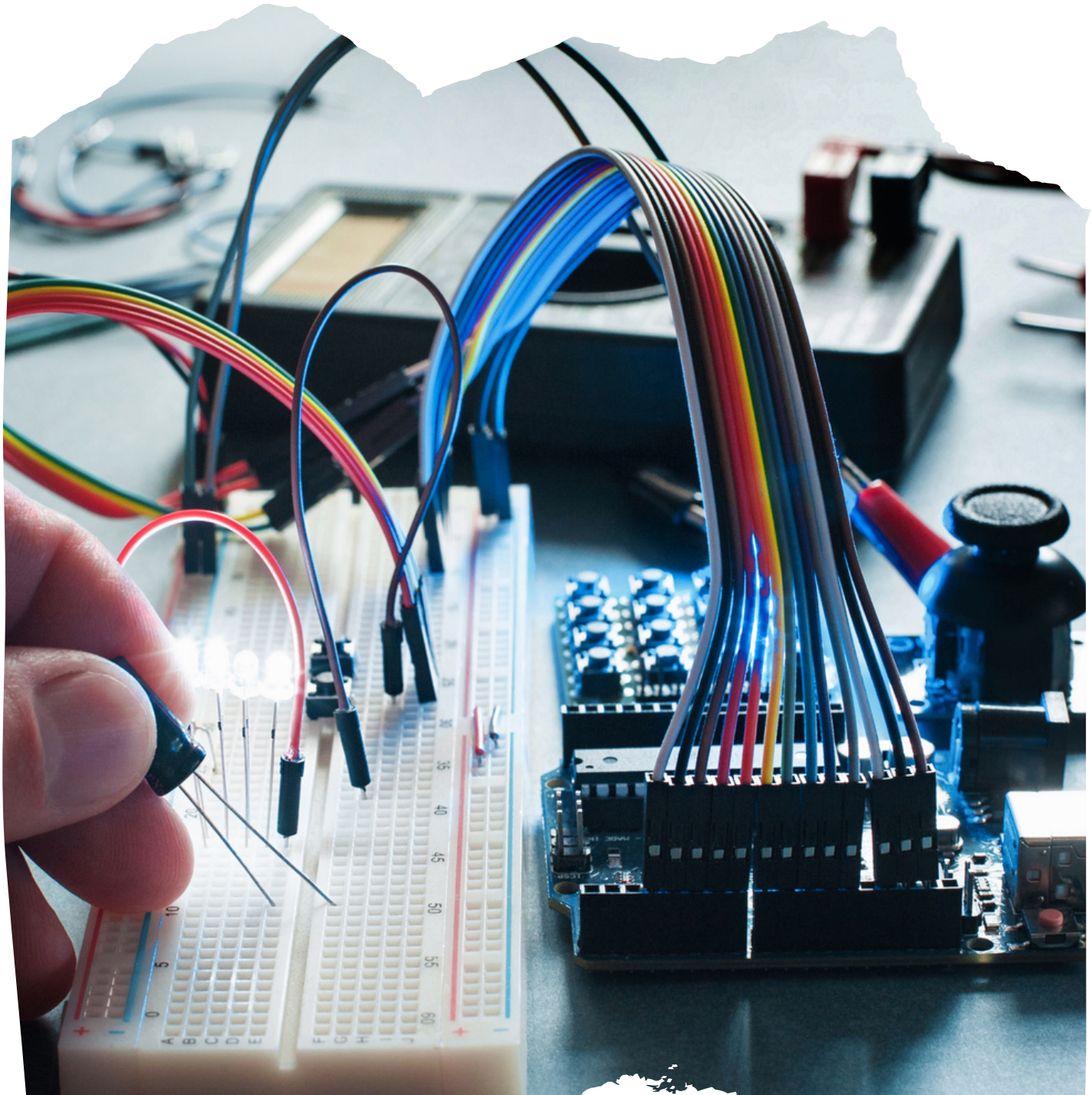
NITI Aayog

ATAL INNOVATION MISSION

MAKER GHAT

ATL TINKERING CURRICULUM

LEVEL I



Message from Dr Chintan Vaishnav
Mission Director
Atal Innovation Mission

Our future generation will be the drivers of innovation and discovery and will set India's pace as a global powerhouse. Atal Tinkering Lab is Atal Innovation Mission (AIM), NITI Aayog's flagship initiative to promote innovation and creativity. ATLs are open innovation makerspaces where young minds give shape to their ideas through hands-on do-it-yourself mode. The program has become a national movement that is revolutionising the Education Ecosystem of India. When I meet students from different quarters of the country who come up with innovations regardless of how remote and resource-constrained they may be, I am filled with much hope for the future of our country.

I am thrilled to introduce the ATL Tinkering Curriculum, a hands-on learning program that empowers young people to build the skills and attributes required for success in the 21st century. This innovative curriculum provides students with the opportunity to understand the basics of emerging technologies and apply their learning to solve real-world problems.

The curriculum focuses on a wide variety of concepts, ranging from basic electronics, mechanics, data visualization, and woodworking, to more advanced technologies such as 3D printing, the Internet of Things, and design thinking. Through hands-on, experiential learning, students will be encouraged to identify and design creative solutions to everyday problems.

The aim of this curriculum is to provide stage-wise learning to meet the needs of students at different stages of their tinkering journey. This will help cultivate the next generation of entrepreneurs, engineers, and innovators, who will be equipped with the knowledge and skills to navigate the rapidly changing technological landscape of the 21st century. I am confident that the ATL Tinkering Curriculum will be a valuable resource for educators and students alike. This new initiative will help in achieving the goal of NEP of developing 21st-century skills in students and preparing them for the fourth Industrial Revolution.

Preface from Deepali Upadhyay
Program Director
Atal Innovation Mission

Under the aegis of Atal Innovation Mission, Atal Tinkering Labs were set up with the goal of inspiring a generation of neoteric innovators and entrepreneurs in India. The underlying philosophy of our ATLs has been to equip the young minds of India with all the knowledge and skills necessary to thrive in the twenty-first century. The idea is to allow children to explore the world of research and innovation, and contribute towards nation development, by developing innovative and disruptive solutions to India's biggest community problems.

In 2022, the Atal Tinkering Labs achieved the milestone of setting up 10,000 labs across India. Today over 75 lakh students in India get to learn in these ATLs. With this accomplished, in the next stage of development, our goal is to ensure that the ATL students have the best tools and resources to learn from.

I am honoured to introduce the ATL Tinkering Curriculum, which is designed to equip young people with the skills and attributes they need to thrive in the 21st century. This hands-on learning curriculum is built around the latest technologies and focuses on a wide range of concepts, from basic electronics and mechanics to advanced topics such as 3D printing, the Internet of Things, and design thinking.

This curriculum starts with basic concepts and hands-on activities in the early stages to introduce students to the subject matter and build their foundation in tinkering. As students progress, the curriculum introduces more advanced topics and projects that challenge them to apply their knowledge and skills in new and creative ways.

I look forward to seeing the impact this curriculum will have on the learning journey of the students in Atal Tinkering Labs. I strongly recommend this ATL Curriculum be used by all ATL schools across the country to learn tinkering.

Foreword by Azra Ismail
Co-Founder
MakerGhat

With the pace of technological innovation, our youth of today face an uncertain future. On one hand, technological progress has led to tools that promise healthier and more comfortable lives. On the other, youth face a future with widespread automation, and have to learn to use emerging technologies and adapt to meet the needs of a changing job market. No longer is it enough to be able to recall information and learn routine tasks that can be performed by a machine. Critical thinking, problem solving, collaboration, and communication skills, along with the ability to self-learn, are essential to stay relevant in the workplace, and to drive innovation and social change in the country over the next few decades.

These goals are laid out clearly in our National Education Policy (NEP) 2020, which aims to develop 'higher-order' cognitive capacities, such as critical thinking and problem solving, alongside social, ethical, and emotional capacities and dispositions. NEP also lays out a focus on experiential learning, and conceptual clarity over rote learning. The making or tinkering philosophy exemplifies such an approach, by centering learning through exploration, experimentation, and play. It also creates room for failure, encouraging youth to take risks and exercise their creativity without fear. The collaborative environment of a makerspace or tinkering lab also creates an opportunity to exercise socioemotional skills, and learn to communicate one's ideas effectively.

MakerGhat's collaboration with the Atal Innovation Mission at NITI Aayog is an exciting opportunity to realize the goals of NEP 2020 and put the tinkering philosophy into practice. The curriculum that we have developed emerged as a result of countless conversations with teachers across the country who expressed an interest in making, but lacked resources that could help them get started. The ATL Curriculum manual aims to fill that gap. It has been designed to support not just schools with access to an ATL, but any educator who is excited about tinkering and making. Many of our activities, particularly at Level I and II, can be performed with space and tools available at hand.

The development of this manual is only the beginning. MakerGhat is excited to support teachers in many other ways, through mentorship, training, and assessment resources. Over the next decade, we are committed to building a network and movement of makers—educators and youth—who can usher in change at a local, national, and global level. The pressing problems of our time need creative solutions from diverse communities. Our educators are the country's best resource to inspire and prepare youth to lead us into a better future, and we invite them to join hands with us to realize this vision.

Overview

The ATL Curriculum helps young people build skills and attributes required for success in the 21st Century. It provides students with the experience to understand the basics of all the emerging technologies and apply the learnings to solve the real-world problems. This is designed to be an hands-on learning program that empowers children to analyse the facts, connect the dots and apply what they learn in school rather than memorizing them which will lead to the creation of next generation of entrepreneurs, engineers and innovators.

This curriculum will enable the young learners to develop interest in Science, Technology, Engineering & Math through a hands-on experiential learning. It focuses on wide variety of concepts ranging from Basic electronics, Mechanics, Data visualisation and Wood working to other emerging technologies such as 3D Printing, Internet of Things and Design Thinking that culminates in building prototypes of their ideas. The aim of this curriculum is to lead the students to identify and design creative solutions to everyday problems.

Curriculum Objectives

Students will be able to:

- Turn ideas into reality by brainstorming, modelling and prototyping.
- Inculcate innovative and entrepreneurial mind-set through Design thinking and Hands-on Learning.
- Identify and research problems in their community and beyond, generate relevant and creative solutions, and develop sustainability plans for their solutions.
- Identify and self-learn for dignified career opportunities based on their skills and interests, particularly in STEM or entrepreneurship.
- Develop basic knowledge in electrical and mechanical engineering principles.
- Develop skills of using hand tools to construct a prototype of an engineering design.

Curriculum Structure

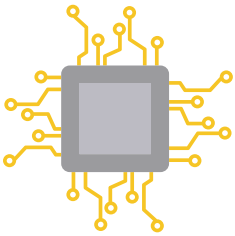
The ATL Curriculum engages students actively in the development of hands-on activities through a sequence of 3 Levels with incremental difficulty. Each level comprises of different modules, which are further subdivided into sessions. It is highly recommended to start the course with Level 1 and end the course with Level 3. The details of each level is as follows:

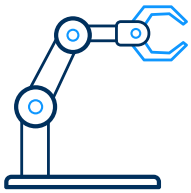
Level 1 comprises of 5 modules namely, Basic Electronics, Mechanics, 3D Design & Printing, Data Visualisation and Design & Entrepreneurial Thinking. All the 5 modules are further divided into 14 sessions. The duration of each session is 60 min.

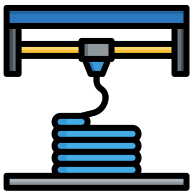
Level 2 comprises of 4 modules namely, Electronics, Mechanics, 3D Design & Printing and Design & Entrepreneurial Thinking. All the 4 modules are further divided into 13 sessions. The duration of each session is 60 min.

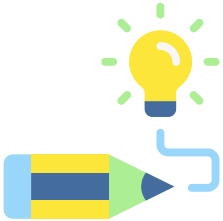
Level 3 comprises of 5 modules namely, Electronics, IoT, 3D Design & Printing, Wood Working and Design & Entrepreneurial Thinking. All the 5 modules are further divided into 17 sessions. The duration of each session is 60 min.

TABLE OF CONTENTS



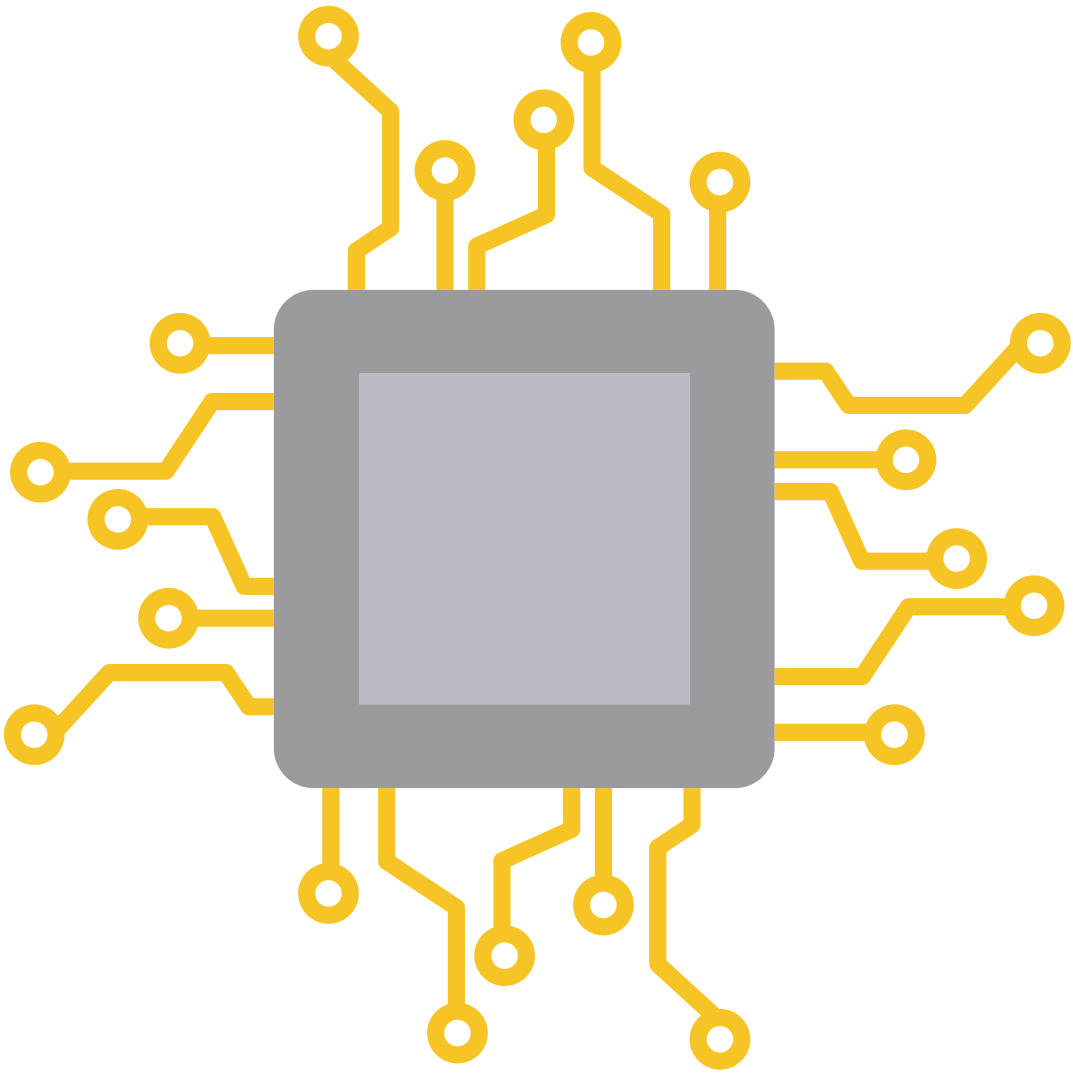




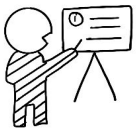


NITI Aayog | ATAL INNOVATION MISSION | MAKER CHAT

BASIC ELECTRONICS



Introduction to Electronics and Circuit (10 mins):



Have you ever opened up a battery-operated toy or a device and seen what is inside?

Inside most small devices, you will find a battery, some wires and a switch. The battery provides power, the wires carry the current and the switch is used to control the current.

Open the back panel of any device you have at home and you will see a circuit. But, what is a circuit? A circuit is a closed circular path of conductors by which electric current can flow.

In this module, we will learn more about these various components and apply them in some fun applications.

Source: kidsunlimited.com.au

Materials Required :

1. Pencils
2. A4 Size sheet
3. LED
4. Coin Cell/Rechargeable 9 V batteries
5. Breadboard
6. Jumpers
7. Multimeter
8. Wire Stripper
9. Conductive (Copper) Tape
10. Resistors

: 60 minutes

Module: Basic Electronics

Grade: 6th to 9th

Importance/ Value:
The aim of this module is to provide some basic electronics activities that explain the basic concepts associated with Electronic Science. This enables the learners to understand more complex electronic concepts and technologies which will help them to build simple electronic projects using the ATL Lab Kits.

Learning Goals:
1. Learners understand the basics of Electronics and the difference between Electrical and Electronics.
2. Learners will gain understanding about essential electronic components and safety measures.
3. Learners will be equipped to make circuits on paper.

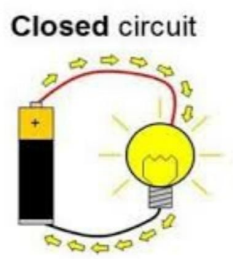
Time	Description
01 Min	Check-in-Experience (CIE)
05 Min	Icebreaker
10 Min	Introduction to the module
15 Min	Understanding Electronics and Circuits
20 Mln	Activity- Make your own Circuit
09 Min	Reflection and Learnings

Icebreaker (5 mins):

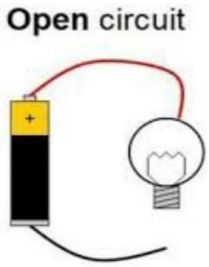
Make enough room in your ATL Lab and form a circle. The teacher will give you instructions, you will have to follow them. Sounds simple, doesn't it? Here is the twist!
The instructions will be any of the following: Jump In, Jump Out, Jump Right or Jump Left. But you have to do the opposite of what the teacher says.

A closed-circuit is like a circle because it starts and ends at the same point forming a complete loop. Furthermore, a closed circuit allows electricity to flow from the (+) power to the (-) ground uninterrupted.

In contrast, if there is any break in the flow of electricity, it is known as an open circuit. As shown in the picture, a switch in a circuit can cause it to be open or closed depending on its position.



Source: brainly.in

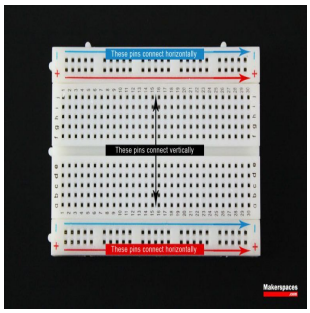


Source: brainly.in

Electrical Tools:

Working with electricity can be dangerous, if not done with proper tools. These tools are essential to safely build electronic devices. Let's take a look at a few of them.

1. Breadboard- This is an essential tool for prototyping and building temporary circuits. These boards contain holes for inserting wire and components.

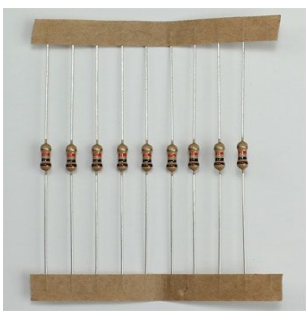


2. Digital Multimeter- This is a device that measures electric current (amps), voltage (volts), and resistance (ohms).

3. Battery Holders- A battery holder is a plastic case that holds batteries from 9V to AA.

4. Wire Cutter- Wire cutters are essential for stripping stranded and solid copper wire.

5. Light-Emitting Diode (LED)- A light-emitting diode is like a standard diode because electrical current only flows in one direction.



