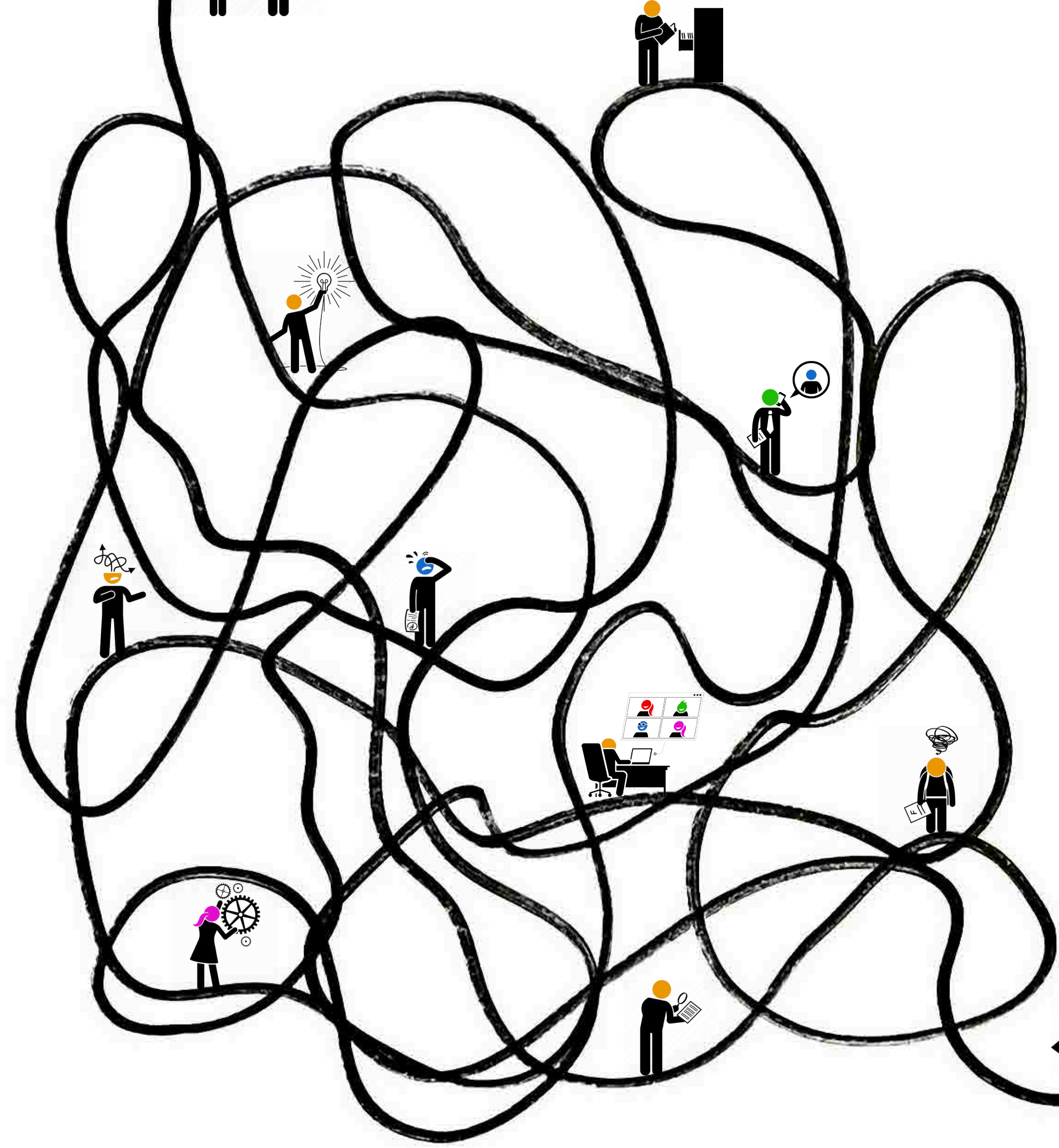


START



DIFS

Digital

Fabrication

Space

Realising visions of those who dare to dream.

