Making Space

Before

After

One-time Expenses (Estimate)

SN	Expense Category	Cost
1	Space Design (Paintwork and Designing)	Rs 50,000
2	Furniture (2-3 working tables, 2 storage cabinets)	Rs 1,50,000
3	Making Space Materials	Rs 3,00,000
4	Screens / Projectors	Rs 50,000
	Total Cost	**Rs 5,50,000**

Annual recurring expenses (Estimate)

SN	Expense Category	Unit	Total	Remarks
1	Teacher's Stipend Assuming once a week session (Rs 1,000 per session)	Rs 4,000	Rs 48,000	Per month
2	Materials Refill	Rs 10,000	Rs 1,20,000	Per month
3	Hosting small exhibition Covers food for students who are exhibiting and materials for the session	Rs 20,000	Rs 80,000	Per event (per year we recommend 4 events)
	Total Cost		**Rs 2,48,000**	

Preparing teachers for the Making Space

In Making Space, with students following their own interests and designing different kinds of projects, the traditional way of running a classroom just doesn't work. Nobody who uses the space needs to be an expert, not even the teacher. The most important thing is to have a passion for and a curiosity about making in many different forms. Once you establish safety and basic competency, students can teach themselves what they need to know with a little guidance from the teachers.

Here are some of the key tasks that would be the responsibility of the teacher in a Making Space

» Recruiting students to form making clubs/ STEAM clubs
» Finding mentors for the students
» Schedule tinkering and making sessions for the students
» Schedule after-school programs on different themes
» Engage other school teachers to regularly use the space to teach their classes
» Share project and process documentation from the students
» Keep learning and experimenting with the tools and materials in the making space
» Be a digital librarian. Point students to different digital resources (or even physical ones) when they wish to learn something new or encounter problems
» Keep track of the inventory and place orders for materials that are running out
» Seek additional funding or donations to maintain and upgrade the Making Space
» Organize exhibitions or showcases to highlight student projects and achievements
» Facilitate collaboration and teamwork among students

What to avoid as teachers in the Making Space?

- **Teachers should shy away from quick demonstrative projects and push students toward solving relevant problems.**
  - » Instead of a quick demonstrative project where students follow steps to build a simple model bridge, push them towards solving a relevant problem, like designing a solution that would allow villagers and their cattle to move heavy loads across a river in the mountains. This involves researching different solutions, planning a design that meets specific criteria, creating a prototype, testing it, and refining the design based on test results. This approach not only teaches engineering concepts but also encourages critical thinking, creativity, and problem-solving skills, making the learning experience more meaningful and engaging.

- **Avoid handing full responsibility of the making space to students.**
  - » Maintain an active role in overseeing and facilitating activities. For example, instead of allowing students to manage the Making Space operations entirely on their own, teachers should set clear guidelines, provide ongoing supervision, and offer structured roles and responsibilities. This ensures that while students are encouraged to take initiative and lead projects, the environment remains organized, safe, and conducive to learning. Teachers can mentor students in leadership roles, monitor progress, and intervene when necessary to provide support and maintain the makerspace's overall effectiveness.

- **Avoid grouping students indiscriminately while working on projects. There's no rule of thumb to decide who should and should not be grouped together but it's important that everyone in the group gets to participate and exercise agency.**

- **Avoid taking over the projects. Even if you see a student struggling, guide them toward the solution instead of doing it for them.**
  - » If a student is having trouble figuring out how to make the wheels turn, resist the urge to fix it for them. Instead, ask questions like,

"What do you think is causing the wheels to stick?" or "Have you checked if the axles are aligned properly?" You might also suggest resources or techniques, such as looking up diagrams of wheel and axle mechanisms or experimenting with different materials. This way, the student learns problem-solving skills and gains confidence in their ability to overcome challenges independently.

- **Avoid creating a competitive atmosphere.**
  - » Making Space should be a place where students can explore, create, and learn without the stress of competition. Encourage students to collaborate and share their ideas instead.

- **Avoid forcing a particular idea or way of doing things onto students.**
  - » Making Space is all about creativity and exploration, so let the students come up with their own ideas and solutions. Let's say the challenge is to design a house for a bird. If a student decides to create a round birdhouse instead of the typical rectangular one, support their creativity by asking questions like, "How will the round shape affect the stability of the birdhouse?" or "What materials do you think will work best for your design?" This way, students can experiment with different approaches, learn from their experiences, and develop unique solutions, fostering creativity and independent thinking.