6. Resistor- Resistors are used to resist the flow of current or control the voltage in a circuit.

7. Heat Gun-
A heat gun is used to shrink plastic tubing, known as heat shrink, to help protect the exposed wire.

8. Soldering Iron-
When it is time to create a permanent circuit, this tool will solder the parts together.

Safety Measures:

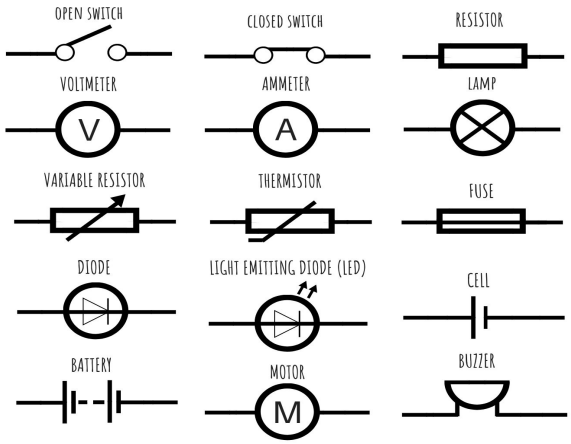
1. Do not connect power to a circuit until the circuit is completed..
2. Never work on a circuit while power is switched on.
3. Never touch any electrical equipment with wet hands.
4. Your work area must always be kept dry.

5. If you smell anything burning, immediately disconnect the power and examine your circuit to find out what went wrong.
6. Always use appropriate insulated rubber gloves and goggles while working on any branch circuit or other electrical circuit.

Activity: Make your own Circuit (20 mins)

Schematic Diagram

When working with circuits, you will often find a schematic diagram. These diagrams use symbols to illustrate what electronic components are used and where they are placed in the course. These symbols are graphic representations of the essential electronic components.



Source: switchelectronics.co.uk

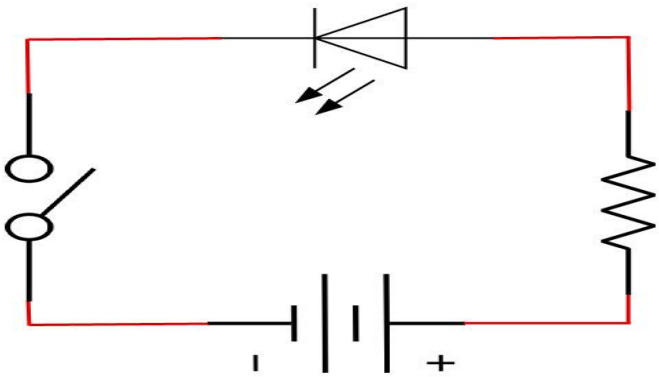
Steps to make a circuit:

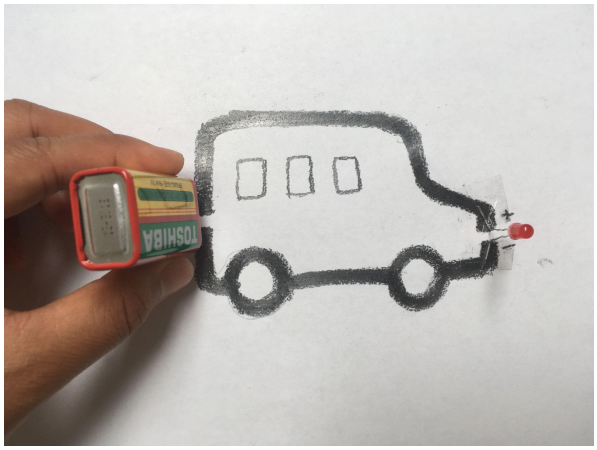
Step 1: Draw a circuit on the paper of your wish, make sure you are not crossing the paths.

Step 2: Make the circuit dark to ensure the current flows through the graphite. You can draw any shape of your choice.

Step 3: Attach the LED to one end of the circuit.

Step 4: On another end, attach a 9V rechargeable battery to glow the LED.





Source: https://www.kiwico.com/

Reflection and Learnings (9 mins):

1. Share at least 3 skills or concepts that you have learnt today.
2. What do you think is the difference between an open and closed circuit?
3. What did you or your team struggle with while doing this activity and why? How can you improve next time?
4. How did you contribute to the team and how do you think it helped? How else could you have contributed?
5. What communication challenges did you and your team face? How can your team communicate better next time?

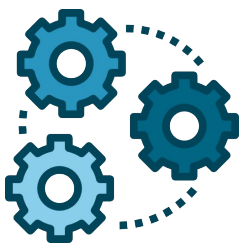
Try it yourself!

Use the concepts of Paper Circuits and try creating a Greeting card for your friends or family.

Use the space to draw or write your reflections and learnings.

Additional Resources

Teachers can scan this QR code to show the students how to do this activity.

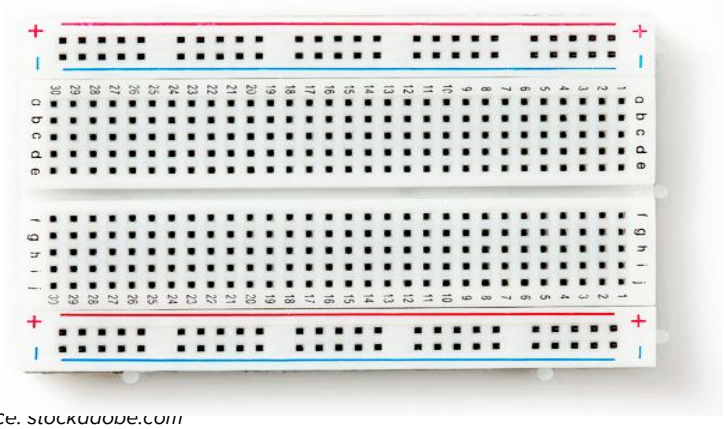


Introduction to Breadboard (10 mins):

When we take the word 'breadboard' in the literal sense, what do you think it means? Can you guess? A breadboard is a simple device designed to let you create circuits without the need for soldering. They come in various sizes, and the design can vary, but as a general rule they look the image given below. We will start with some of the basics of breadboards before we start with the circuit.

Breadboards are one of the most fundamental pieces when learning how to build circuits. It is simply a board for prototyping or building circuits on. It allows you to place components and connections on the board to make circuits without soldering. The holes in the breadboard take care of your connections by physically holding onto parts or wires where you put them and electrically connecting them inside the board. The ease of use and speed are great for learning and quick prototyping of simple circuits!

Let's explore this a bit further by creating circuits on the breadboard.



Source: stockadobe.com

Materials Required :

1. Pencils
2. A4 Size sheet
3. LED
4. Coin Cell/Rechargeable 9 V batteries
5. Breadboard
6. Jumpers
7. Multimeter
8. Wire Stripper
9. Conductive (Copper) Tape
10. Resistors

: 60 minutes

Module: Basic Electronics

Grade: 6th to 9th

Importance/ Value:
The aim of this module is to provide some basic understanding of how a breadboard works and it's uses for research purposes and building projects using ATL Kit.

Learning Goals:
1. Learners understand the basics of Electronics and its components
2. Learners will gain understanding about essential electronic components and safety measures.
3. Learners will be equipped to create a simple circuit on a breadboard

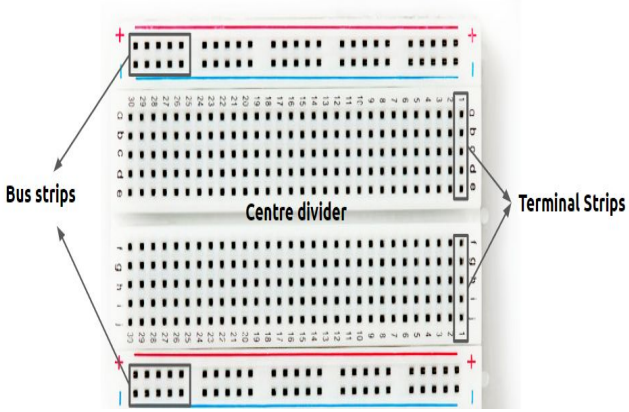
Time	Description
01 Min	Check-in-Experience (CIE)
05 Min	Icebreaker- Jump!
10 Min	Introduction to Breadboard
15 Min	Understanding Parts of a breadboard
20 Mln	Activity- Simple Circuit
09 Min	Reflection and Learnings

Icebreaker (5 mins):

The game is quite simple and yet needs a lot of creativity to be played; The learners can sit in a circle and someone has to start with a good first line such as "once upon a time". The next person adds four more words to the story, such as "there was a frog". The kid after that continues adding four more words, and the game progresses. The rule of the game is to make sure not to repeat what another says.

Parts of a Breadboard:

In the breadboard, there are horizontal and vertical rows, where the horizontal rows can be known as **Bus strips** and vertical rows are known as **terminals strips**. These are mainly useful in connecting the power supply toward the breadboard. On this board, the red lines are positive rails whereas the blue lines are the negative rails. Usually, breadboards have different connections like bus strips which are known as **metal strips.** While connecting a circuit on a breadboard, we need power in various places, so bus strips can provide you easy access wherever you require it within your circuit. Here, Bus strips (red/black or blue strips) are labeled with positive (+) and negative (-) symbols for indicating the +ve & -ve sides.

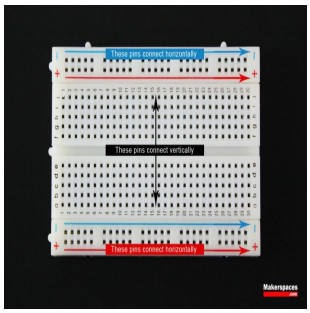


Source: Stockadobe.com

Electrical Tools:

Working with electricity can be dangerous, if not done with proper tools. These tools are essential to safely build electronic devices. Let's take a look at a few of them.

1. Breadboard- This is an essential tool for prototyping and building temporary circuits. These boards contain holes for inserting wire and components.

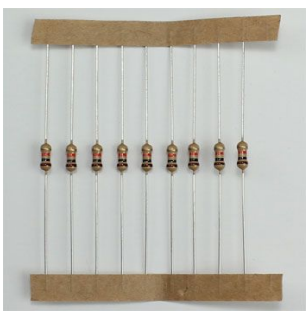


2. Digital Multimeter- This is a device that measures electric current (amps), voltage (volts), and resistance (ohms).

3. Battery Holders- A battery holder is a plastic case that holds batteries from 9V to AA.

4. Wire Cutter- Wire cutters are essential for stripping stranded and solid copper wire.

5. Light-Emitting Diode (LED)- A light-emitting diode is like a standard diode because electrical current only flows in one direction.



6. Resistor- Resistors are used to resist the flow of current or control the voltage in a circuit.

7. Heat Gun-
A heat gun is used to shrink plastic tubing, known as heat shrink, to help protect the exposed wire.

8. Soldering Iron-
When it is time to create a permanent circuit, this tool will solder the parts together.

Safety Measures:

1. Do not connect power to a circuit until the circuit is finished.
2. Never work on a circuit while power is switched on.
3. Never touch any electrical equipment wet hands.
4. Your work area must always be kept dry.

5. If you smell anything burning, immediately disconnect the power and examine your circuit to find out what went wrong.
6. Always use appropriate insulated rubber gloves and goggles while working on any branch circuit or other electrical circuit.

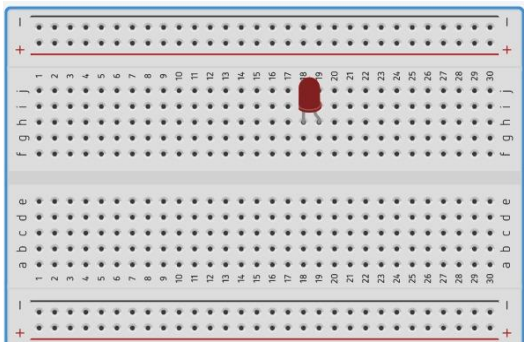
Activity: Simple Circuit (20 mins)

Once you are familiar with the uses of a breadboard and it's different parts, it is time to build a simple circuit to have a basic understanding of it's working.

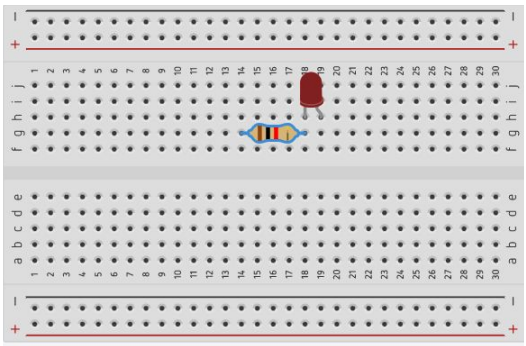
Take your LED bulb, 9V battery, 330 Ohm resistor, connecting wires and a breadboard and let's start!

Steps to make a simple circuit:

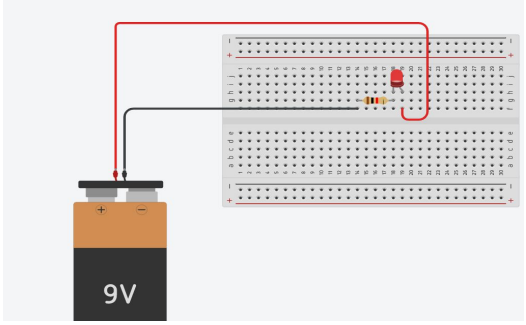
Step 1: Insert a LED into the breadboard



Step 2: Insert the Resistor into the breadboard and connect it to the negative terminal of LED



Step 3: Connect the red wire(+) of the battery to the positive side of the LED and and connect black wire(-) to the other end of the resistor.



Source: Tinkercad.com

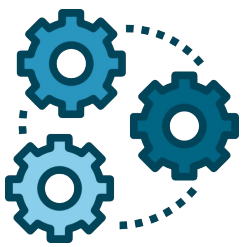
Reflection and Learnings (9 mins):

1. Share at least 3 skills or concepts that you learned today.
2. How will you apply these skills outside the ATL Lab?
3. What did you or your team struggle with while doing this activity and why? How can you improve next time?
4. How did you contribute to the team and how do you think it helped? How else could you have contributed?
5. What communication challenges did you and your team face? How can your team communicate better next time?

Try it yourself!

Use the concepts of Breadboards and try connecting 2 LED's of different colours and make them glow.

Use the space to draw or write your reflections and learnings



Introduction to Circuits (10 mins):

In the 1800s, a man called Alessandro Volta created the first-ever battery which could provide a continuous flow of current. This source for a flow of current made the very first circuits a possibility.

Volta discovered that you could create a continuous flow of electricity by connecting bowls of salt solution with metal strips. Then he used discs of copper, zinc and cardboard that had been soaked in a salt solution to create the first battery, which was called the Voltaic Pile.

The early uses for this new discovery were for circuits to provide electricity for lighting just before the bulb was invented by Thomas Edison.

An electric circuit is path for transmitting electric current. An electric circuit includes a device that gives energy to the charged particles constituting the current, such as a battery or a generator; devices that use current, such as lamps, electric motors, or computers; and the connecting wires or transmission lines. Two of the basic laws that mathematically describe the performance of electric circuits are Ohm's law and Kirchhoff's rules.

Electric circuits are classified in several ways. A direct-current circuit carries current that flows only in one direction. An alternating-current circuit carries current that pulsates back and forth many times each second, as in most household circuits.

Source: twinkl.co.in

Materials Required :

1. Pencils
2. A4 Size sheet
3. LED
4. Coin Cell/Rechargeable 9 V batteries
5. Breadboard
6. Jumper wires
7. Multimeter
8. Wire Stripper
9. Conductive (Copper) Tape
10. Resistors
11. Push botton

: 60 minutes

Module: Basic Electronics

Grade: 6th to 9th

Importance/ Value:
The aim of this module is to provide some basic understanding of different types of circuit and its uses.

Learning Goals:
1. Learners will be able to understand the basics of Electronics and its components.
2. Learners will be able to make a different types of circuit on a breadboard.

Time	Description
01 Min	Check-in-Experience (CIE)
05 Min	Icebreaker
05 Min	Introduction to Series and Parallel Circuits
20 Min	Activity-Parallel Circuit
20 Mln	Activity- Series Circuit
09 Min	Reflection and Learnings

Icebreaker (5 mins):

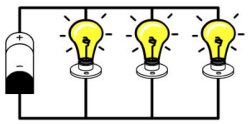
Pick a superpower!

You all wish you have a superpower right, like a superpower to go invisible, to read people's mind etc., Now, think a superpower you would like to have. Write down the superpower what would it be, draw yourselves as a superhero

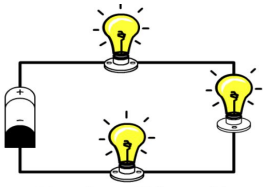
Types of Circuits: Parallel and Series

A circuit is said to be parallel when the electric current has multiple paths to flow through. The components that are a part of the parallel circuits will have a constant voltage across all ends.

A circuit is said to be connected in series when the same current flows through all the components in the circuit. In such circuits, the current has only one path. This is nothing but a series of multiple tiny bulbs connected in series. If one bulb fuses, all the bulbs in the series do not light up.



Parallel Circuit



Series Circuit

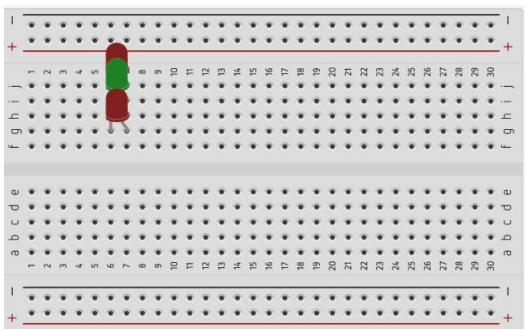
Activity: Parallel Circuit (20 mins)

After, building a simple circuit on the breadboard, let us now see what it is like to build a parallel circuit.

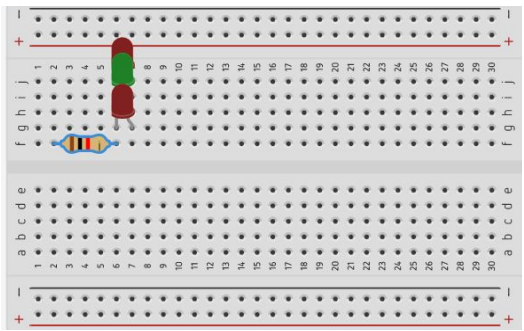
Take your LED bulb, 9v battery, 330v resistor, connecting wires and a breadboard and let's start!

Steps to make a parallel circuit:

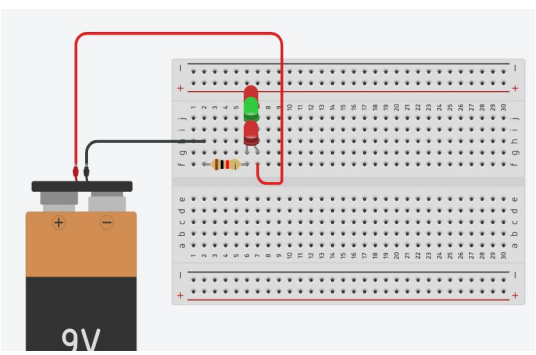
Step 1: Insert a LED bulbs into the breadboard as as shown in the image



Step 2: Insert the Resistor into the breadboard and connect it to the negative terminal of LED



Step 3: Connect the battery redwire(+) to the positive side of the LED and and connect black wire(-) to the other end of the resistor.