FINISH

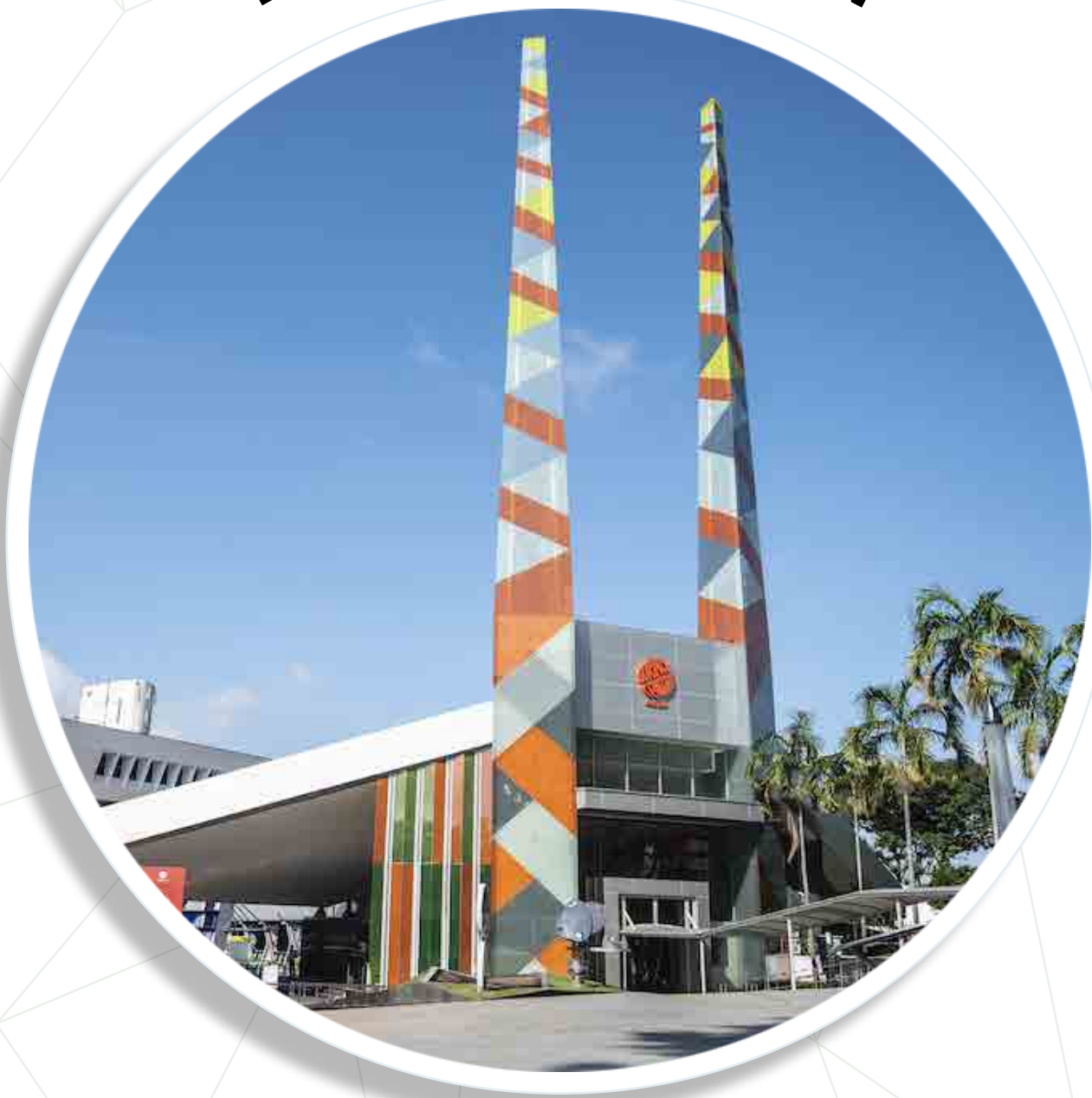


“Commit yourself to lifelong learning. The most valuable asset you’ll ever have is your mind and what you put into it.”

- Motivational public speaker and self-development author, Mr Brian Tracy

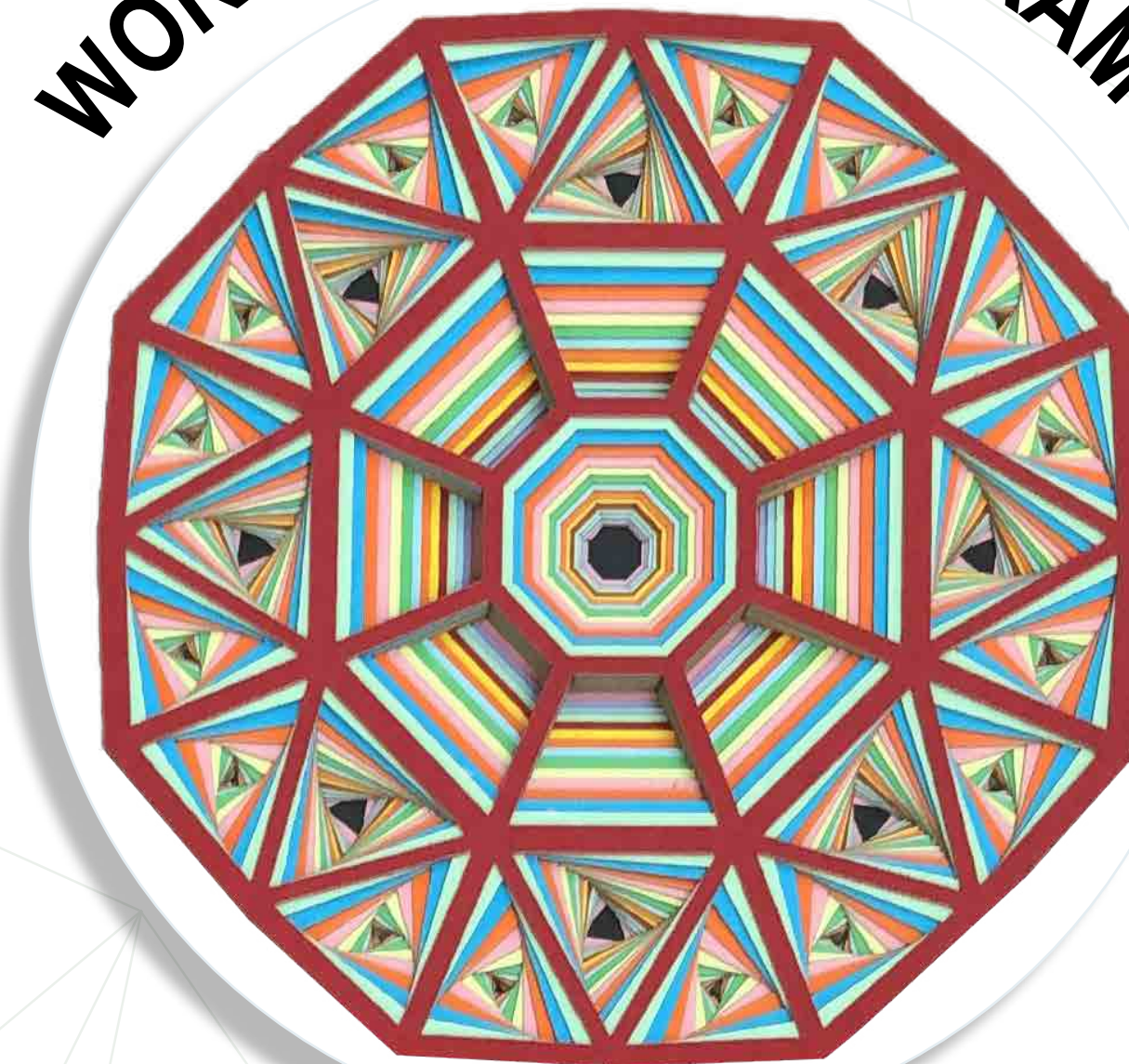
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WORKSHOPS & PROGRAMS



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EQUIPMENT & FAB LAB



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Science Centre Singapore

Science Centre Singapore (SCS) is a leading regional and informal educational institution, which along with its group of attractions, brings out the wonders of science, technology, engineering and mathematics (STEM) through its unique blend of exhibitions, educational programmes and events.