Co-designing the space with teachers and school leaders

We recommend having teachers and school leaders be involved in the entire design process of the making spaces as co-designers. This builds the ownership of the space, as well as ensures that the teachers and the school leaders are ready to create learning experiences in these spaces for their students and fellow teachers.

Here are some steps that you can follow when co-designing the space with the schools

ORIENTING TEACHERS ON THE MAKING SPACE

Even before we begin to start designing the making spaces it is important to orient both the teachers and the school leaders about Making Spaces

Ideally, the orientation should cover
» What a Making Space and how does it connect to student learning?
» The pedagogy behind Making Space and Maker culture
» Tour (Virtual or physical) of existing Making Spaces
» Overview of Human Centered Design and how we can apply that to the design process of the Making Space

IDENTIFYING A SPACE AND A THEME

Instead of the school leaders and the teachers determining the theme, you would want to encourage them to gather inputs from their students and their colleagues on what they want out of the making space. Observations, interviews, and even surveys to some extent help with collecting input. You can find resources to help you conduct good interviews, and do effective observations in the Appendix section.

The inputs from the students and also teachers can then be turned into actionable insights to identify a theme

PROTOTYPING THE SPACE

It's important to encourage teachers to bring their visions to life by creating prototypes of their space using basic materials like paper and cardboard. This hands-on activity fosters creativity and gives teachers a chance to immerse in the making space experience themselves. Have the teachers and school leaders go through multiple iterations of prototypes by providing them with constructive feedback. These prototypes could lay the groundwork for an architect or an interior designer.

If you are hiring an architect or an interior designer, encourage teachers and school leaders to work closely with them to create a design layout.

INVENTORY MANAGEMENT

As Making Spaces are resource intensive, managing the inventory is one of the biggest challenges. Teachers will face issues with frequent loss and improper tracking of the materials. It's important for teachers to learn about properly managing the inventory of the Making Spaces without being overwhelmed.

DOCUMENTATION

Proper documentation in a Making Space is crucial for teachers as it enhances the learning experience and ensures project continuity. It's important to build teachers' capacity to record processes, materials used, and outcomes, so that they can create a valuable resource that students can refer to, fostering independent learning and problem-solving skills. Well-documented projects also facilitate knowledge sharing and collaboration among students, allowing them to build on each other's work. Moreover, teachers should be able to use documentation in assessing student progress, identifying areas for improvement, and showcasing the educational value of the MakingSpaces to stakeholders.

PLANNING FOR THE FUTURE

It's important to get teachers and school leaders involved in the co-designing process to create concrete plans on how they intend to use the Making Space in the future. We used the Results-Based Management Framework to get our teachers to define goals, outputs, and a yearly plan of activities to achieve those goals and outputs. There are many other frameworks that can be used for this as well. It's always nice if they can integrate the yearly plan into their school calendar with other school events.

Helping teachers define values for the space, and also come up with a mission statement will be helpful in planning for the future.

03
Preparing your students for the making space

After your Making Space is built, it's crucial to consider how to make it operational. Questions to consider include who will use the space, how it will be utilized, and who is responsible for its smooth operation. Also, planning the content is crucial. Here are some ways to get started.

Form a Making Club:

» A Making Club allows students to experiment with various materials and tools, fostering creativity and critical thinking. You can announce this program in your school notice board or by other means, and ask interested students to sign up.

» The club members will be the heart of your Making Space. When selecting these students, it's important to ensure they will be responsible for everything from inventory management to organizing exhibitions and sessions in the Making Space.

» Start with 10-15 students. You can lead a few sessions with this small group, and they can later facilitate sessions for other students. Managing a large group can be challenging, so starting small is beneficial.

» Forming a club instead of an open call can be beneficial in several ways. It helps create a dedicated group of individuals who have a shared interest and commitment to the activities. This can lead to increased productivity and efficiency as club members can work together over an extended period and build on each other's ideas. It also fosters a sense of community and belonging which can be motivating for the members. In addition, managing a club can be easier in terms of resources and logistics compared to an open call where the participants may vary each time.