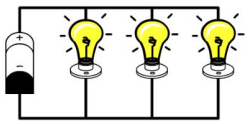


Source: Tinkercad.com

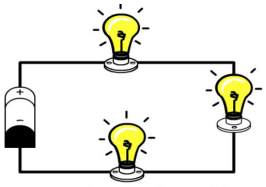
Types of Circuits: Parallel and Series

A circuit is said to be parallel when the electric current has multiple paths to flow through. The components that are a part of the parallel circuits will have a constant voltage across all ends.

A circuit is said to be connected in series when the same current flows through all the components in the circuit. In such circuits, the current has only one path. This is nothing but a series of multiple tiny bulbs connected in series. If one bulb fuses, all the bulbs in the series do not light up.



Parallel Circuit



Series Circuit

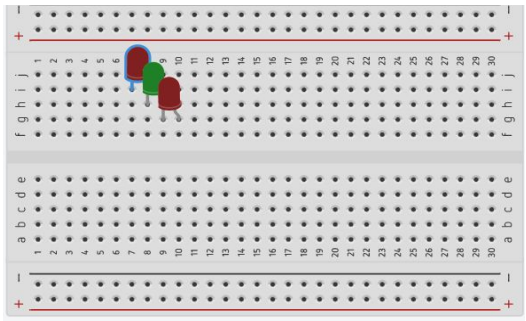
Activity: Series Circuit (20 mins)

After, building a parallel circuit on the breadboard, let us now see what it is like to build a series circuit.

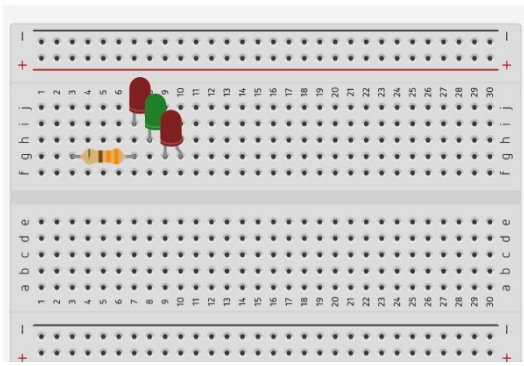
Take your LED bulb, 9v battery, 330v resistor, connecting wires and a breadboard and let's start!

Steps to make a series circuit:

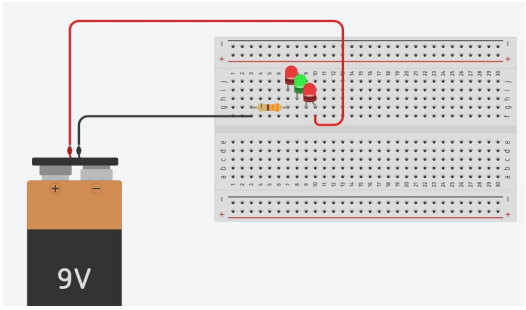
Step 1: Insert a LED bulbs into the breadboard as as shown in the image



Step 2: Insert the Resistor into the breadboard and connect it to the negative terminal of LED



Step 3: Connect the battery redwire(+) to the positive side of the LED and and connect black wire(-) to the other end of the resistor.



Source: Tinkercad.com

Reflection and Learnings (9 mins):

1. What do you think is the difference between a Series and a Parallel Circuit?
2. Can you think of different real-world applications of Series and Parallel Circuits?
3. What did you or your team struggle with while doing this activity and why? How can you improve next time?
4. How did you contribute to the team and how do you think it helped? How else could you have contributed?
5. What communication challenges did you and your team face? How can your team communicate better next time?

Try it yourself!

Use the concepts of Series and parallel circuits, build a series or a parallel circuit and try adding a switch to each LED and make only one LED glow at a time similar to the ones we see in the corridor.

Use the space to draw or write your reflections and learnings

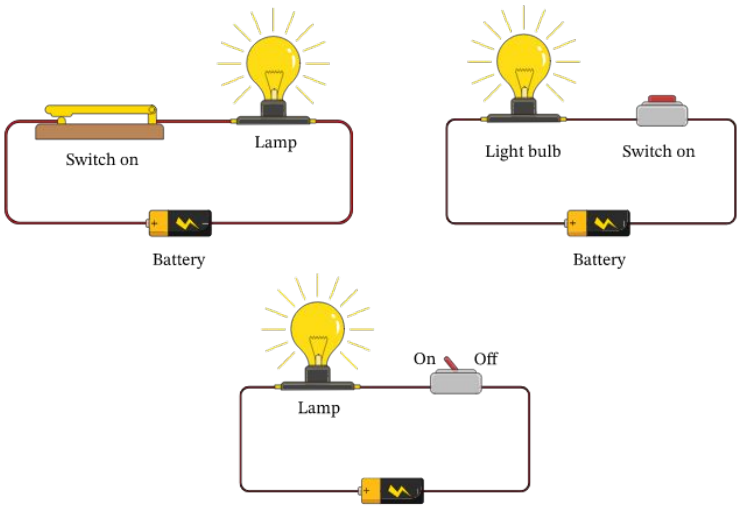
Introduction to Traffic Light Circuit with a Switch (10 mins):

What is an Electrical Switch?

A switch is a component which controls the open-ness or closed-ness of an electric circuit. They allow control over current flow in a circuit (without having to actually get in there and manually cut or splice the wires). Switches are critical components in any circuit which requires user interaction or control.

A switch can only exist in one of two states: open or closed. In the **off** state, a switch looks like an open gap in the circuit. This, in effect, looks like an **open circuit**, preventing current from flowing.

In the **on** state, a switch acts just like a piece of perfectly-conducting wire. A short. This **closes the circuit**, turning the system "on" and allowing current to flow unimpeded through the rest of the system.



Source: nagwa.com

Materials Required :

1. Pencils
2. A4 Size sheet
3. LED's - 3 (Red, Yellow, Green)
4. Rechargeable 9 V batteries
5. Breadboard
6. Jumper wires
7. Multimeter
8. Wire Stripper
9. Resistors
10. Push button

: 60 minutes

Module: Basic Electronics

Grade: 6th to 9th

Number of Sessions: 4

Importance/ Value:
The aim of this module is to provide some basic understanding of different types of circuit and its uses

Learning Goals:
1. Learners will be able to understand the basics of Electronics and its components.
2. Learners will be able to make a different types of circuit on a breadboard.

Time	Description
01 Min	Check-in-Experience (CIE)
05 Min	Icebreaker
15 Min	Introduction to Electric Switch
20 Min	Activity- Traffic Light
20 Min	Challenge- Traffic light
09 Min	Reflection and Learnings

Icebreaker (5 mins):

Sit in a circle. Once person from the circle should say something funny — they could tell a joke or narrate a funny incident.

The others have to listen to it but not smile or laugh. Let each child smile or laugh and say something funny in turns. The other children have to look at them and maintain a straight face.

Safety Measures:

1. Do not connect power to a circuit until the circuit is finished.
2. Never work on a circuit while power is switched on.
3. Never touch any electrical equipment wet hands.
4. Your work area must always be kept dry.

5. If you smell anything burning, immediately disconnect the power and examine your circuit to find out what went wrong.
6. Always use appropriate insulated rubber gloves and goggles while working on any branch circuit or other electrical circuit.

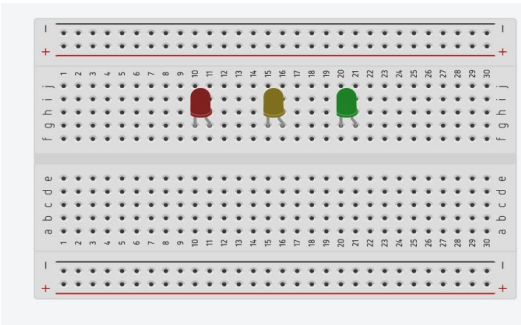
Activity: Traffic light (20 mins)

Once you are familiar with the uses of a breadboard and different types of circuit, it is time to build a Traffic light circuit to have a basic understanding of it's working.

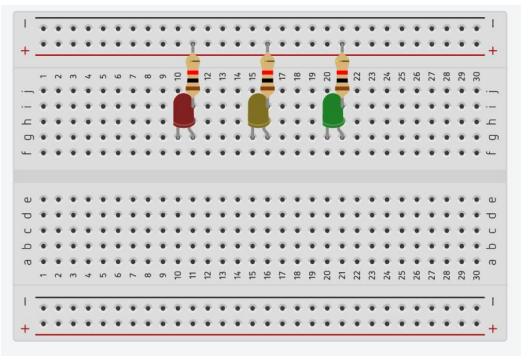
Take your LED bulb, 9v battery, 330v resistor,push button, connecting wires and a breadboard and let's start!

Steps to make a traffic light

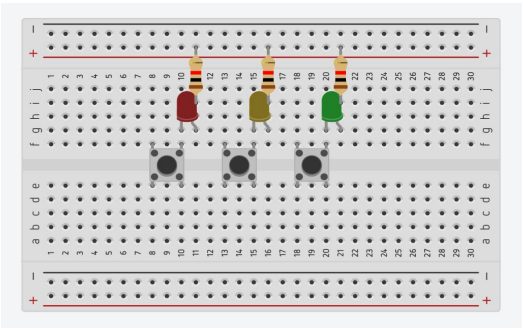
Step 1: Insert a LED into the breadboard.



Step 2: Insert the Resistor into the breadboard and connect it to the positive terminal of LED.

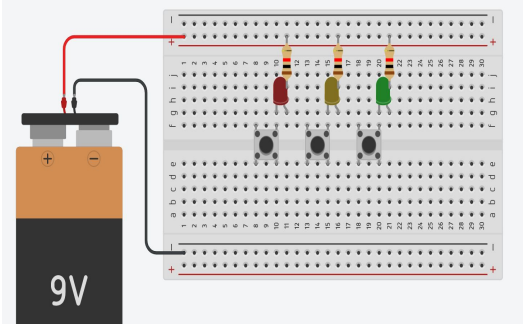


Step 3: Add the push button and connect it to the negative side of LED like as shown in the picture.

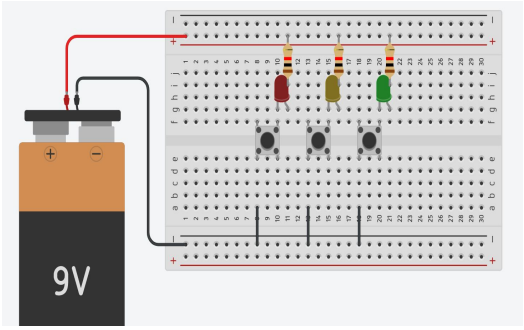


Source: Tinkercad.com

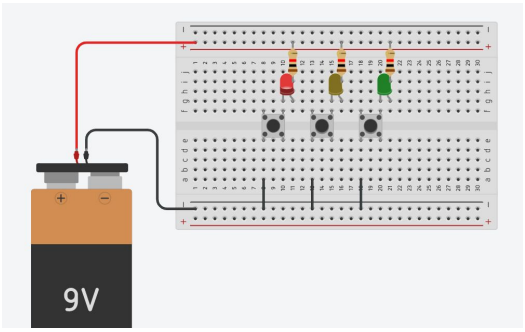
Step 4: Connect the 9v battery to the circuit.



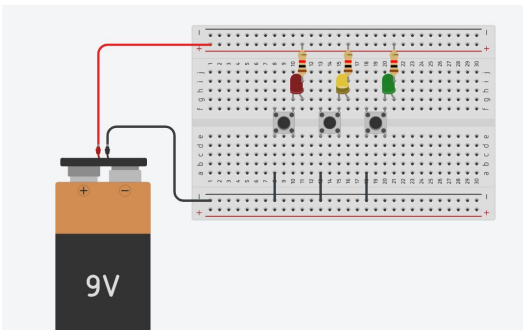
Step 5: Connect the pushbutton and neutral of the battery by using the connecting wires.



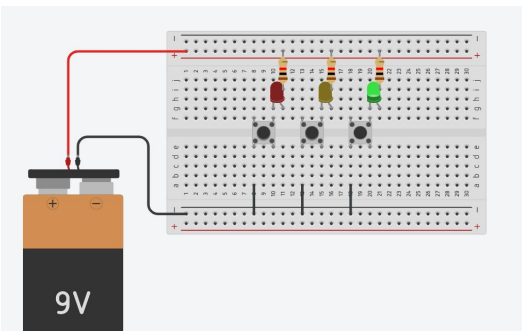
Step 6: To turn on red light, press the press the push button that is connected to the Red LED.



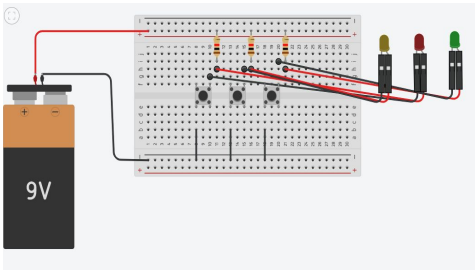
Step 7: To turn on yellow light, press the push button that is connected to the Yellow LED

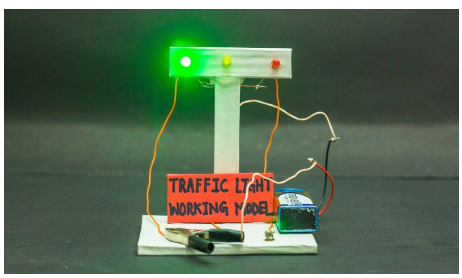


Step 8: To turn on green light, press the push button that connected to the Green LED



Challenge (Try it Yourself!): Now that you have learnt how to build a simple circuit that represents the Traffic Light, Here is a small Challenge for you. You need to create a traffic light model using cardboard and other available materials and connect LEDs using Jumper wires
Reference Images :





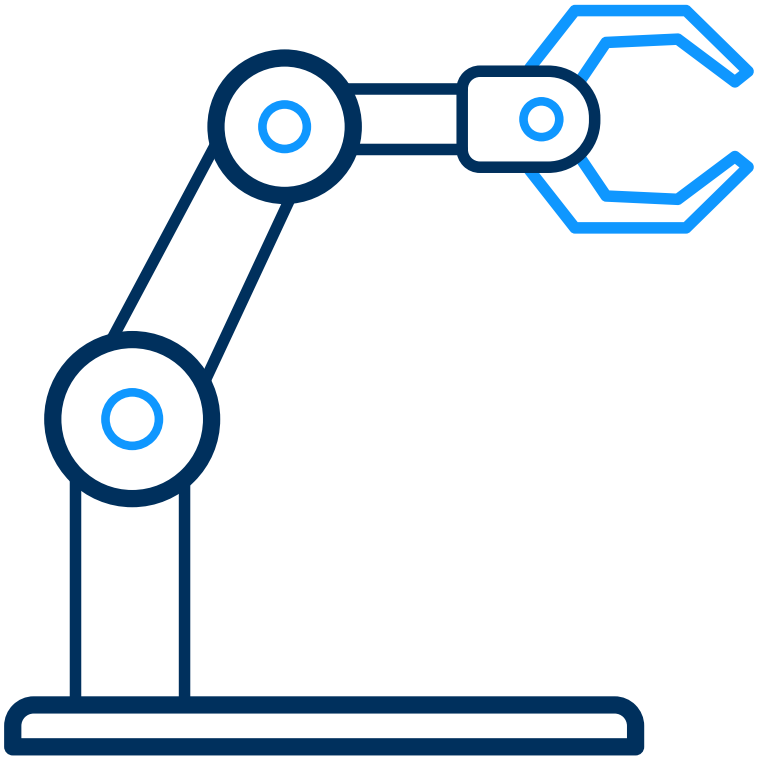
Source: Tinkercad.com

Reflection and Learnings (9 mins):

1. Which type of circuit is a Traffic Light. Series or Parallel?
2. How will you apply these skills outside class?
3. What did you or your team struggle with while doing this activity and why? How can you improve next time?
4. How did you contribute to the team and how do you think it helped? How else could you have contributed?
5. What communication challenges did you and your team face? How can your team communicate better next time?

Use the space to draw or write your reflections and learnings

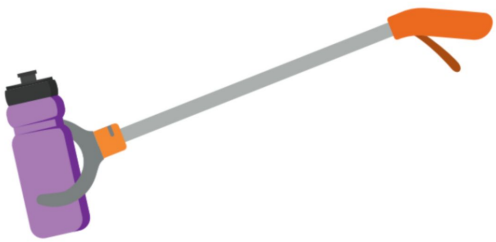
MECHANICS



Introduction to DIY Grabber :

Grabbers are handheld tools used to aid a person's reach and pick up items. Grabbers are often mechanical, meaning they have moving parts that the user can control, but there are lots of different types of grabbers. As the name suggests, the mechanism on these designs will be used for grabbing things! In addition to creating with simple machines, building a grabber will give you a practical tool you can use around your house!

Mechanical DIY Grabber Examples
There are a lot of creative examples we can imagine and must have seen all these things around us, one can be a Chapati grabber used in houses on a daily basis. Others could be something like this:



: 60 minutes

Module: Cardboard Construction

Grade: 6th to 9th

Importance/ Value:
The aim of this module is to provide some basic mechanics activities using simple DIY material that explain the basic concepts associated with Physics. This enables the learners to understand more complex concepts and technologies which will help them to build simple DIY and mechanics projects using the ATL Lab Kits.

Learning Goals

1. Learners will learn about the basics of cardboard constructions, its tools and the techniques.
2. Children will learn about different tools used for cardboard.

Ice Breaker Activity (5 min) :

Pick up a blob of ink or drop of colour. Splash an ink blob or paint blob on a sheet of paper and make it into what you see. You can create it into any kind of thing, object or abstract art.