SCS has captured the evolution of scientific developments for over four decades. With the help of its partners, it has also played a pivotal role in transforming the way that students and the public interact with and learn about STEM.

Since 1997, SCS has welcomed over 30 million visitors and inspired them with more than 1,000 exhibits spread across 14 exhibition galleries and outdoor exhibition spaces.

The SCS group of attractions include Science Centre, KidsSTOP™, Omni-Theatre and Snow City.



Digital Fabrication Space

The Digital Fabrication Space (DFS) has been a hotbed of activity for the schooling community. Since its inception, numerous groups have been purposefully engaged in a host of STEM workshops through which they have become conversant with the tools and skills of digital fabrication.

Building on the success of this, the Centre has broadened the scope of DFS's programs by facilitating internships and partner-run programs. These initiatives have enabled DFS to transcend its functionality as a mere space for activity into an endearing and dynamic gateway to STEM education.

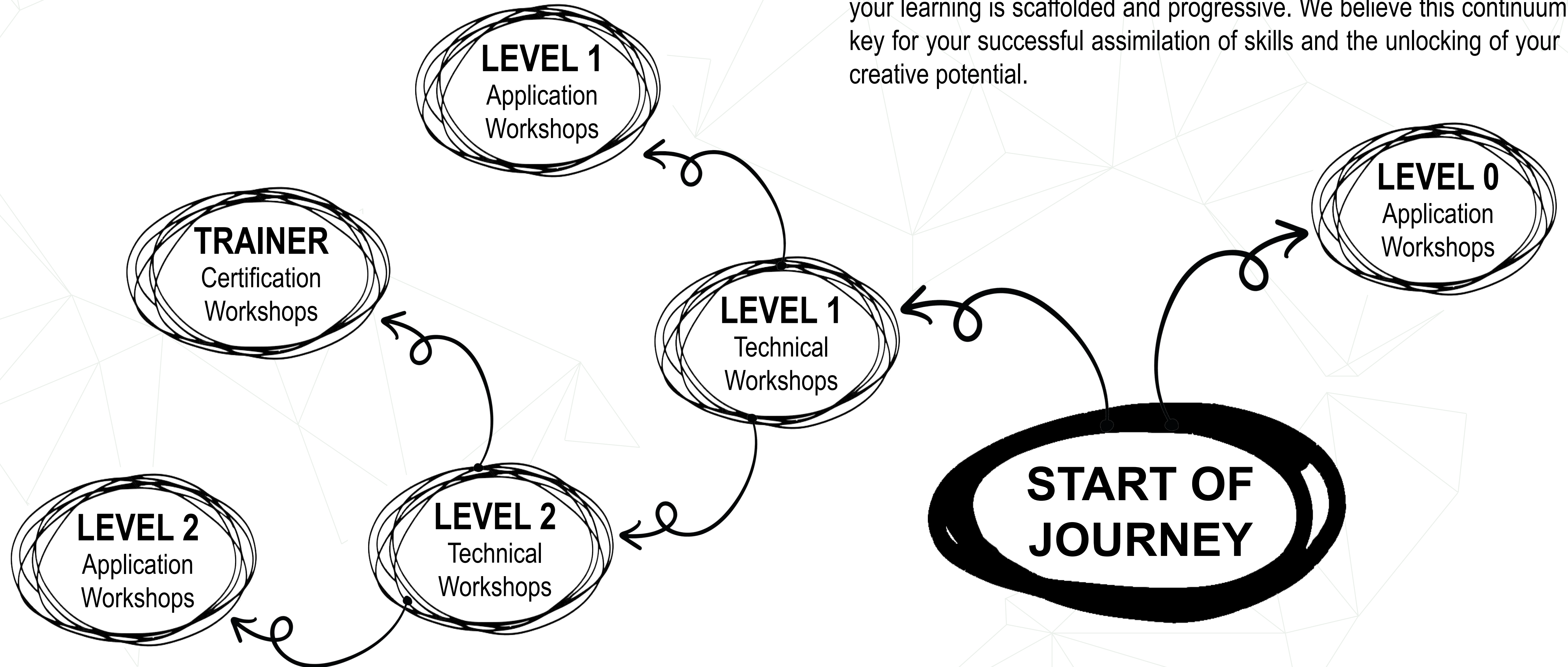
By incorporating the STEM mindsets into our programs, we aim to inspire confidence in the learner's ability to harness technology, and to apply that competently in problem solving, prototyping and product development. Through the continual refinement of these endeavours, DFS strives to remain relevant and relatable to every learner that comes through its doors.



Workshop Pathway

The offerings at DFS are structured to provide an in-depth view of the topic. Besides the skill acquisition offered by the TECHNICAL workshops, there are APPLICATION workshops where you can learn more about the concepts involved in creating products.

The Learning Journey outlines the pathway you can embark on, ensuring that your learning is scaffolded and progressive. We believe this continuum is the key for your successful assimilation of skills and the unlocking of your innate creative potential.