Setting up an after-school program:

» Establishing an after-school program can provide students with an invaluable opportunity to delve into their interests within a less formal setting. This program can encompass workshops or allocated free time for students to utilize the Making Space. Implementing such a program is beneficial as it fosters an environment of self-directed learning and promotes creativity. Additionally, it allows students to experiment and explore at their own pace, thereby enhancing their problem-solving skills and encouraging innovative thinking.

Using Making spaces for regular classes:

» We have found that dedicating a space solely for after-school activities may not be sustainable. It's essential to explore multiple use case scenarios. One interesting scenario is incorporating the space into regular classes. This integration can reinforce classroom learning. Teachers can link projects in this space to topics they're covering in class, allowing students to apply what they've learned in a hands-on manner.

» In this way, it's not just a few teachers using the space. Other teachers can also take advantage of the area and its resources, broadening their understanding of its potential.

Our Team

SURYA GYAWALI - PROJECT LEAD

  » Surya led the design of all the 5 Making Spaces and authored this guide . He helped in delivering teacher development sessions, co-designing making spaces, and coordinating with teachers and various vendors. Furthermore, he designs lessons and after-school programs, supervising their implementation in all participating schools.

YUVRAJ KARKI

  » Yuvraj is an electrical engineer and a learning resource designer at Karkhana Samuha. Yuvraj has supervised the creation of the Panchakanya making space and has contributed to the establishment of two other making spaces. Additionally, he facilitated after-school sessions, familiarized teachers about electronics, and documented the updates of making space activities.

SAMEER PRASAI

  » Sameer is a trained ethnographer with deep interest in the anthropology of education. He conducted field research at the making spaces, studying the engagement of teachers and students with the environment and lessons.

SANGDEN GHISING

  » Sangden worked in building a community of teachers called TeaCoP (Teaching Community of Play) for the Making Spaces. The community shares the joys and challenges of teaching, enabling them to find, share, and create learning resources. Sangden co-facilitated workshops specifically for Making Space teachers, supporting them in co-designing these spaces in their schools.

HASIN SHAKYA

  » Hasin helped with writing the Making Space toolkit and facilitated sessions for the teachers to familiarize them with the idea of learning through Making.

Acknowledgments
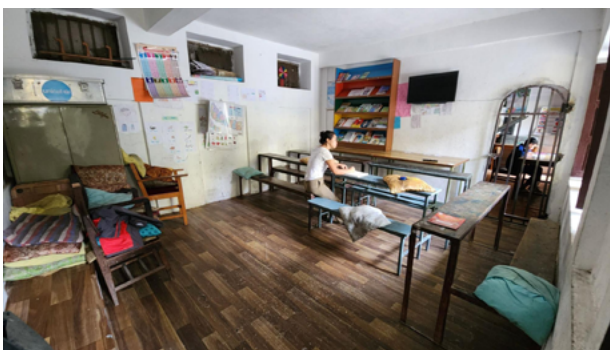
Annex

1. Photos of the spaces before and after setting up making spaces

Panchakanya Making Space

Saraswati Niketan Making Space

Shramjit Making Space

Niten Memorial Making Space

Kathmandu University High school Making Space

2. Link to all the Learning Resources https://shorturl.at/PI7gn
3. Timesheet format

Time Sheet

Name:
Designation:
Month:
Project Name:

SN	Working Dates	Working Hour	Description of work	Collaborator (if any)

Prepared By: **Approved By:**

4. Inventory management forms
  a. Google Form: **https://forms.gle/TdeG8oUrhuAre3sa8**
  b. Google Sheets: **https://shorturl.at/dbAZl**
  c. Material Lists: **https://shorturl.at/IZuXs**

5. Workshop lesson plans
https://shorturl.at/1YWHH

Karkhana Samuha

Karkhana Samuha's Learning resources

Additional Learning Resources

Field Guide (English) -
Field Guide (Nepali) -
Our Making Spaces

About Karkhana Samuha

Karkhana Samuha is a Nepal focused non-profit organization that seeks to promote local innovations that can make a global impact. It empowers people, particularly with the skills and attitude to help them build their own future and the future of their community. To achieve this end, it uses design thinking and results-based management approaches to work under five broad areas (SLIDE) – Sustainability and Climate Action, Lifelong Learning, Innovative and Inclusive Education, Digital Transformation, and Education in Emergencies.

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