Materials Required :

1. Pencils
2. A4 Size sheet
3. Cardboard Sheets
4. Fevicol
5. Scissor
6. Geometry Box
7. Metal Ruler
8. Multi-purpose knife
9. Cello Tape
10. Hole Punch Machine (If available)
11. Rubber band
12. Pins
13. String or yarn piece

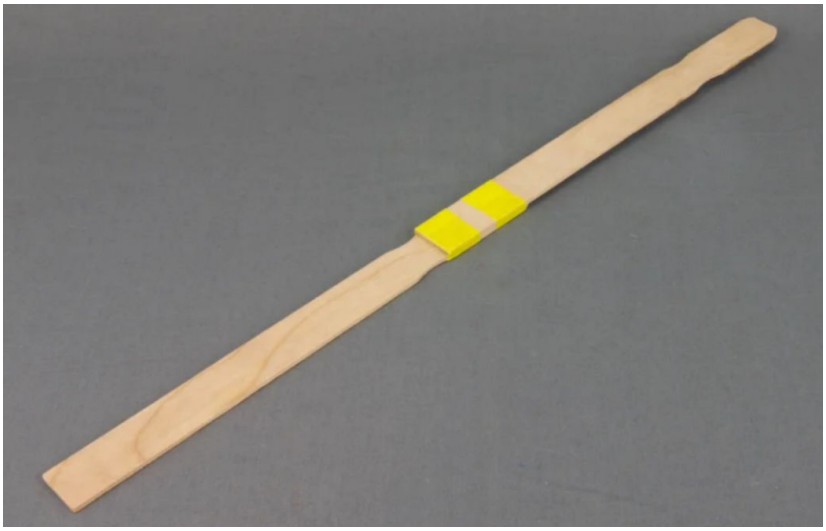
Time	Description
01 Min	Check-in-Experience (CIE)
05 Min	Icebreaker
15 Min	Introduction and Recap
30 Mln	Activity: Mechanical DIY Grabber
09 Min	Reflection and Learnings

Activity : Making DIY Grabber

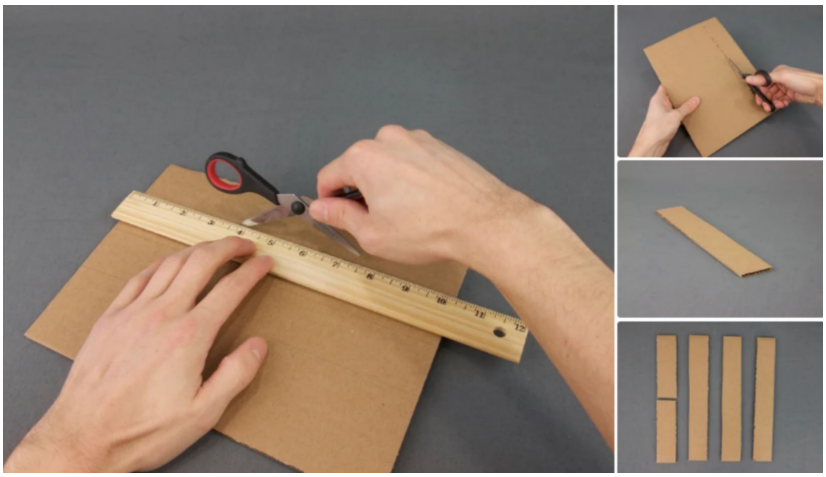
In this activity you will design a device that can pick up three different objects from at least 2 feet away. Divide into groups and assemble all the materials for yourself. If you have ides then you can work independently as well.

Steps:

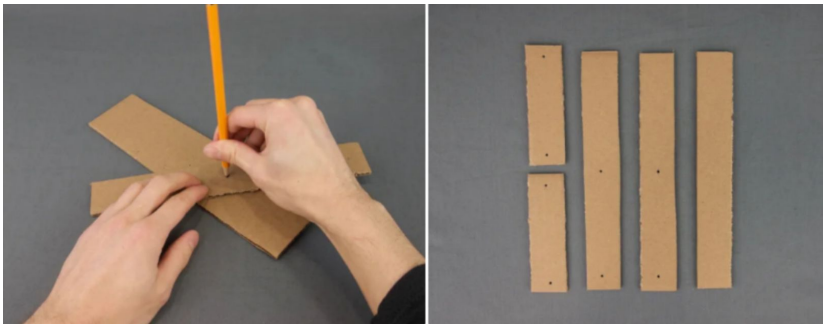
Step 1: Create the handle
Build the handle! Overlap the paint stirrers by about 4" (10 cm), and wrap tightly with masking tape in at least 2 places. You can also use hard cardboard if you don't have paint stirrers.



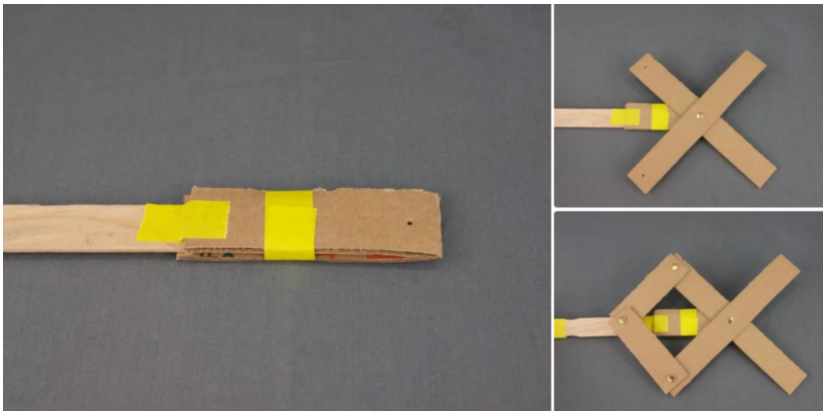
Step 2: Cut the Cardboard.
Cut the cardboard. Cut 10" (23 cm) pieces of cardboard that are about 1.5" (3.8 cm) wide. An adult may need to prep this step with a utility knife and cutting mat.
Each grabber needs three 10" (23 cm) and two 5" (12.5 cm) pieces.



Step 3: Poke Holes Into the Cardboard
(Picture 1) Use a sharpened pencil to poke hinge holes into the cardboard as shown.
(Picture 2) The holes should be at least ½" (1 cm) from the edges, and they don't need to be very big. Note that one piece isn't poked at all.
Keep your pencil sharp by placing a scrap piece of cardboard behind the area you're piercing.

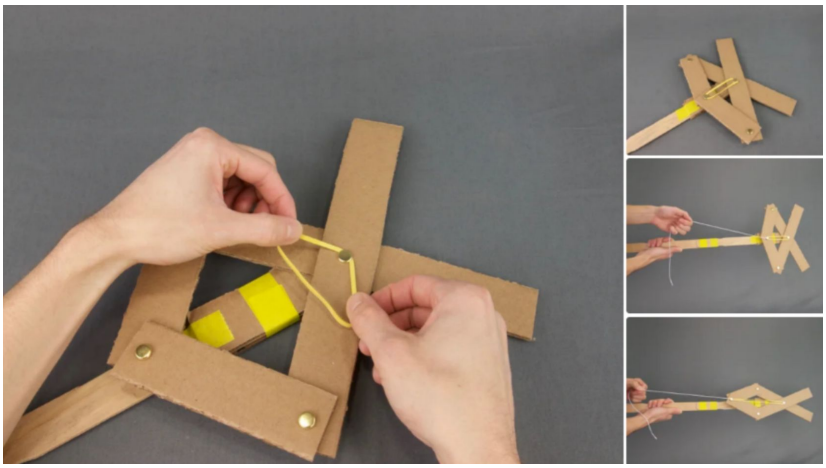


Step 4: Assemble the Grabber Mechanism
(Picture 1) Take the piece that doesn't have holes, bend it in half, and tape it to the end of the handle as shown. Overlap most of it with the handle, but leave about 1" (2.5 cm) of the folded side not overlapped with the wood. Poke a hole through that part of the cardboard.
(Picture 2) Assemble the cardboard as shown using a metal fastener. On the other side, fold the fastener tabs completely flat, and secure them in place with a piece of tape. This step is important! If the fastener tabs are not folded and taped, the grabber will come undone!
(Picture 3) Attach the two 5" (12.5 cm) pieces as shown. Remember to fold and tape the fastener tabs.



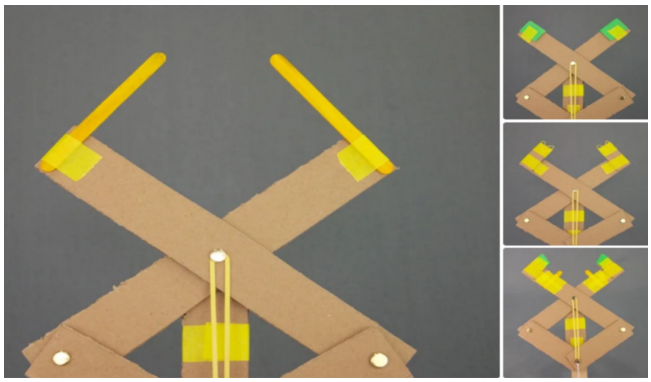
Step 5: Attach the Rubber Band and String

(Picture 1) Attach the rubber band! This will help automatically open up the grabber.
Start by stretching the rubber band with both hands, and slipping it under the middle fastener as shown, then repeat with the other middle fastener. (Picture 2)
(Picture 3 & 4) Tie a piece of string to the fastener as shown. The grabber is ready to test! Tug at the string, and your grabber should close.



Step 6: Improve the Grabber's Grip

Time to start innovating! It's up to you to use your available materials to figure out how to improve your grabber's grip. Check out the pictures for some inspiration.



Reflection and Learnings :

1. How to you thing a DIY grabber is useful?
2. What are some other objects you can build like this?
3. Write down a few key points you learned from this activity?
4. Write down which part you liked about the activity most?
5. Write a few good things about working as a team/with your friends

Use the space below to draw or write your reflections and learnings

Try it yourself!

Look at the image given, Try creating a simple movable mirror of such kind with the concepts you have learnt in this session.

Source: amazon.in

Use the space to draw or write your reflections and learnings

Introduction to Robotics

Robotics: The word robot was coined by Czech novelist Karel Capek in a 1920 play titled Rossum's Universal Robots (RUR) • Robot in Czech is a word for worker or servant.

A robot is a reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialised devices through variable programmed motions to perform various

: 60 minutes

Module: Mechanics

Grade: 6th to 9th

Importance/ Value

Working with cardboard helps the learners explore different materials and quickly test out mechanical models, which gives them opportunities to create new things in the ATL Lab.

Learning Goals

1. Learners will understand the basics of cardboard construction, its tools and techniques.

2. They will also understand the basics of a Robotic hand.

Materials Required :

1. Pencils
2. A4 Size sheet
3. Cardboard Sheets
4. Fevicol
5. Scissor
6. Geometry Box
7. Metal Ruler
8. Multi-purpose knife
9. Cello Tape
10. Hole Punch Machine (If available)
11. Rubber band
12. Pins
13. String or yarn piece
14. Plastic Straws
15. Popsicle sticks (Optional)

Robotics is a process where machines that work like human behavior are produced, and they are called Robots. Robotics produces machines that can perform like human and can replace the human. Firstly, robots are produced to work in the dangerous workplace so that people involved in those industries do not face problems. But later robots are used in many different industries like manufacturing, laboratories, military, hospitals, research centers, etc. Robots not only replace humans but also perform better than humans.

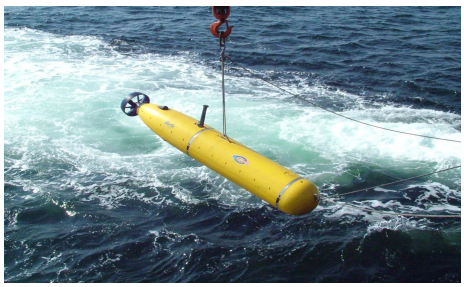
Let us see how to make a prototype of a functional robotic arm!

Types of Robots :

1) Manipulators: Robotic manipulation refers to the ways robots interact with the objects around them: grasping an object, opening a door, packing an order into a box, folding laundry. All these actions require robots to plan and control the motion of their hands and arms intelligently.

2) Legged Robot and Wheeled Robot: Legged and Wheeled robots are mobile robots that use articulated limbs, such as leg mechanisms, to provide locomotion. They are more versatile than wheeled robots and can traverse many different terrains.

3) Unmanned Aerial Vehicles and Autonomous Underwater Robots: AUR and UAV are self-propelled, unmanned, untethered underwater and aerial vehicles capable of carrying out simple activities with little or no human supervision

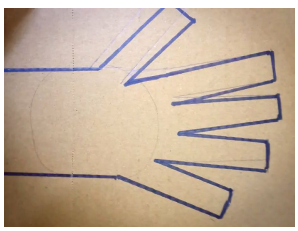


Activity : Making of a functional Robotic Arm

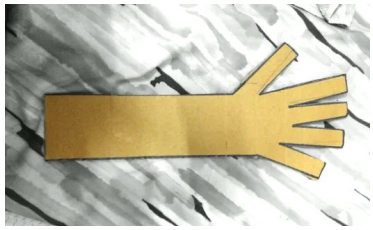
Build a robotic arm from cardboard using thread, straw, and ice cream sticks/Popsicle sticks in this class. Follow the instructions given by your teacher to complete the making in groups or you can work independently if you already have ideas to build on.

Steps:

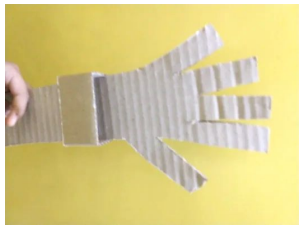
Step 1: Outline the hand. Make it according to the size you want.



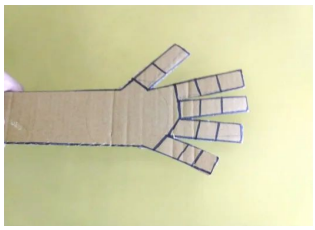
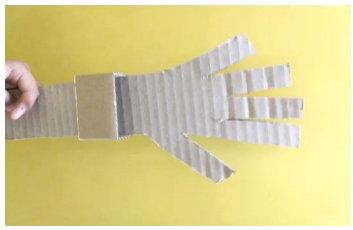
Step 2: Cut It Out.



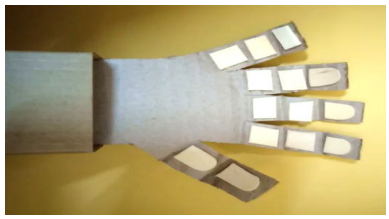
Step 3: Now, make a handle by which you will be holding the robotic hand, as shown in the image.



Step 4: Now, observe the image below and fold accordingly. This will help you move the fingers at last.

Step 5: Now, you must paste some more hard cardboard pieces to make it strong. You can also use Popsicle sticks if you want.



Step 6: Cut some small pieces of straw and paste them on the hand as shown in the images above. We will take out the threads or wire through these pipes, whatever you want to use.



Step 7: Due to the positioning of the thumb, we need to stick the straws in a bit different way. See the images to get a better understanding.



Step 8: Now stick the threads on the top of the fingers; take the line through the loops made by straws. Then make small loops at the end to put your fingers in it. It will help you to control the arm.

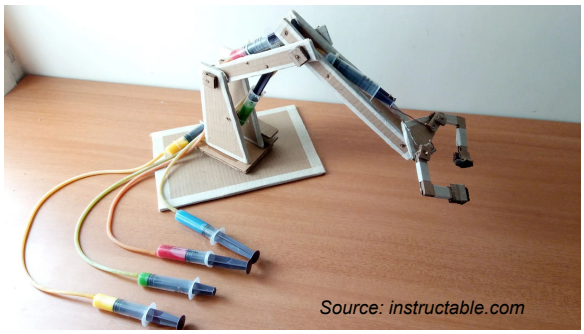
Step 9: Now the hand is ready. You can use this robotic arm to hold things, make hand gestures, etc. Now it's ready to have fun!


Reflection and Learnings :

1. What do you think will happen if the same Robotic hand is made out of Iron instead of cardboard?
2. What do you think are the real-world applications of a Robotic Hand?
3. What did you or your team struggle with while doing this activity and why? How can you improve next time?
4. How did you contribute to the team and how do you think it helped? How else could you have contributed?
5. What communication challenges did you and your team face? How can your team communicate better next time?

Try it yourself!

Look at the image given, Try creating a simple hydraulic hand of such kind with the concepts you have learnt in this session.

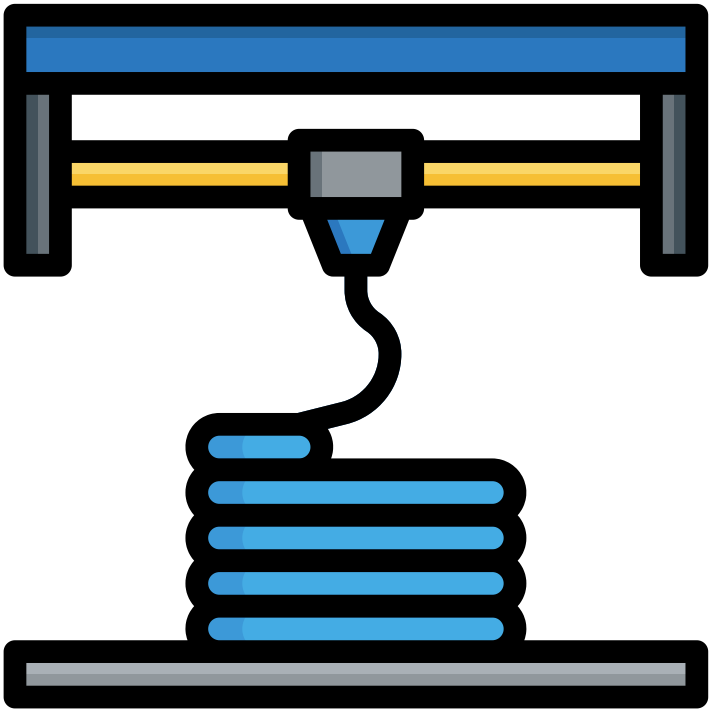


Use the space to draw or write your reflections and learnings

Additional resources :

You scan this qr code to see a detailed video of making robotic hand

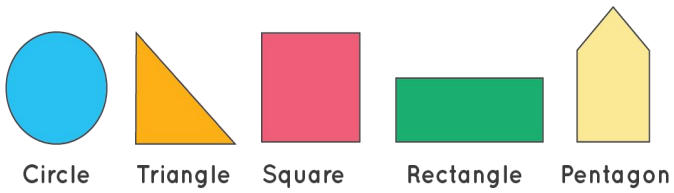
3D DESIGNING & PRINTING



Introduction to 2D and 3D Shapes (10 mins):

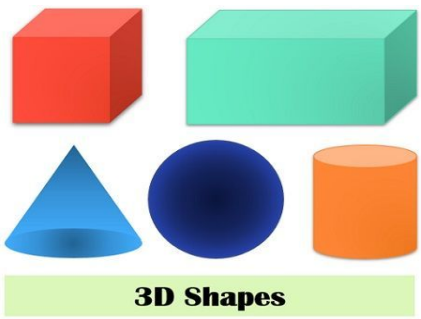
2D Shapes

A 2D shape has two dimensions, that is, Length and Breadth. 2D shapes are flat because they don't have any height or depth. Examples of 2D shapes include circle, rectangle, square, polygons, etc. Since 2D shapes don't have any height, they don't have any volume either. 2D shapes have only areas. 2D shapes are drawn using X-axis and Y-axis. Refer to the picture given below.

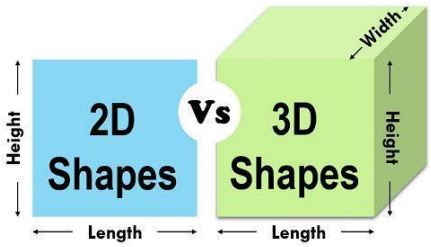


3D Shapes

Most of the objects that we see around us have 3D shapes, which means they have three dimensions: Length, Breadth, and Depth. Examples of 3D shapes include cubes, cylinders, spheres, cones, et



Since 3D shapes have depth, they occupy some volume. 3D shapes are drawn using X-axis, Y-axis, and Z-axis.



Source:www.cuemath.com

Materials Required :

1. Laptop with Internet Connection
2. 3D Printer

: 60 minutes

Module: 3D Design and Printing

Grade: 6th to 9th

Importance/ Value:
3D Printing and Design allows children to think, visualize their imaginative concepts and create prototypes on their own in the ATL Lab. It also enables the children to understand the basic design concepts while differentiating between 2D and 3D images.

Learning Goals:

1. Learners will be able to understand the basic concepts of 3D design.
2. Learners will explore and learn to use a simple 3D design software called Tinkercad.
3. Learners will design and 3D print a simple key chain exploring the possibilities of 3D Printing.

Time	Description
01 Min	Check-in-Experience (CIE
05 Min	Icebreaker- Get-to-know
10 Min	Introduction to 3D Printing
35 Min	Activity - Design and 3D Print a cup.
09 Min	Reflection and Learnings

Icebreaker (5 mins): Get-to-know

Create groups of 4-5 people, and let them discover what they have in common, along with interesting characteristics that are unique to a person in the group. This icebreaker promotes unity as it gets people to realize that they have more common ground with their peers than they first might realize. As people become aware of their own unique characteristics, they can also help people feel empowered to offer the group something unique.