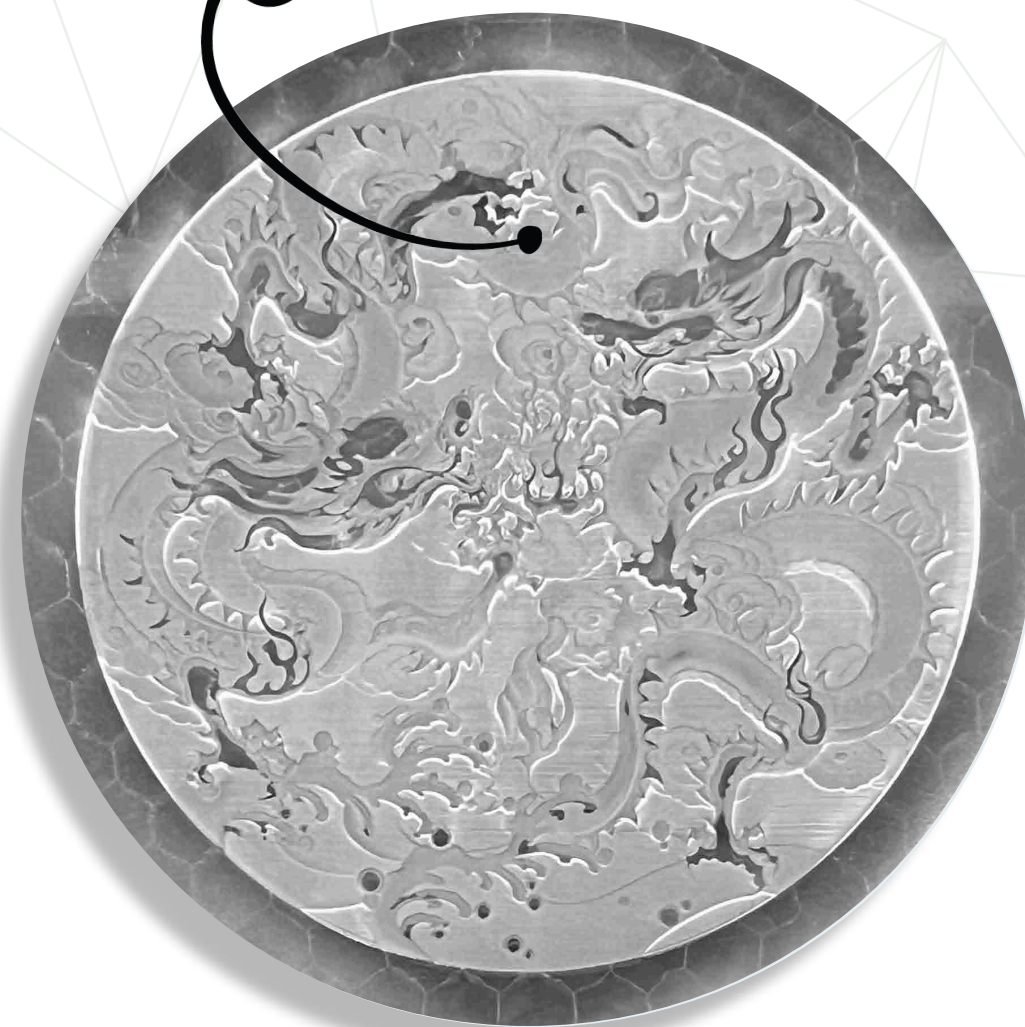


Prototyping Journey

Prototyping is a journey. There is seldom a product that is THE ONE. Even for products in the market, they undergo numerous iterations after the official launch. With each cycle, the designers learn and improve on their previous versions, finding new ways to bring out the best in the products. At DFS, we endeavour to guide participants through the journey.



1 A single pass at 80% speed and 85% power yielded a very shallow profile. Although the process was relatively fast (~7 minutes), the outcome is not desirable.



2 There is improvement after another 2 passes but the profile is only starting to show some semblance of the image.



3 After a total of 7 passes, the desired profile is achieved. However, the entire process took too long (~49 minutes). A faster approach is tested.



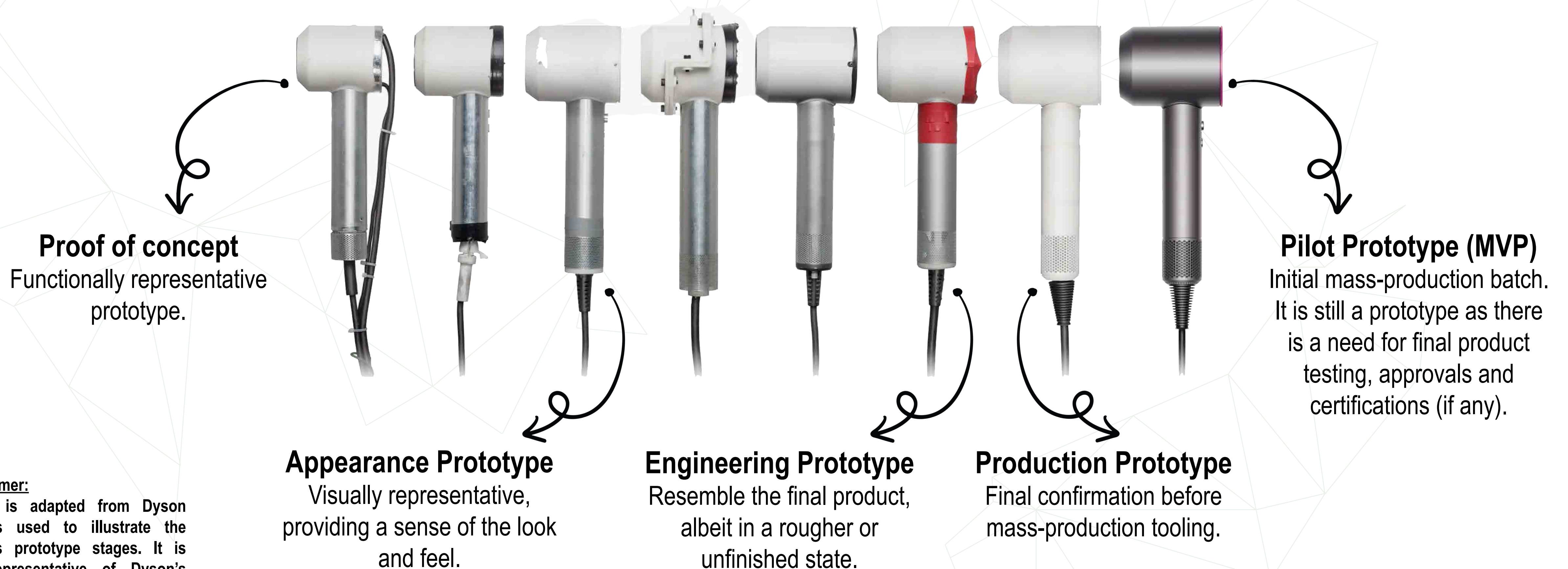
4 A lower speed setting with a higher power setting is set. The outcome is comparable to Step 2 but the laser burnt more of the surface, reducing the gradients of the profile.



5 The relief pattern is applied onto a solid wood block and the results after 3 passes were more stunning than on acrylic. Continual testing will be done to determine the best settings, processes and materials for relief engraving.

Prototype Development Phases

Prototyping is a journey whereby a concept or idea is materialised using fabrication techniques. During this time of materialising, the prototype undergoes various stages of completedness and it is important to know where you are at. Typically, product designs go through several iterations before they are deemed ready for the production line. This process is usually nonlinear in nature, as you might use lessons learnt in the different phases to revisit earlier iterations.



Disclaimer:
Image is adapted from Dyson and is used to illustrate the various prototype stages. It is not representative of Dyson's interpretation of their product.

“For the things we have to learn before we can do them, we learn by doing them.”

- Aristotle

2D CAD Workshops

LEVEL 0 APPLICATION



page 11

2D Stack Art

LEVEL 1 TECHNICAL



page 12

Fast Prototyping with 2D

LEVEL 2 TECHNICAL



page 13

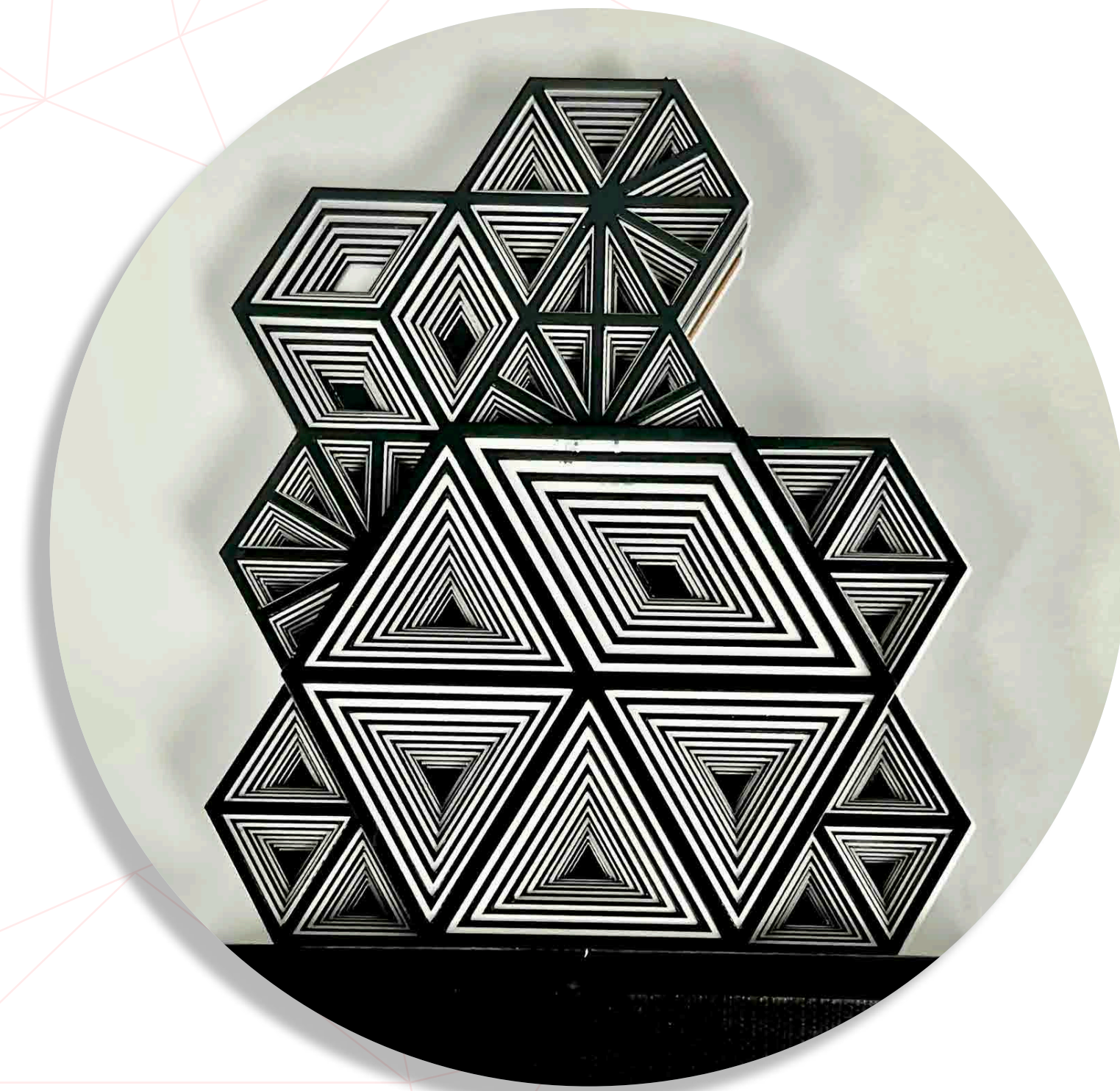
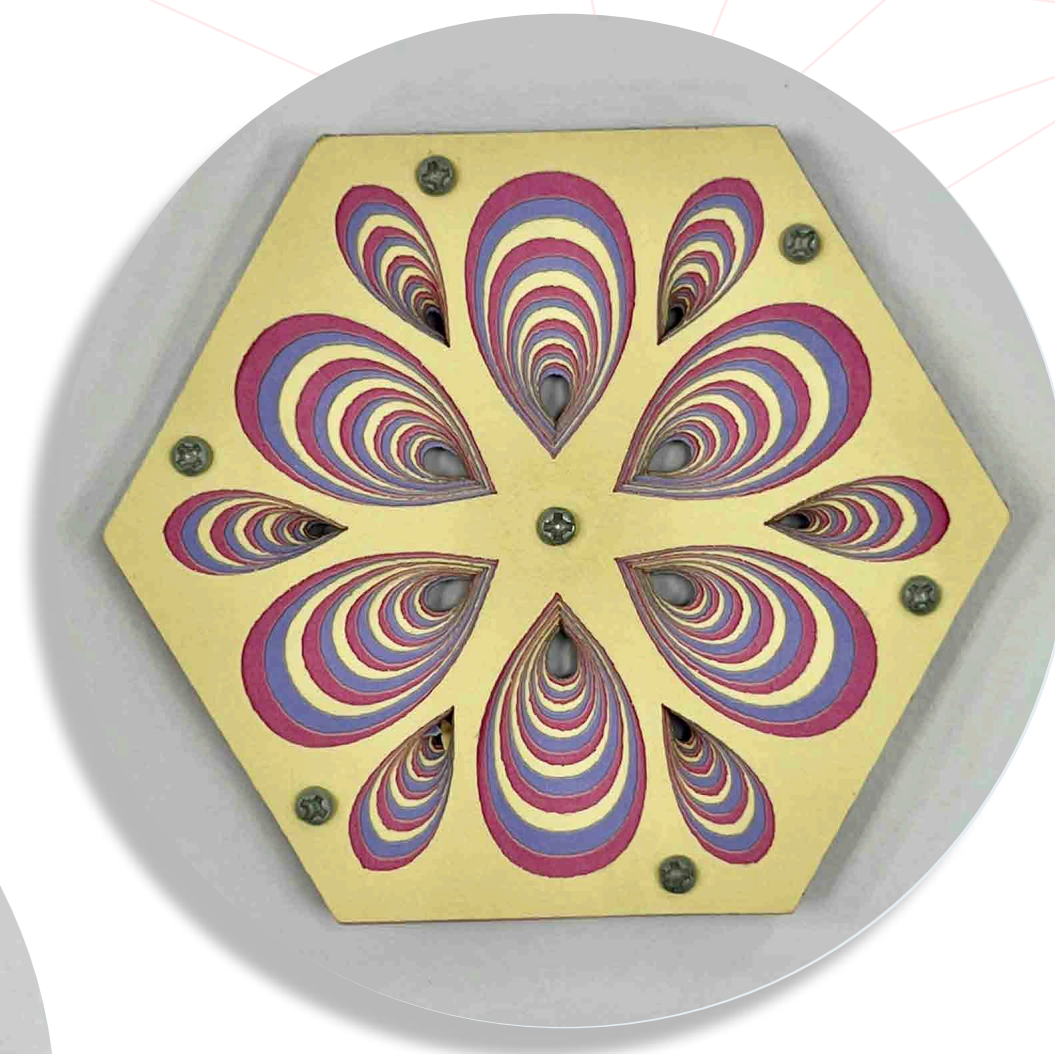
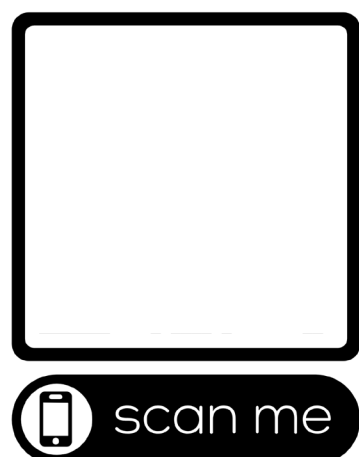
2D CAD: From 2D to 3D