Safety Measures:

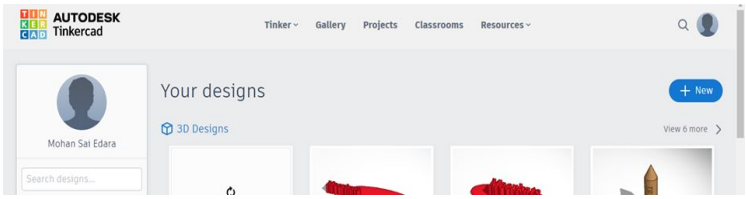
1. Put your 3D printer in an area which isn't easily accessible
2. Wear gloves when handling your 3D printer.
3. Keep a mental note in your head that your 3D printer gets very hot.
4. Only reach for your printer when you are certain it's off

Activity: Design & 3D Print a simple Key Chain

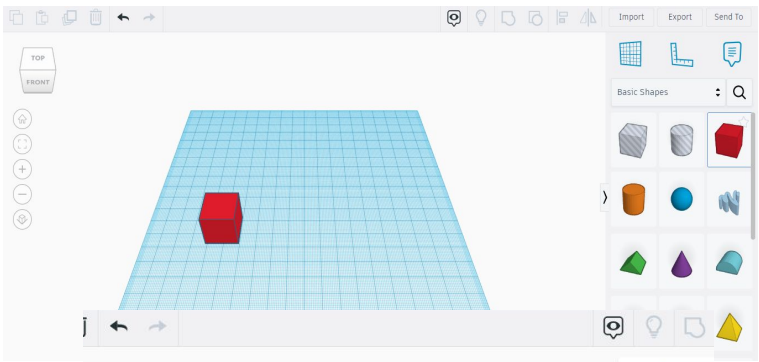
In this activity you will learn how to use a 3D design software called TinkerCad and Design a simple 3D key chain and 3D print it.

Step 1: Open a browser and type tinkercad in the url and press enter. Click on the first result www.tinkercad.com and you will be redirected to a tinkercad website. Click on sign in and use your google account or autodesk account to sign in to the tinkercad website.

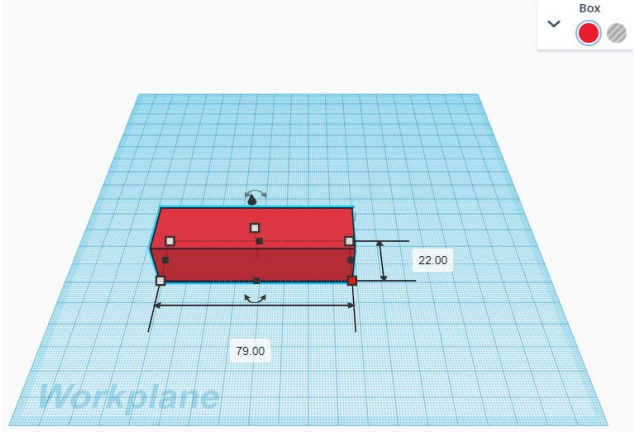
Step 2: After logging in, click on +new to start a new design.



Step 3: Drag and drop a box from the basic shapes onto the work plane.

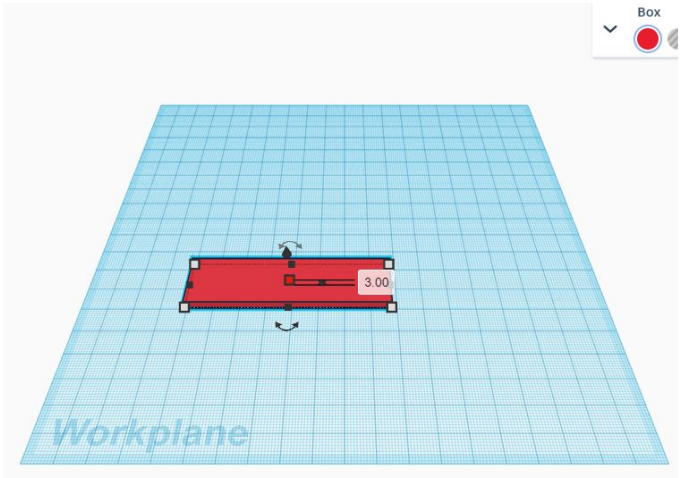


Step 4: Click on one of the corners of the box and adjust the length by 35 mm and width by 22 mm with the help of the mouse by holding the shift key.

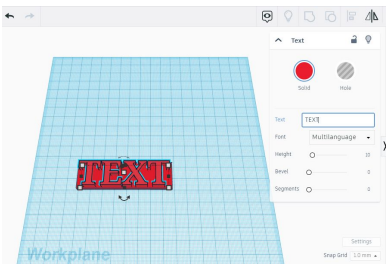


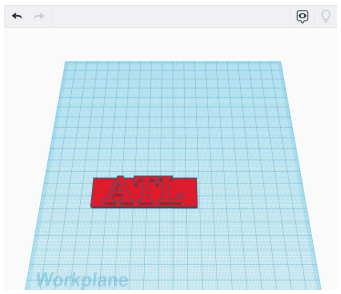
Source: tinkercad.com

Step 5: Hold the middle hand and reduce the height to 3mm.

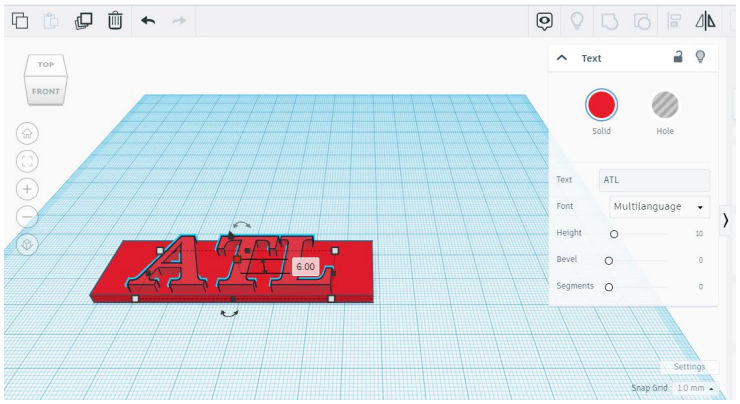


Step 6: Type “ATL” in the Text box.

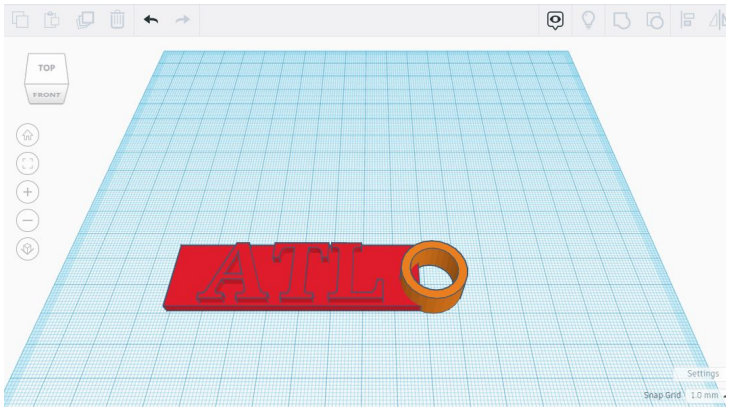




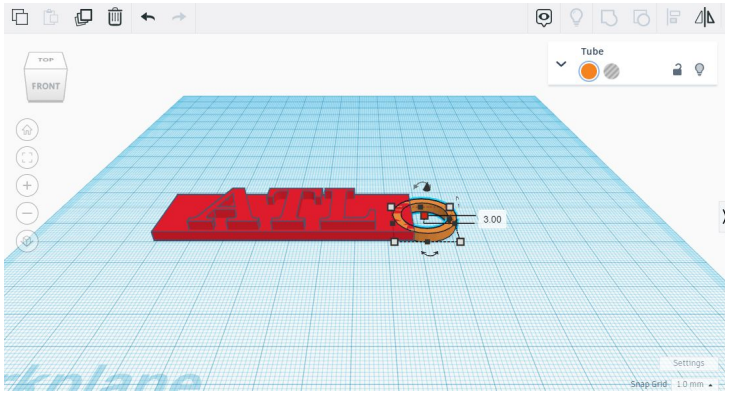
Step 7: Click your middle handle and decrease the thickness of your name to around 6mm.



Step 8: Scroll to the bottom of your Basic Shapes menu and drag a tube onto the Workplane.

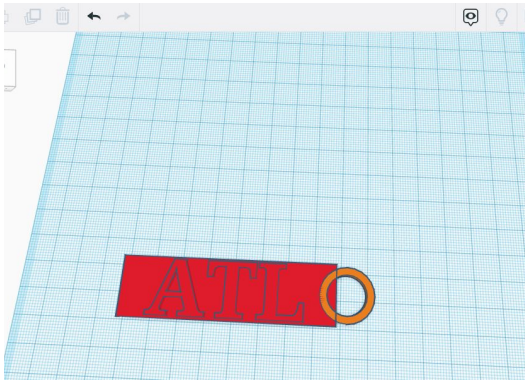


Step 9: Click and drag the middle handle to reduce the thickness of the tube to around 3mm.

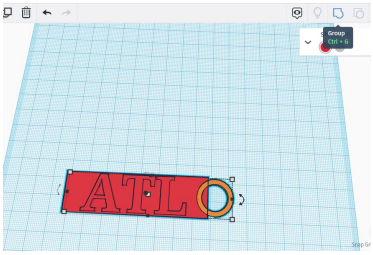


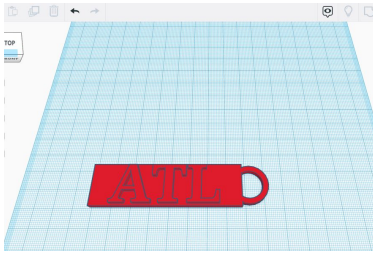
Source: tinkercad.com

Step 10: .Drag your tube and place it so the bottom ¼ (or so) is inside your box.



Step 11: Click and drag a square around your entire project. Click on the Group button, which will connect all the pieces of your project together.





Source: tinkercad.com

YOU HAVE SUCCESSFULLY COMPLETED THE ACTIVITY

Reflection and Learnings (9 mins):

1. What is the difference between 2D and 3D objects?
2. What will happen when you use the group option in Tinkercad?
3. Imagine yourself to be an eagle and draw the Top View of your house.
4. What did you or your team struggle with while doing this activity and why? How can you improve next time?
5. How did you contribute to the team and how do you think it helped? How else could you have contributed?

Try it yourself!

Using the concepts you have learnt so far, Try creating a simple 3D quotes as shown in the image.

Source: vanillatech.net

Use the space to draw or write your reflections and learnings

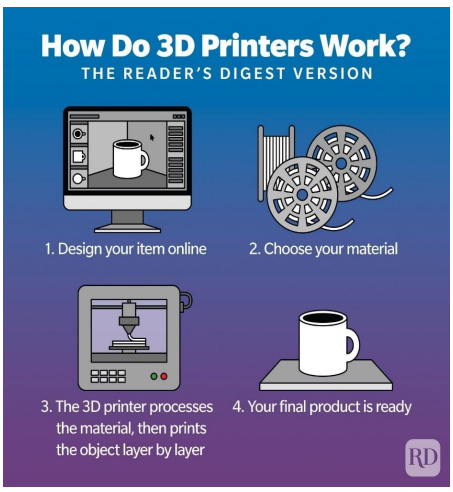
Introduction to 3D printing (10 mins):

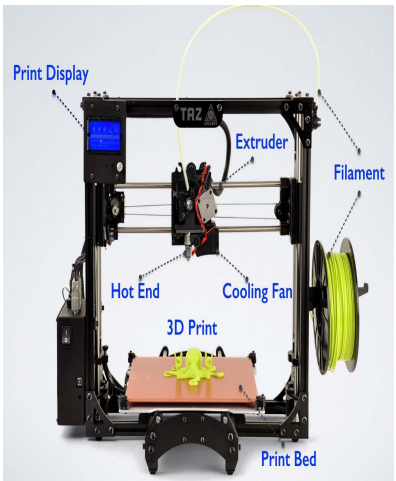
What is 3D printing and how it works?

3D printing is a process by which a digital representation of an object is created using computer aided manufacturing (CAM) technology. 3D printing is a path breaking technology and has also evolved through several different forms. The key thing to know about 3D printing is that it doesn't work like regular manufacturing methods: rather than starting with an existing object, the printer has to make one from scratch by building up layers of material in a process called additive manufacturing. In other words, it works with the same materials used in traditional manufacturing but recreates objects because it uses special materials that can be built layer by layer.

3D printing is a relatively new technology, but it's going to change the way we live. We'll be able to print out everything from toys and clothes to food and medicine in our homes. It will also help us create replacement parts for appliances and vehicles that break down on the road—and even help astronauts repair satellites. 3D printers are literally just printers. But instead of printing words on paper, they print 3D objects, layer by layer, and can make them out of everything from carbon fiber and powders to plastic and metal

Parts and Working of printer





Source: https://www.rd.com

Materials Required :

1. Laptop with Internet Connection
2. 3D Printer

: 60 minutes

Module: 3D Design and Printing

Grade: 6th to 9th

Importance/ Value:
3D Printing and Design allows children to think, visualize their imaginative concepts and create prototypes on their own in the ATL Lab. It also enables the children to understand the basic design concepts while differentiating between 2D and 3D images.

Learning Goals:

1. Learners will be able to understand the basic concepts of 3D design
2. Learners will explore and learn to use a simple 3D design software called Tinkercad
3. Learners will design and 3D print a simple cup exploring the possibilities of 3D Printing

Time	Description
01 Min	Check-in-Experience (CIE
05 Min	Icebreaker- I'm Awesome!
10 Min	Introduction to 3D Printing
35 Min	Activity - Design and 3D Print a cup.
09 Min	Reflection and Learnings

Icebreaker (5 mins):

#I'm Awesome

Take a full size A3 chart and tape it to the wall. Once students enter the ATL Lab, hand them a marker and have them think of 2-3 hashtags that describe themselves. Allow them to write their hashtags on the wall and explain them to the rest of the class.

Safety Measures:

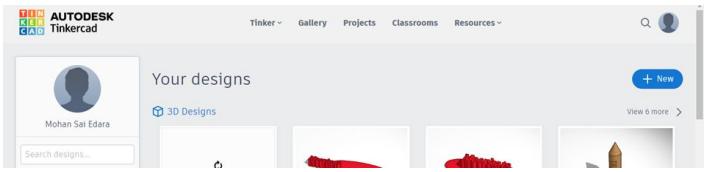
1. Put your 3D printer in an area which isn't easily accessible
2. Wear gloves when handling your 3D printer.
3. Keep a mental note in your head that your 3D printer gets very hot.
4. Only reach for your printer when you are certain it's off

Activity: Design & 3D Print a Cup

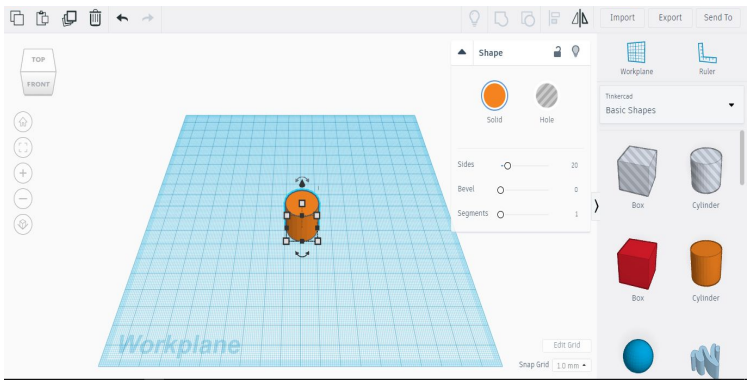
In this activity you will learn how to use a 3D design software called TinkerCad and Design a simple 3D cup and 3D print it.

Step 1: Open a browser and type tinkercad in the url and press enter. Click on the first result www.tinkercad.com and you will be redirected to a tinker cad website. Click on sign in and use your google account or autodesk account to sign in to the tinkercad website.

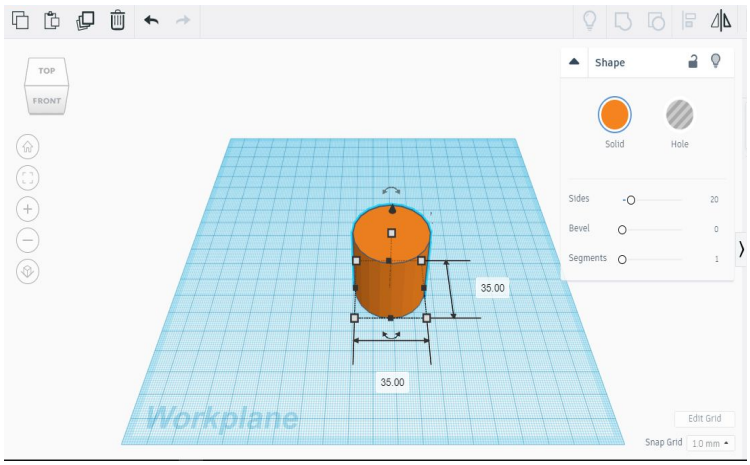
Step 2: After logging in, click on create a new design.



Step 3: Drag and drop a cylinder from the basic shapes on the work plane.

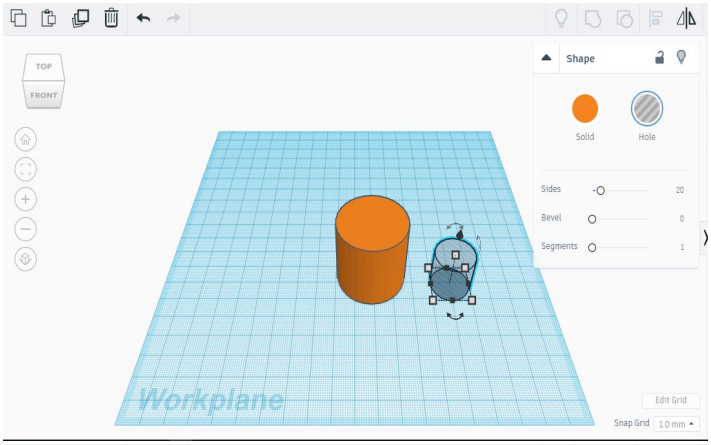


Step 4: Click on one of the corners of the cylinder and adjust the cylinder dimensions to 35mm with the help of the mouse by holding the shift key.