2D Stack Art

Do you like designing or making things? 2D Stack Art gives you a chance to do both! By stacking 2D surfaces, you can achieve interesting 3D art pieces! 2D stacking has many applications in industry including architecture, construction, exhibits and materials engineering. When combined with mathematical concepts, an array of interesting 3D structures can be created!

Outline:

1. Introduction
2. Theory and Applications
3. Fundamental Theory
4. Regular polygons – scale only
5. Regular polygons – scale and rotate
6. Placing onto templates
7. Irregular polygons – scale and rotate
8. Discussion
9. Inspiration



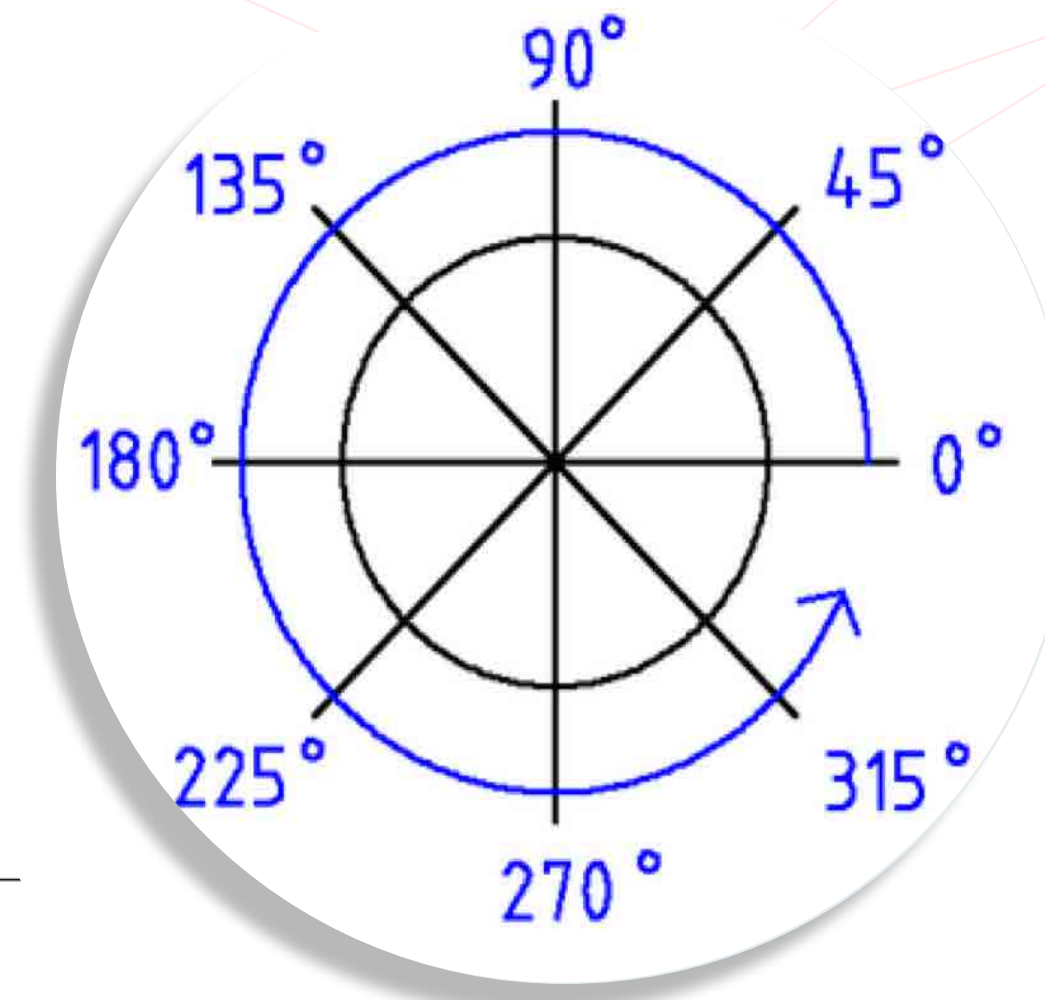
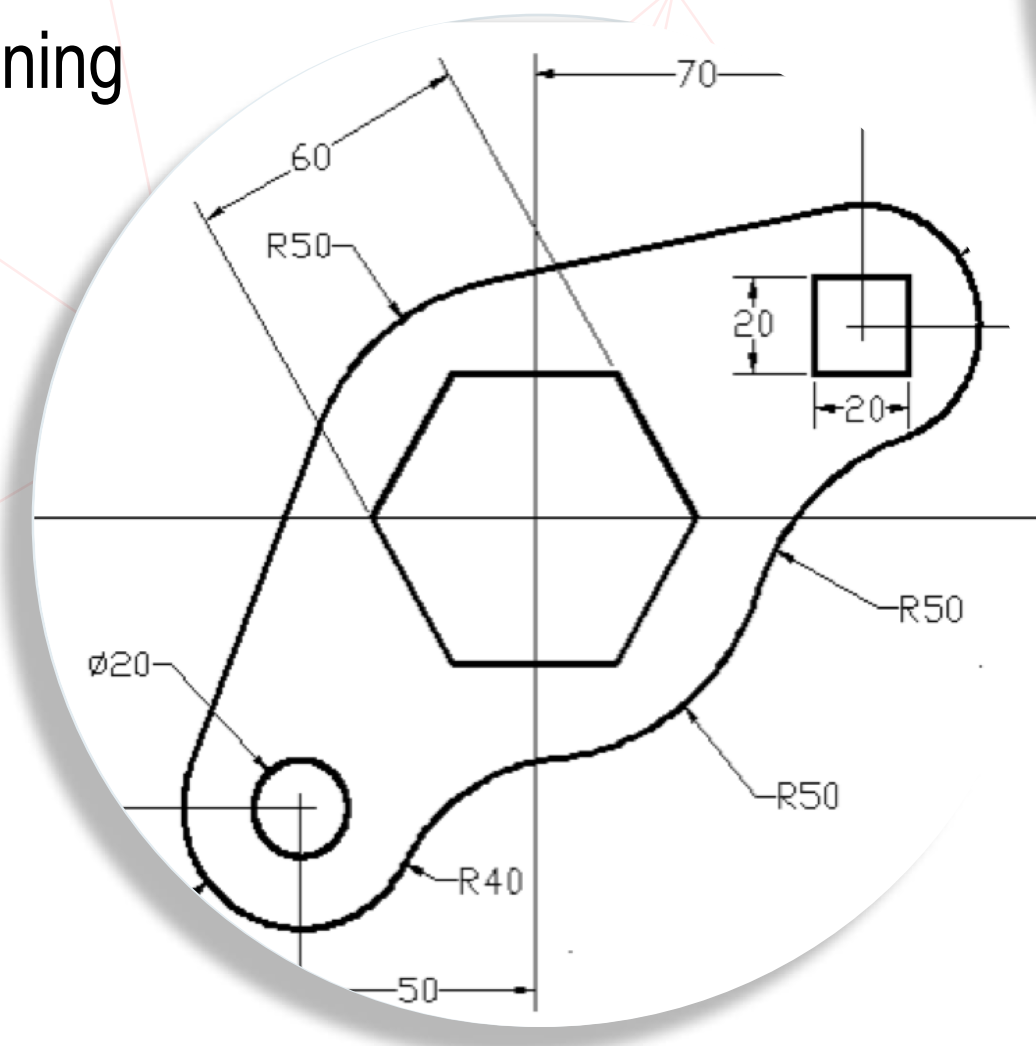
- 💡 LEVEL 0-A ⌚ 3 hours 🎂 > 13 years old
- 📄 No prior experience required 👥 4 to 12 pax
- 💻 Bring your own laptop with LibreCAD installed
- 📍 Einstein Room, Science Centre Singapore, Level 2
- 🔒 SGD 155 / pax (*check with us on your eligibility for subsidy*)

Fast Prototyping with 2D

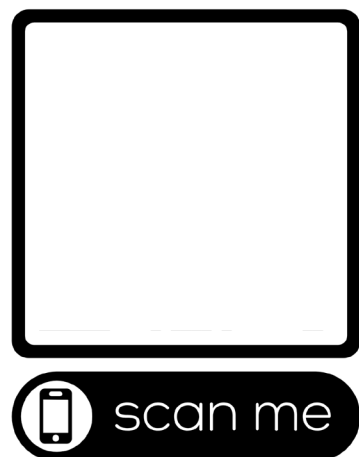
Learn 2D Computer-Aided Design (CAD) software and start creating projects with precision! You won't need stencils, compasses or protractors. This powerful drawing application has the tools to take care of it all! By focusing on basic mathematical concepts, drafting skills and design techniques, you can design and create 2D components in a matter of minutes or, sometimes, in seconds.