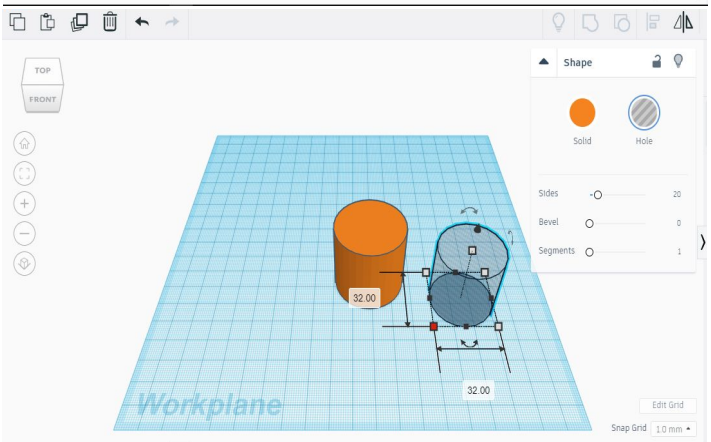


Source: Tinkercad.com

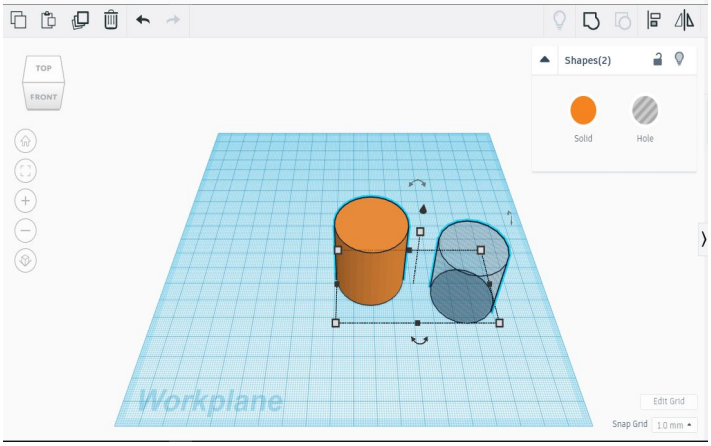
Step 5: Select a grayed-out cylinder from the basic shapes section and place it in the middle of the screen



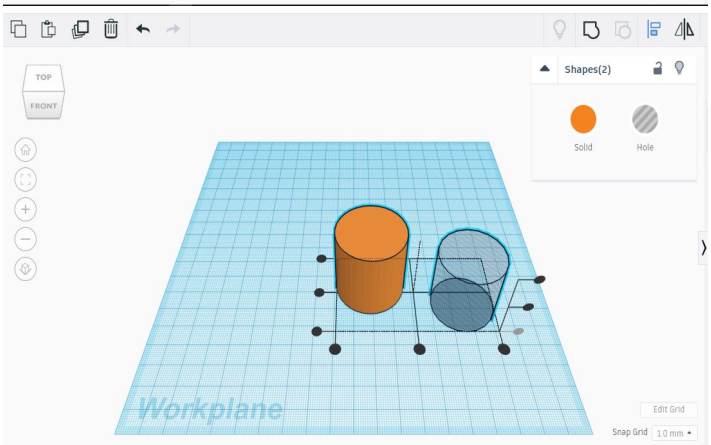
Step 6: Click on the corner and adjust the dimensions of the grayed-out cylinder it to 32 mm, like previously done.



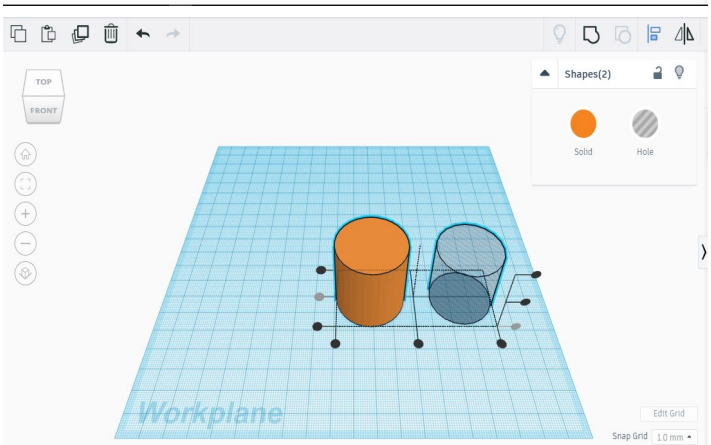
Step 7: Select both the shapes by dragging the cursor on the shapes.



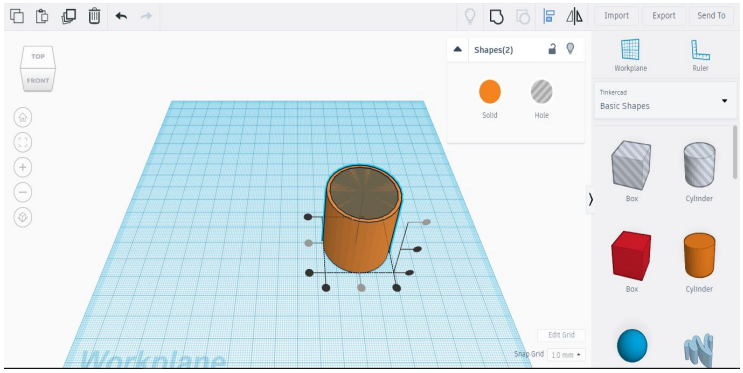
Step 8: Now let's align the shapes by centering the small grayed-out cylinder inside the solid cylinder.
Click on the align icon or press letter L



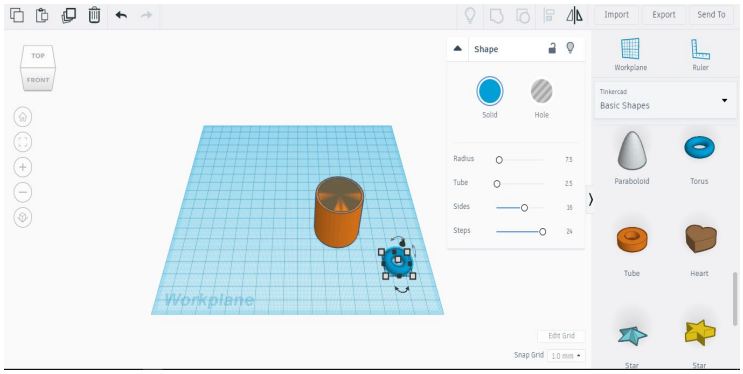
Step 9: Align the cylinder hole into the cylinder solid shape by clicking on the left middle dot and the front middle dot as shown in the images given below.



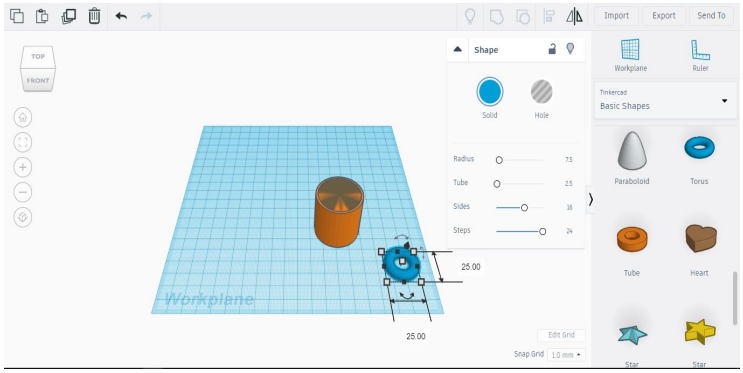
Step 10: Click on the top dot of the vertical 3 dots.



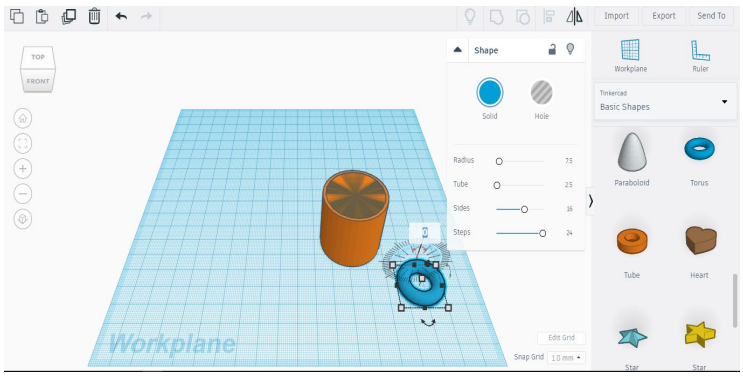
Step 11: Drag and drop a torus from the basic shapes and place it on the work plane beside the cylinder.

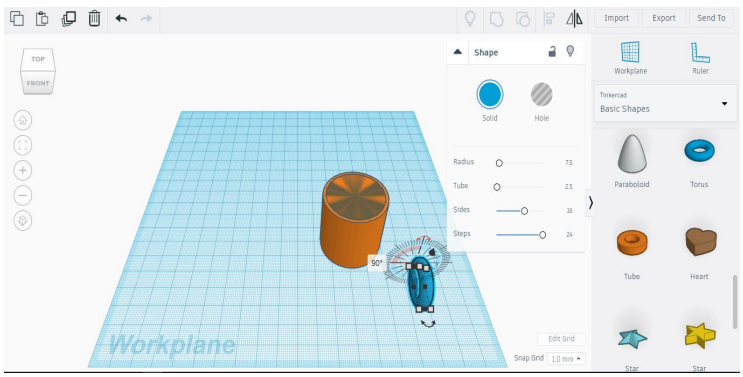


Step 12: Select the shape, click on a corner and adjust the dimensions to 25mm.



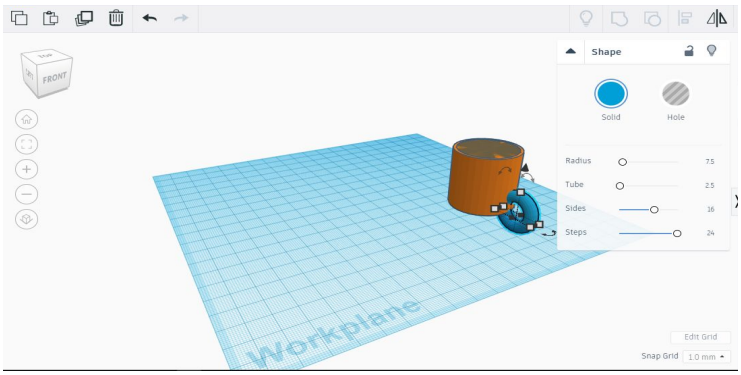
Step 13: Now let's rotate the shape to 90 degrees. To do so, Click on the curve shaped arrow and edit the 0 degrees and change it to 90 degrees as shown in the images given below.

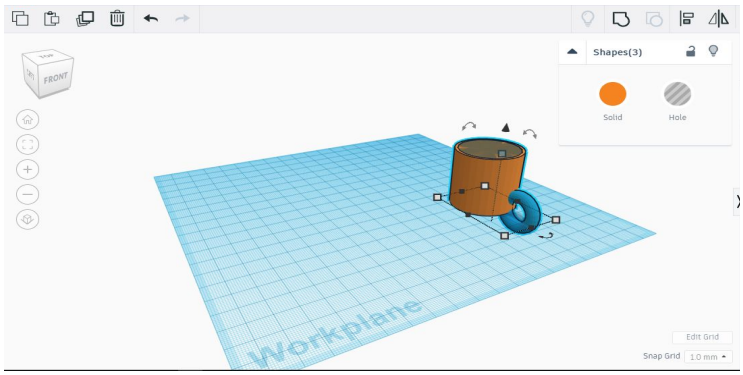


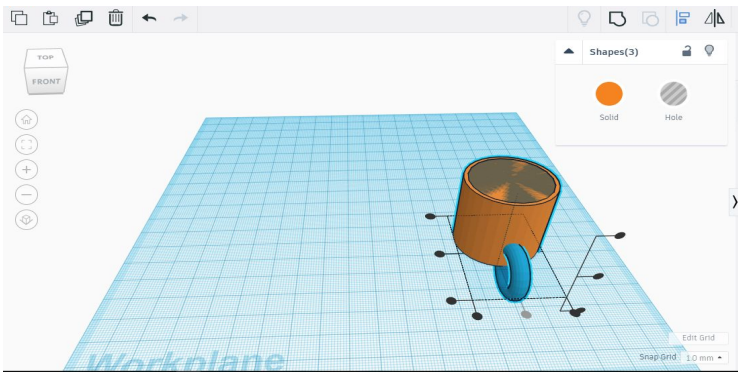


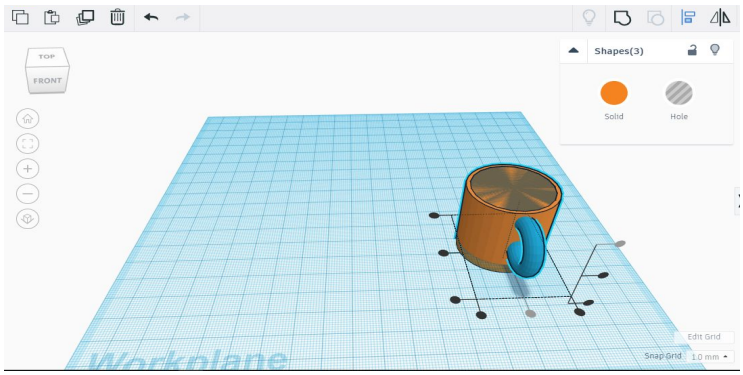
Source: Tinkercad.com

Step 14: Select the torus and move it onto the surface of the cup. Then center align the shape as shown in the images given below.

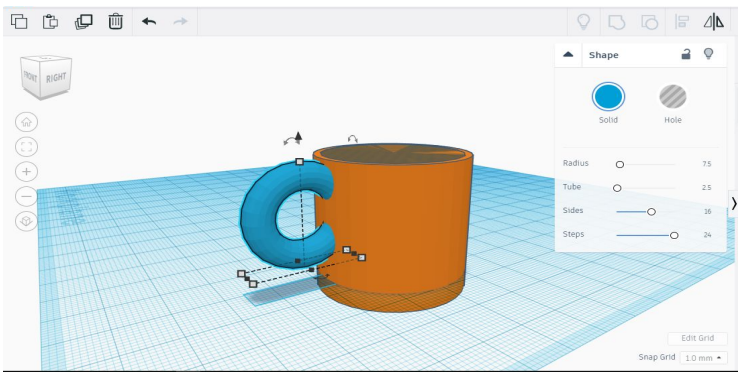


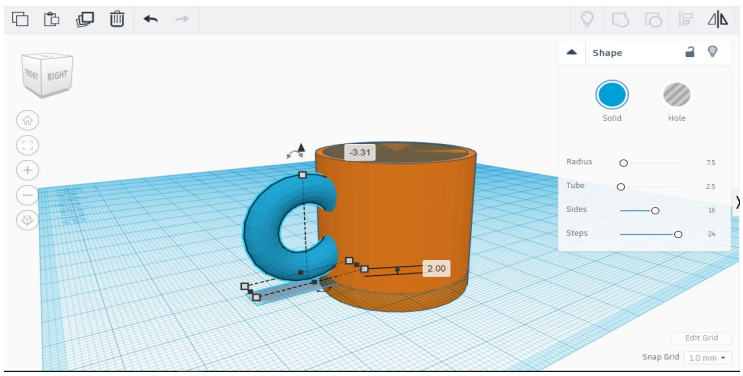




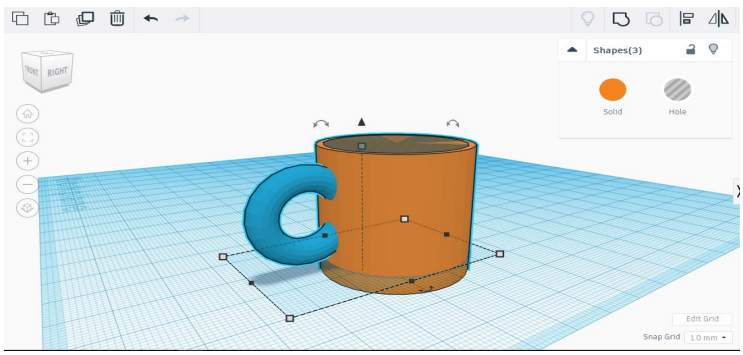


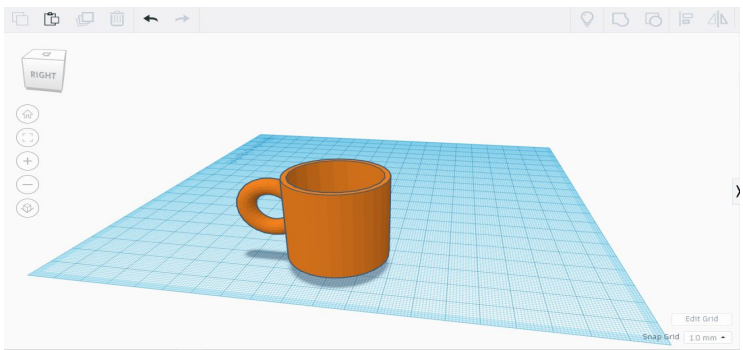
Step 15: Turn the shape to the right side and move the handle to the center of the cup.





Step 16: Click and select both the shapes. Then click on the combine shapes icon and combine them.





Source: Tinkercad.com

Reflection and Learnings (9 mins):

1. How do you think you can use 3D Printing in a real-world scenario?
2. What are the benefits of 3D Printing an object?
3. Imagine and draw the Top View and front view of the cup.
4. What did you or your team struggle with while doing this activity and why? How can you improve next time?
5. How did you contribute to the team and how do you think it helped? How else could you have contributed?

Try it yourself!

Using the concepts you have learnt so far, Try creating a simple 3D Trophy as shown in the image.

Use the space to draw or write your reflections and learnings

Source: tinkercad.com

DATA VISUALIZATION

Data Visualisation
Session 1
How do I spend my day?

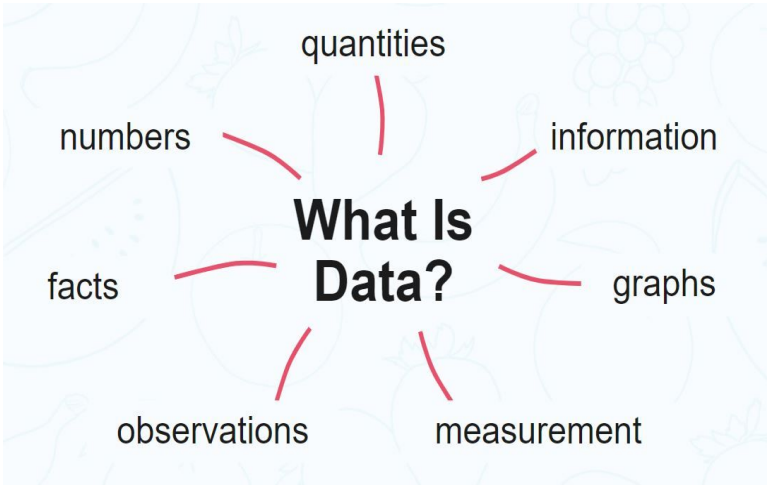
What is Data?

Let's learn about **data**. What is data? Have you come across that word before? Data is facts or information that we can collect by asking questions, observing or taking measurements. Data is usually organised in a table which include facts, numbers and measurements.

Why do we need data? Data helps us learn about our world, our communities, and ourselves!

Can you think of ways we can show data? You may have learned about pie charts, bar graphs, and tables in your maths classes. These are all ways to show data. Surprisingly, it is one of the most common mathematics topics people come across in their day-to-day life!

For this session we are going to learn what data is, what is data visualisation and how we can **visualise** it!



Materials Required :

1. Colourful Pens
2. Post-it notes
3. Chart Paper
4. Wall space if available to stick post-it notes
5. Any other materials in your environment!

: 60 minutes

Module: Data Visualisation

Grade: 6th to 9th

Importance/ Value:
The importance of data visualization is simple: it helps people see, interact with, and better understand data. Whether simple or complex, the right visualization can bring everyone on the same page, regardless of their level of expertise.

Learning Goals:

1. Students will get introduced to data visualisation.
2. Learn to how data is collected and verified for visualisation purposes.

What is data visualisation?

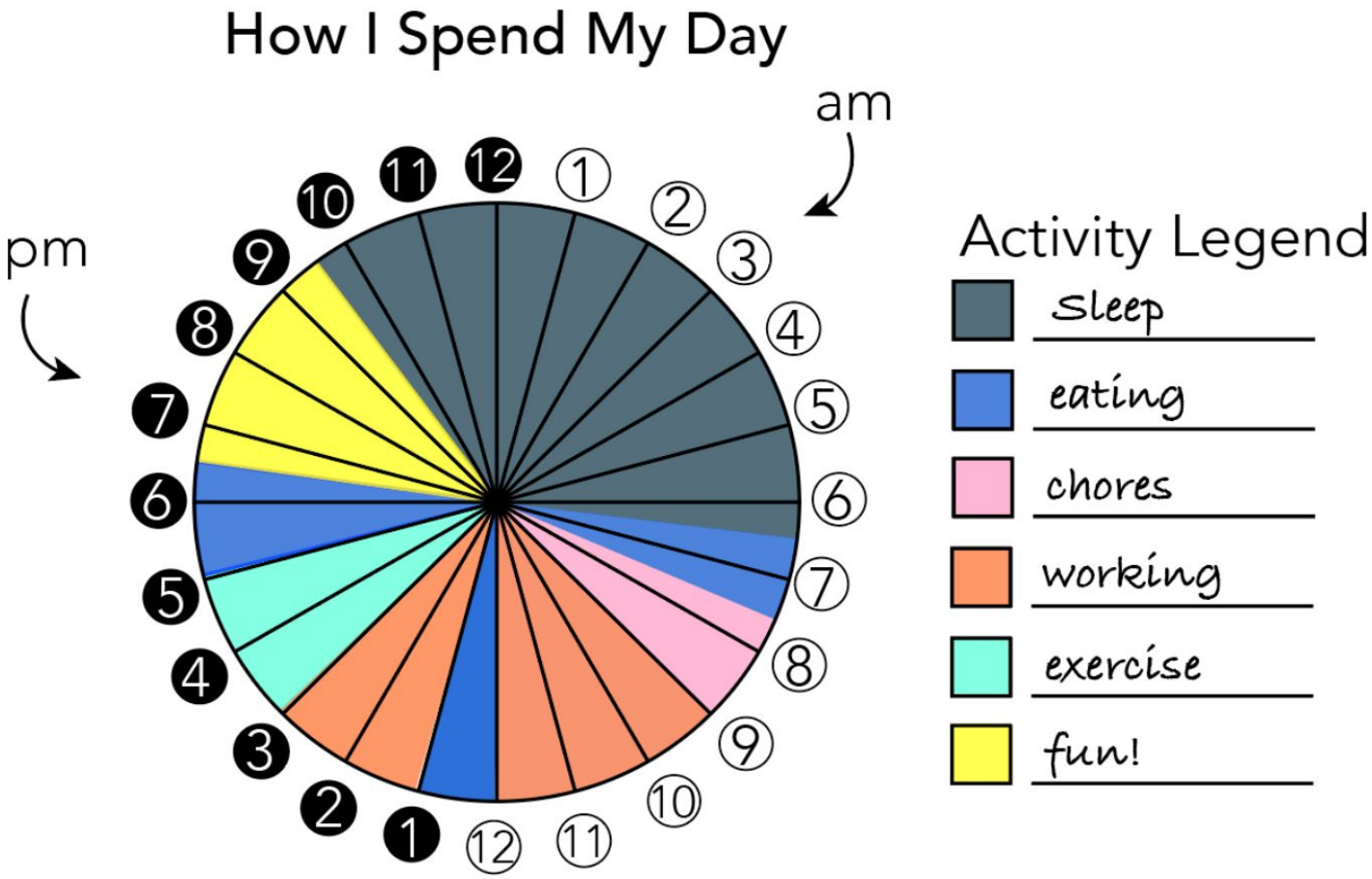
Data visualisation is the process of turning data into a visual form, like a chart or graph.

Charts or graphs make the **understanding** of data **easier.** Charts have several different elements to show the facts and numbers from our data.
Now, can you think of what facts and information you can get from your neighborhood that will help you learn more about your community? For example, you can identify one problem in your community and create a short survey that will help you get facts or data from your neighbourhood. This will help you visualize the data and draw it on paper and think about the solutions that can solve that problem.
Take 5 minutes to discuss how you would go about this!

It’s pie time you got a watch!

Data visualisation simplifies the way information is presented. Let’s practice a few activities that will help you present your data in a simple yet fun and exciting way!

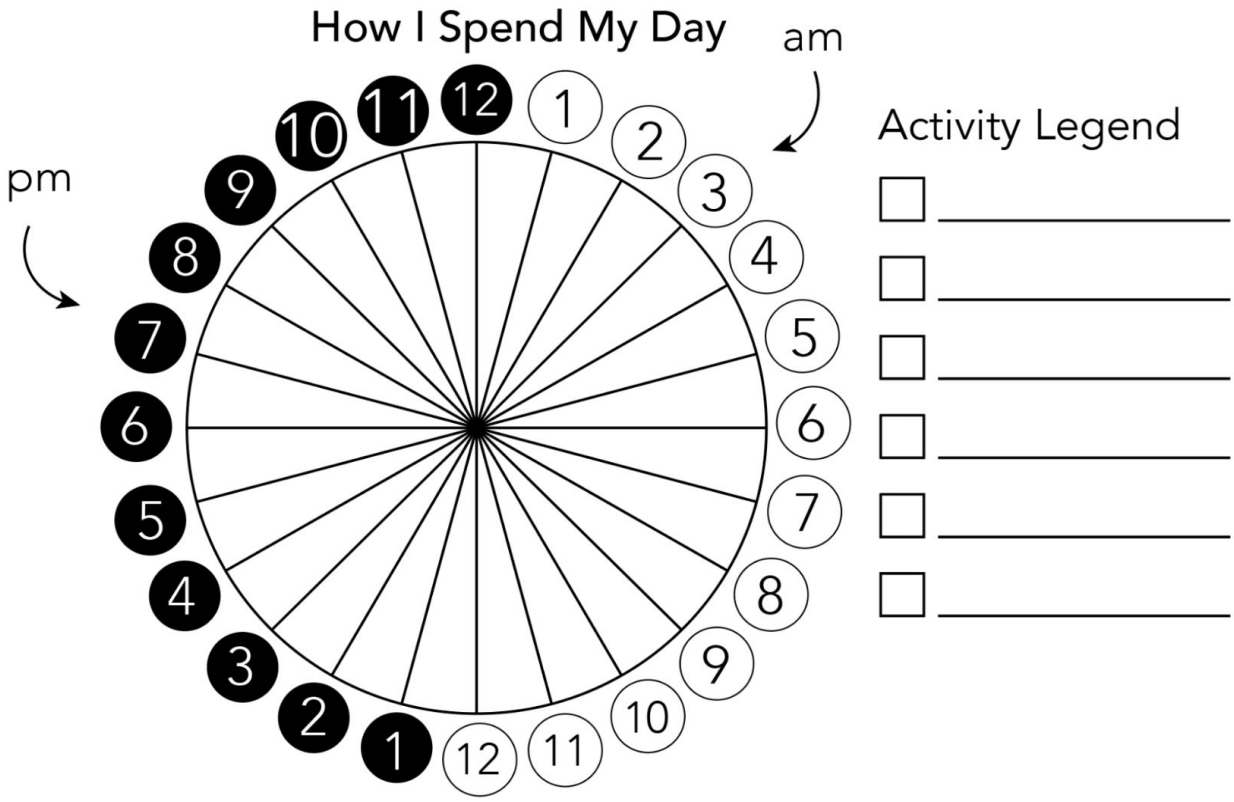
A **pie chart** can help us see the different parts of a whole, and compare the sizes of each part. This pie chart shows us someone’s daily schedule, and how much of the day each activity takes. The purple portion shows when they are asleep—from around 9:30 pm to around 6:30 am. (Based on the activities, can you guess if this is a school day or a weekend?) They also spend some time eating, doing chores, working, exercising, and having fun!



Now it’s your turn!

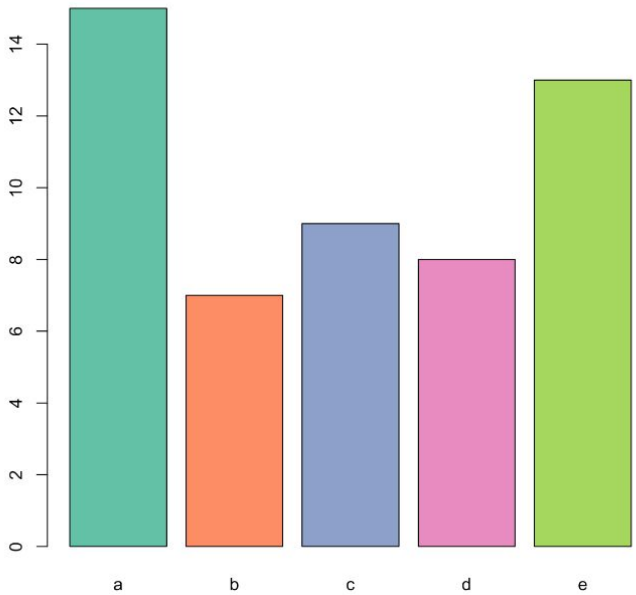
You can color in the empty chart on the next page to see what your daily schedule looks like! The legend will help you keep track of what each color means. Take 10 minutes to think about how you spend your day. This can be completed at home if you run out of time.

Make sure you fill it in before the next session!



Try it Yourself: Most affected cities by Covid-19

For this activity, we will represent data through a bar graph. A **bar graph** can be defined as a chart representing data through bars or stripes. Bar graphs are usually used to compare and contrast different categories. Bar graphs have a horizontal and vertical line (or axis) representing data and usually looks like this:

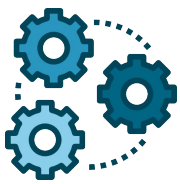


For your take home activity, you will need to find which cities/towns in your state were most affected by **Covid-19.** You can find information from your local newspaper, internet, or ask elders and learn more on how the pandemic has affected lives in your **state.** The horizontal line can represent the cities/towns you have chosen and the vertical line can show the total number of cases as of today. You can put an approximate value if you are unsure of an exact number. Bring your graphs and present it in the next class. You can talk about how you went about gathering data as well and what were some useful learnings from this activity!

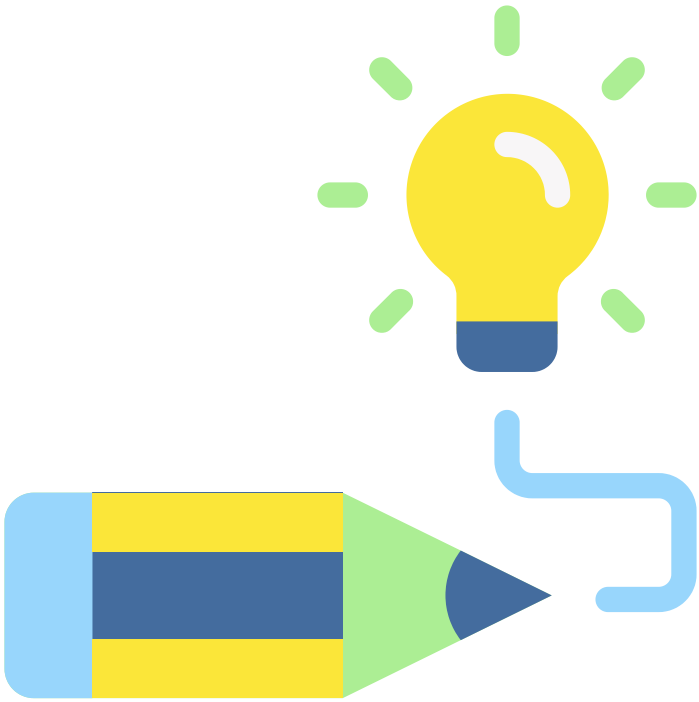
Reflection and Learnings (9 mins):

1. How do you think you can use Data in a real-world scenario?
2. What are the benefits of representing data in charts and graphs?
3. What did you or your team struggle with while doing this activity and why? How can you improve next time?
4. How did you contribute to the team and how do you think it helped? How else could you have contributed?

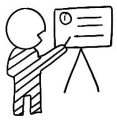
Use the space to draw or write your reflections and learnings



DESIGN & ENTREPRENEURIAL THINKING



Introduction to Design Thinking



Have you ever paid attention to the objects in your environment, and thought about who designed it?

Design is part of our everyday life and shapes the way we interact with the world, but we frequently don't realize it. Everything from the tables and chairs you are sitting on, to the pen in your hand, your water bottle and lunchbox, school bag, pencil case was designed by someone.

Sometimes you realize that the design is not good, such as when your water bottle leaks or you wish your bag had an extra pocket. Other times, you may have come across an object that is designed in a way that is so beautiful, useful, or unexpected that it causes you to stop and think!

Today, we will learn about the design process!

: 60 minutes

Module: Design Thinking

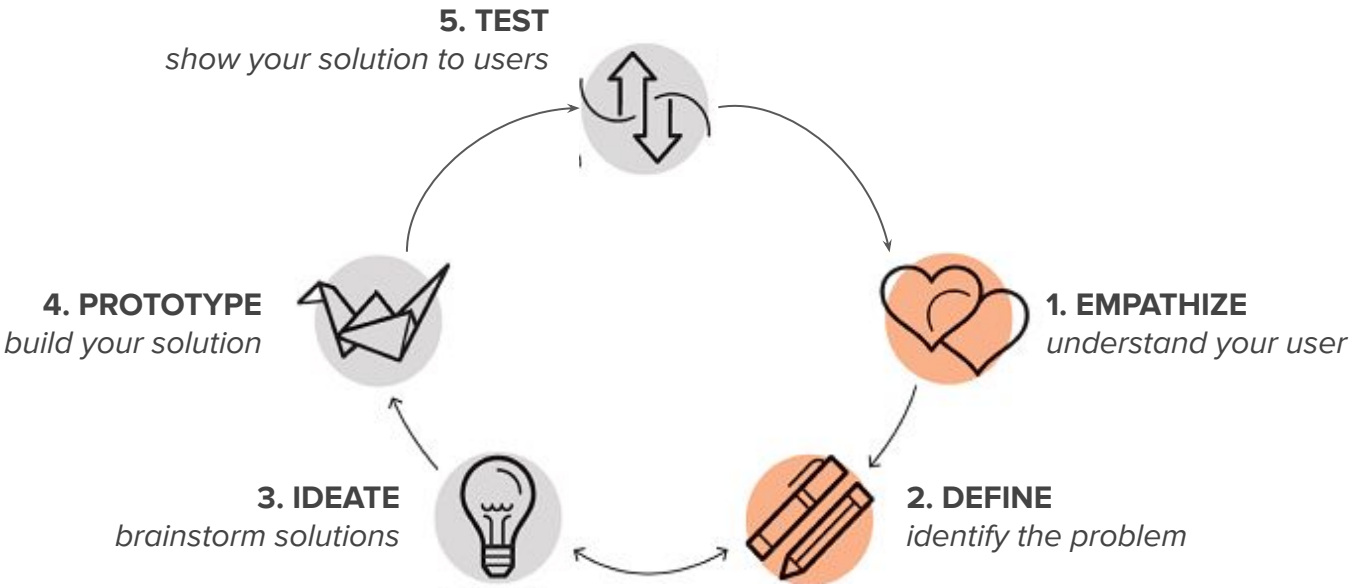
Grade: 6th to 9th

Learning Goals:
1. Learn about the problem discovery process.
2. Learn to rapidly design and sketch.
3. Solve problems using Design Thinking Approach.

One of the ways to think about design is as a **5 step process: Empathize, Define, Ideate, Prototype, and Test.** In this class, we will do a quick version of going through this process so that you are familiar with it. But in real life, the design process can take months! Design is a whole profession, and designers put in a lot of effort to come up with a good product!

Materials Required :

1. Colourful Pens
2. Post-it notes
3. Chart Paper
4. Wall space if available to stick post-it notes
5. Any other materials in your environment!



Activity: Re-Design the Autorickshaw

Have you ever sat in an autorickshaw? What are some things you noticed about the vehicle?

For today's activity we will be looking at redesigning a rickshaw!! Do not hesitate to be creative and come up with solutions that you think will work best!

For this activity you will need to get into groups of 4-5. Follow the instructions of your teacher.

Step 1: EMPATHISE: To understand the users and see things from their perspectives

This is the foundation of all design. It means that you need to think about who you want to design for and really understand their behavior. There are many ways to do this: observing people, talking to them, or doing some kind of activity with them. Now, let us do the interviews!
For this step you will need to get into pairs to conduct the interviews

Take turns to ask each other the following questions on the rickshaw. You are on the EMPATHIZE step! Fill out what you learned below. You get 3 minutes each.

1. What is the purpose of the rickshaw?
2. What are the problems that your interviewee has with rickshaws?
3. What would be the best and most effective form of transportation? (think broad!)
4. What do you like about rickshaws? Why?
5. What do you not like about rickshaws? Why?
6. Are they effective at what they do? How?
7. Come up with your own questions!

Person 1:
Person 2:
Person 3:
Person 4:

Step 2: DEFINE: The goal for the next step is to come up with a problem statement

What is the problem that rickshaws solve? You will now *synthesize* what you learned from the interviews. (Synthesize means to combine different parts into one unified whole).

In your respective teams, come up with a definition of the general problem that rickshaws try to fix.

There are many different problem statements that you can come up with depending on what you care about. You will have a different *point-of-view* depending on the *stakeholder* that you care about: e.g. a young child, teenager, parent, woman, rickshaw driver, government, traffic police etc. Think about the *values* that you care about as a team---affordability, availability, profit, energy efficiency, environmental impact, safety, traffic, etc. The problem statement that you choose to write down depends on what matters to you. In the real world, different stakeholders will have conflicting values so it is really important to have a problem statement that reflects values that are important and relevant to multiple people.

Write down your problem statement below in 1-2 sentences.

Step 3: IDEATE: Come up with design alternatives

Now comes the fun part! Thinking of your problem statement, **come up with AS MANY SOLUTIONS AS POSSIBLE to the problem statement.** GO WIDE, GO BIG! Think of crazy ideas, don't limit yourself by physical constraints or common sense limitations. These could involve technology, humans, policy/rule/law, or something else. If you are interested in mechanics and energy systems, you can consult chapters 8, 9, and 11 of the 9th standard Science textbook. Write down your ideas on post-it notes and find a wall or chart paper to stick it on. Once you are done, count how many ideas each person on your team came up with below.

Person 1:
Person 2:
Person 3:
Person 4:

Now as a team, discuss the ideas that you came up with. Which ideas did everyone like? What were common themes? What was unexpected?

Write down three ideas that you liked as a team below. Make sure that everyone's ideas were considered fairly. You can even combine ideas that are similar or that you think go well together. Pick one idea to proceed with for the rest of the class (you can circle the number 1, 2, or 3). If you are struggling to decide what ideas to pick, you can vote on each one.

Finally, reflect on your decision-making process? Why did you pick these ideas over others?

Idea 1:
Idea 2:
Idea 3:
Reflection:

Share your final ideas with the class! Each team will have exactly 5 minutes to present their ideas.

Step 4: PROTOTYPE: Build your own design solution

Prototyping is the process of experimenting with ideas, and trying to bring it to life. You work on implementing your idea using various materials---paper, cardboard, wood, digital, clay, electronics. The purpose of prototyping is not necessarily to create a perfect product, but to quickly test out what the product should look like, feel like, and how it will function.

As a team, sketch a prototype of your favorite solution from the previous step.

Step 5: TEST: Get feedback on your design

For this next step, you will **share your prototype with another team.** In real life, you would show your idea to real users and get their feedback. Each team will get 5 minutes for their turn: 2 minutes to present their idea, and 3 minutes to hear feedback. Note down the feedback that you received.

Remember to give feedback in the I like, I wish, what if format below. Record the feedback that you got from the other team below.

I like:
I wish:
What if:

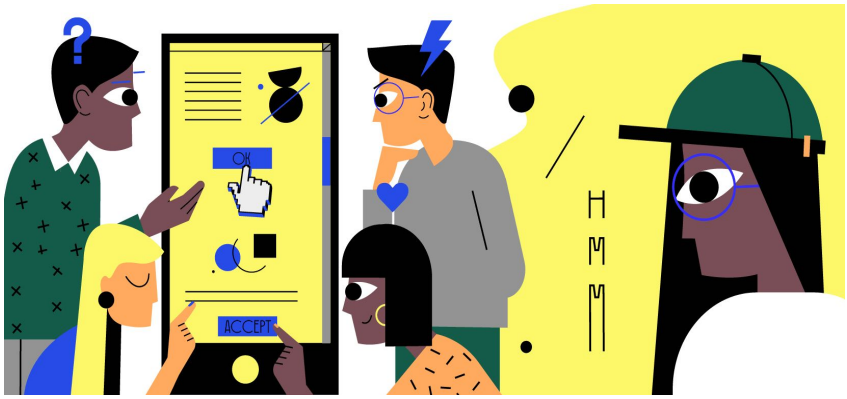
Once you are done, go back to the drawing board! Improve your solution based on the feedback you received. Record the improved design below. (5 minutes)

Now that you have gone through the entire exercise, **share your final design with the class!** You have exactly 5 minutes to present your final prototype. In real life, the next step would be for you to repeat this process multiple times to improve the design until users are satisfied!

Conclusion

Design is a skill that takes time to cultivate. The best designers are those that practice their skill and have learned to see the world as full of opportunities for better design. But even without being a professional designer, you can benefit from applying design tools to your everyday life. It forces you to think about your environment, and identify ways that things can be done better. It can even help you find opportunities to build a product that others may want to buy!

In your everyday life, be more conscious about the items and services you use. Observe your environment carefully and engage with people different from you to understand their point-of-view and values. Keep a diary to record interesting observations or ideas that come to your mind and share it with others for feedback!



Reflection and Learnings (9 min) :

1) Share at least 3 skills or lessons that you learned today.
2) How will you apply these skills outside class?
3) What did you or your team struggle with while doing this activity and why? How can you improve next time?
4) How did you contribute to the team and how do you think it helped? How else could you have contributed?
5) What communication challenges did you and your team face? How can your team communicate better next time

Use the space below to draw or write your reflections and learnings

Design Thinking and Rapid Prototyping

In our previous sessions, we learned the **5-step process: Empathize, Define, Ideate, Prototype, and Test.** Let us do a quick recap of how we applied this step-by-step process to Re-Design the Autorickshaw

The foundation of all design is that you need to think about whom you want to design for and understand their behavior. There are many ways to do this: observing people, talking to them, or doing some kind of activity with them. This is the first step - Empathy! Empathy is when you are able to understand and share the feelings of another person. From the last sessions we were able to some extent understand what the problems a rickshaw had with its design are and empathize with users.
The second stage is “define” which we did in the last session where all of us came up with a problem statement and discussed the problems that need to be solved with the Rickshaw

The next stage was ideation, we discussed ideas to solve the problem and finally, rapid prototyping. Building/sketching a model of your solution and receiving feedback on it.

For this session we will use the 5 step process to design your final project!

Materials Required :

1. Colourful Pens
2. Post-it notes
3. Chart Paper
4. Wall space if available to stick post-it notes
5. Any other materials in your environment!

: 60 minutes

Module: Design and Entrepreneurial Thinking

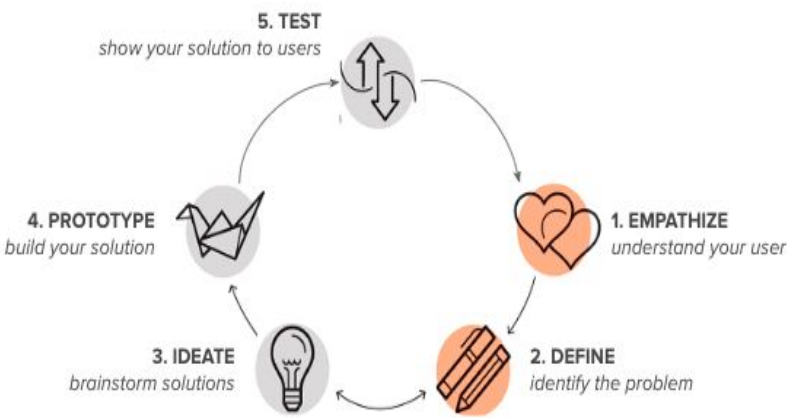
Grade: 6th to 9th

Learning Goals:

1. Learn to independently come up with solution to problems using the design thinking approach
2. Learn to rapidly design and sketch

The final project is an opportunity to use these 5 steps and create your own solutions for a problem in your community! You will get to put in practice the problem discovery process and rapid prototyping.

Remember, there is no right or wrong. Each design solution is unique to their own and it is more important to enjoy the process!



Step 1: EMPATHISE: To understand the users and see things from their perspectives

As we learned in the previous session, this is the foundation of all design. It means that you need to think about who you want to design for and really understand their behavior. There are many ways to do this: observing people, talking to them, or doing some kind of activity with them.

For the final project, here are a few problems you can find solutions for in your ATL Lab environment ! Remember, it is not necessary that you choose these specific problems for your project but these **examples** will help guide your approach to find solutions.

a. Many students do not have sufficient space to sit in their ATL Lab. Having enough space and a comfortable setting contributes to the student's learning experience. Think of ways you can create a comfortable sitting chair/space or make improvements to the chair you have already been provided with at your school

b. Creativity is what enhances your growth and helps students think in different ways especially in practical learning. Think of different ways you can enhance the creativity element in your ATL Lab, make the environment more fun and interesting!

c. As the world moves at a faster rate, we are unable to have access to resources that are essential for us, this is especially true for energy/electricity. Look around your ATL Lab and see where and how you can use energy efficiently and build prototypes accordingly (**hint:** use concepts from the basic electronics module, ask your teacher for help)

Use the space below to write which problem you have chosen to solve and why it is important. You have 5 minutes for this.

Once you have chose which problem to solve, it is time go a bit deeper on what the problem is. For this step you will need to get into pairs to conduct the interviews.

You can come up with your own interview questions by using these guiding questions:

1) What *should be* happening (ideal condition) and what *is currently* happening (reality)
2) Ask “Why?, Why?, Why?”
3) Try to define who all are affected by the problem
4) How are they currently trying to solve the problem?
5) What will happen in the future if the problem is solved/ not solved?
6) Try and see the problem from different perspectives

Use the space below to write your interview questions along with the responses. You get 5 minutes each.

Step 2: DEFINE: The goal for the next step is to come up with a problem statement

You will now *synthesize* what you learned from the interviews. (Synthesize means to combine different parts into one unified whole).

Write down the common problems you saw people having that you interviewed.

There are many different **problem statements** that you can come up with depending on what you care about. You will have a different *point-of-view* depending on the *stakeholder* that you care about: e.g. a young child, teenager, parent, woman, a shopkeeper, government, traffic police etc.

Think about the **values** that you care about as a team---affordability, availability, energy, health efficiency, environmental impact, safety, etc. The problem statement that you choose to write down depends on what matters to you. In the real world, different stakeholders will have conflicting values so it is really important to have a problem statement that reflects values that are important and relevant to multiple people.

Once you identify the problem, record the problem statement in the following format and share it with the class. Write down your problem statement below or in your notebooks in the following format. Here is an example of a problem statement from the choices given:

Here is an **example** of a problem statement:

The problem I have identified is ***there are no backrests on chairs for students*** and it affects ***student comfort while learning.*** I wanted to do something about this because ***I want my peers and I to have a better learning experience.***

The problem I have identified is (1)_____ and it affects (2)_____. I wanted to do something about this problem because (3)_____”

Slot 1 - write what is the issue you have identified
Slot 2 - Define the stakeholders (whom all it affects and are involved)
Slot 3 - Put down your “why” to address this problem (personal motivation)

Take Home Activity: Problem Research

Research is a critical step in the problem-solving process. It helps us identify the problem better and get more information on it. Through this, we can understand thoroughly what problem we are dealing with and who all are affected by it.

TASK: Do more research on the problem statement you have identified. If you didn't get enough time to come up with questions in class, you can take the time now to come up with questions.

Once you have finalized your problem statement and have come up with the questions which you want to research more, In teams you have to go and ask as many people as possible to get the research for this. You must ask at least 10 people these questions and note down what they say.

As a team decide when you will meet and where you will go.

After you have the required information from the people you spoke to, you have to see what Information you can use and what you have to remove.
The way you can do this is to see if the answers given by people are related to the problem statement you want to solve.

REMEMBER: Safety is the top priority. You must always be in teams. You should not enter any strangers' houses or go to unsafe locations in the community.

* **Always inform your teacher and parent before you go to any specific area and ask for advice if is safe and which locations you must avoid.**

***Bring your responses to the next session and share a few of them with the class.**

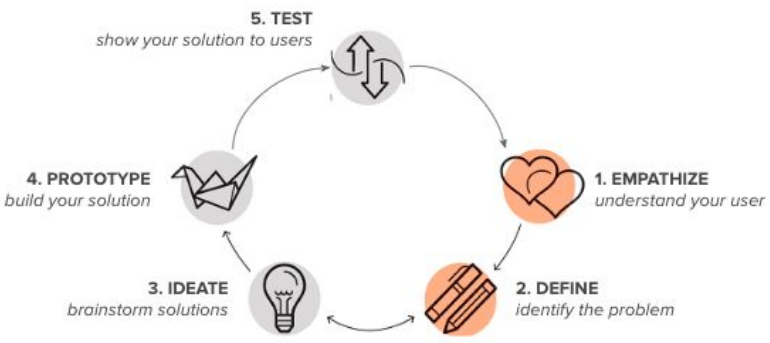
Design Thinking and Prototyping

In our previous sessions, we learned the **5-step process: Empathize, Define, Ideate, Prototype, and Test.**

In the previous session you were asked to choose one problem and explain why you chose the problem and what you want to solve. The first step was empathy which means that you need to think about whom you want to design for and understand their behavior. We saw that there were many ways of doing this and learned some guiding questions to help learn about the problem more and their perspective. We learned what the problems of our community are and empathize with them.The second step was “define” where all of us came up with a problem statement and did research to back it up as a take home activity.

Take **5 minutes** to quickly share with the class some findings from the take home activity.

In our previous sessions, we have completed the first two steps now it is time to look at ideation!



Materials Required :

1. Colourful Pens
2. Post-it notes
3. Chart Paper
4. Wall space if available to stick post-it notes
5. Any other materials in your environment!

: 60 minutes

Module: Design Thinking and Rapid Prototyping

Grade: 6th to 9th

Learning Goals:

1. Learn about ideation and how to solve the problem better
2. Learn to rapidly design and sketch
3. Learn how to build a prototyping

Activity: Impossible objects

Think about any object around you. Now pair up and begin the ideation process—you have to connect the two objects and come up with a hybrid (combination of both of the objects). Try imagine the item that comes out of it and what details it entails

Draw a picture of it on a piece of paper or in your notebook. This is just an ideation process, it need not be a real object. You have to use your imagination to come up with something.

You have **5 minutes** to do this in your pair. You to be honest and not change objects for convenience of this activity. In fact the more creative the idea the better, Go as crazy as possible!

Once the 5 minutes are done, share it with the class.

IDEATION

From the previous activity, keep up the same spirit of coming up with crazy ideas.
We will use the same creativity from the last activity and use it for our projects.
In your project groups (group of 5) think of your problem statement, **come up with AS MANY SOLUTIONS AS POSSIBLE to the problem statement.**

For example: If you interviewed the elderly and they said they need help with remembering what medicines to take and when then you can make them a medicine reminder box.

GO WIDE, GO BIG! Think of crazy ideas, don't limit yourself by physical constraints or common-sense limitations.
This is an ideation process. Each person in the team should come up with as many ideas as possible. You should note it down individually in this guide or paper. You have 5 minutes to come up with as many ideas as they can.
Once you are done, count how many ideas each person on your team came up with below.

Person 1:
Person 2:
Person 3:
Person 4:
Person 5:

Now in your team, share the ideas that everyone came up with. You can take 5 minutes for this.
The next step is to discuss the **following questions-**

1. Which ideas did everyone like?
2. What were common themes?
3. What was unexpected?

Now, you have to decide on the top 3 ideas that you like.
Make sure that everyone's ideas were considered fairly. You can even combine ideas that are similar or that you think go well together. If you are struggling to decide what ideas to pick, you can vote on each one!

Idea 1:
Idea 2:
Idea 3:

PROTOTYPING

The next stage that comes in the design process is prototyping.

Prototyping is the process of experimenting with ideas and trying to bring them to life. You work on implementing your idea using various materials---paper, cardboard, wood, digital, clay, electronics. A prototype is used to test different working aspects of a product before the design is finalized.

A prototype is a working model of a product that is used for testing before it is manufactured. The advantages of prototyping are :-

1. They help the people understand what all is required to make the product. Basically they understand the manufacturing process
2. How users will use the product
3. How the product could fail or break.

For example, a team of engineers designing a new cell phone might produce several cardboard and paper models to illustrate how the final product would look and feel. They may survey the general public to gain feedback about how the cell phone could look. The team might build a sturdier plastic prototype to test how easily the cell phone could break when dropped. If the prototype does not meet the team's design requirements, then they may try again to come up with a better prototype.

For this activity you will stay with your group created before. As a team, sketch/draw a prototype of your favorite idea you had selected from the last session using the space below or on a piece of paper. You can use any material you need, the Idea is to make a prototype of the product you will implement.

While creating the prototype these are few things you can keep in mind:

1. What will be the name of your product?
2. What will it look like ?
3. What materials will you need to make it?
4. What do you want your final product to do?

The teams have 30 minutes to come up with the drawing of the prototype.

Once you are done with the drawing of your prototype, each team has **5 minutes** to come up and present your ideas to the class!

Now, we need to examine and evaluate your final prototype to see what works and what doesn't. Once you have finalized it on paper you have to make a physical prototype of the product. You can use the components that you actually plan to use or use material like cardboard and chart paper to give a feel of what it will look like.

***Please get your prototypes and come to class for the next session.**

Take Home Activity: Solutions Research

For this assignment, you will have to do more research on the solution just as you did for the problem itself. When you identify a problem, more often than not there is already a solution out there!

Find out whether:

a. People have tried to solve this before
b. If a solution to this problem already exists
c. If there is already a solution, why hasn't it been implemented it
d. What you plan to do with your solution would help the different stakeholders

Use the space below to write your responses:

Feedback and User Survey

As we saw in the previous session, A prototype is used to test different working aspects of a product before the design is finalized. One of the main advantages of prototyping is that we understand the experience of the user and improve on the model

User feedback is essential to guide and inform your decision making and influence innovations and changes to your product

For ideas to be workable we have to make products that your users like. How do we get inputs from the minds of our users It is difficult but not impossible! The best way to improve your product is to understand through customer experience.

Measuring user satisfaction allows you to understand potential problems at an individual and aggregate level. More importantly, it helps you improve over time!

In this session, let us try improving our design with the feedback given from the users of our product!

: 60 minutes

Module: Design Thinking and Rapid Prototyping

Grade: 6th to 9th

Learning Goals:

1. Learn about the problem discovery process
2. Learn about creating user survey and valuable feedback

A user survey help to provide insights and help with overall quality of product. If you are in the early stages of your design project and just want some simple and rough feedback, it's good enough to test on your classmates. However, towards the end of your project, when you create more detailed prototypes, you should test on a users from your community to get the most relevant feedback.

Materials Required :

1. Colourful Pens
2. Post-it notes
3. Chart Paper
4. Wall space if available to stick post-it notes
5. Any other materials in your environment!

Activity: Creating a User Survey

For this activity, we will be creating a User survey. To prepare the questionnaire, work with your groups in which you had worked with for your previous session. Appoint one person to write neatly on a blank sheet of paper or use the space below and create multiple choice questions as this sheet will be shared with other groups. Following are some sample questions that you can have in your User survey

1. Name, age, occupation?
2. Which area are they living in?
3. What are some of the problems they are facing in and around their community?
4. What is their opinion on the idea you have come up with?
5. Do they think it will work ?
6. What are some ways they can improve on this idea?

Use the space below to write your sample questions for your user survey. You have 15-20 mins for this.

The User survey should be short, simple and direct to the point. User will not have time to talk to you for more than 10 minutes so make use of all the time you get!

Presenting your Prototype

Now you will require to collaborate with groups. You will pair with another group and will be presenting your prototype to them.

Pair with your partner group and take 15 minutes to present your prototype and ask your customer survey questions. After this they will receive feedback from the other team for 5 minutes. Then the reverse will happen. The other team will present for 15 minutes and then take feedback for 5 minutes.

Some of the questions may not come in use because they are talking to students. So they can just ignore such questions!

Use the space below to write the feedback you received for your prototype.

Through these activities we came to know how effective and useful user surveys are to improve your prototype. Always keep in mind the guidelines that we had discussed while creating the user survey. We have almost come to the end of our final project with this step!

In the next session, we will present our final prototype to the class.

Group Presentations

Before presenting your final prototypes it is important to set some norms.

- Make sure that when a group is presenting, we must respectfully listen and support your peers.
- Each group has **15 minutes** to present.
- Make sure to encourage all your group members to participate and speak up
- Once the group presentation is done, make sure to encourage your peers and clap for a job well done!

Once the team is done presenting, it will be time for a feedback session. For this you will need to follow the format below while sharing your feedback

I like, I wish, What if

As we come to the end of the program, we hope all of you have some important things to take away from each module. It is essential to understand the values and thought process that drive hands-on-making and tinkering. What we hoped to achieve through this program was to foster problem solving and critical thinking while having a humanistic outlook to situations/scenarios.

let us take **5 minutes** and write on a piece of paper and write down 3 words to describe your experience with hands-on-making.

Materials Required :

1. Colourful Pens
2. Post-it notes
3. Chart Paper
4. Wall space if available to stick post-it notes
5. Final Prototype

: 60 minutes

Module: Design Thinking and Rapid Prototyping

Grade: 6th to 9th

Learning Goals:

1. Learn about effective communication and self confidence

Team Awards

For this activity, you design unique **titles/awards** for each team member. The groups collectively decide which person gets what title and select one person to read the list out to the class and explain why they've got that title. Keep it funny, unique and appreciate all your team members in some way. For example - we can have one member's title as the 'fire extinguisher' - this person puts out everyday fire like a pro and always keeps calm and composed, the peacemaker during conflicts.

You have 5 minutes to present.

Reflection and Learnings :

1) Write down some new things you have learned about your community. Share your experience with the class or use the space below.

2) Coming to identifying problems in the community, we know it is never easy to find a solution but were you able to make a meaningful impact through your project?

3) What were some hiccups you faced during the solution finding process - did it help that you worked as a team?

4) What were the ideas that the team came up with and which was the final idea? What was the feedback they received for the prototype from the customers? Were you able to try out their idea and what happened because of it?

Use the space below to draw or write your reflections and learnings