Outline:

1. Introduction
2. Basic CAD Concepts
3. LibreCAD 2D CAD Software
4. Graphical User Interface
5. Geometric Construction and Editing Tools
6. Object Properties, Layer and Dimensioning
7. Laser Kerf and Adjustments
8. Laser Cutting and Engraving
9. Tips for Laser Cutting Efficiency



- 💡 LEVEL 1-T ⌚ 6 hours 🎂 > 13 years old
- 📄 No prior experience required 👥 8 to 15 pax
- 💻 Bring your own laptop with LibreCAD installed
- 📍 Einstein Room, Science Centre Singapore, Level 2
- 🔒 SGD 265 / pax (*check with us on your eligibility for subsidy*)



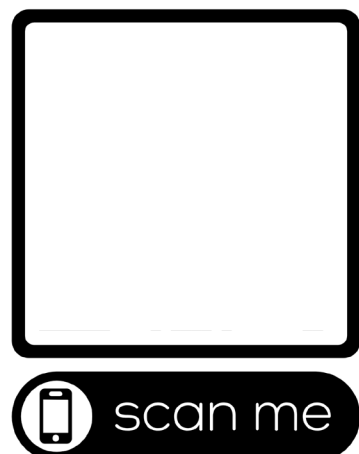
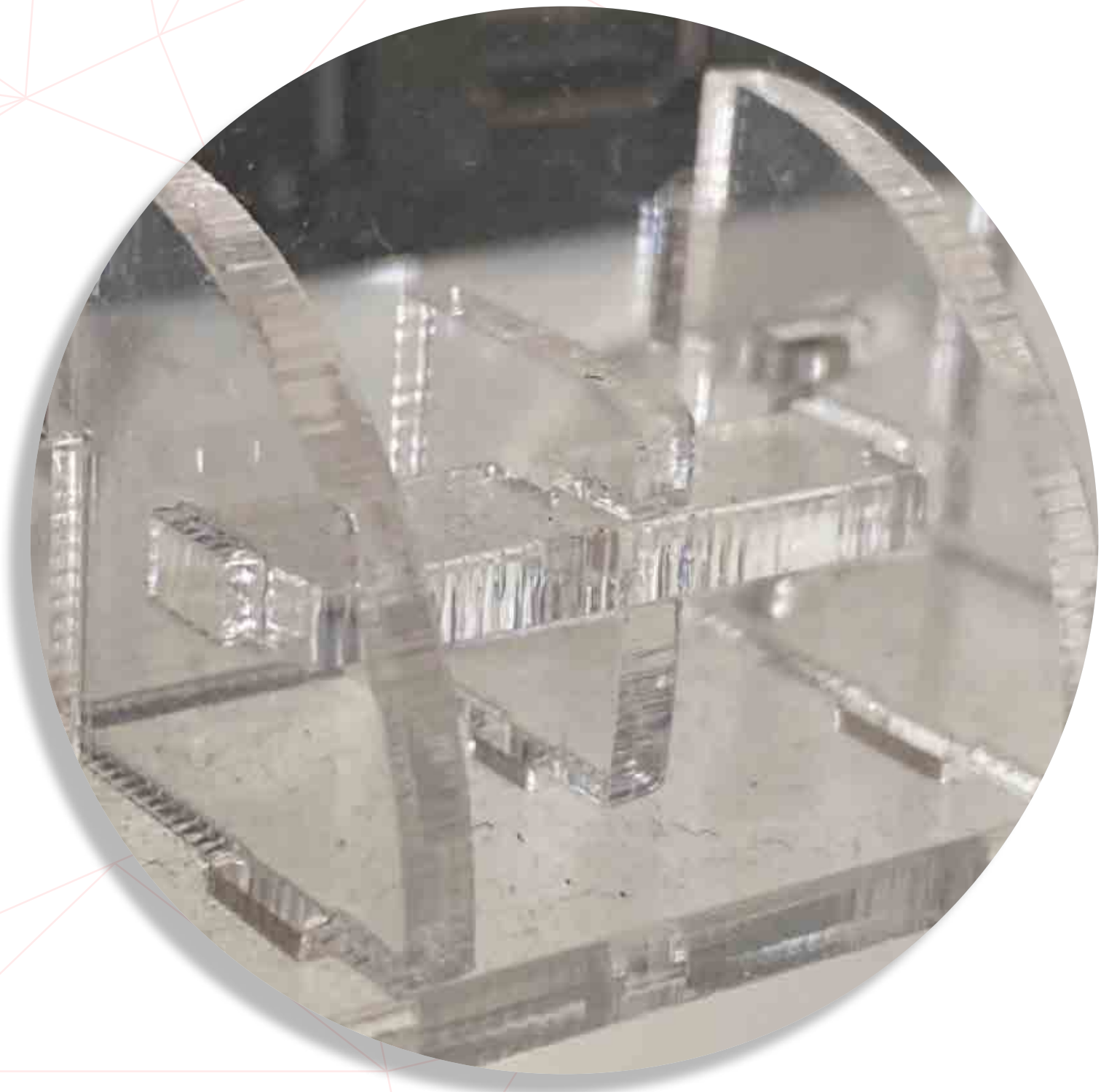
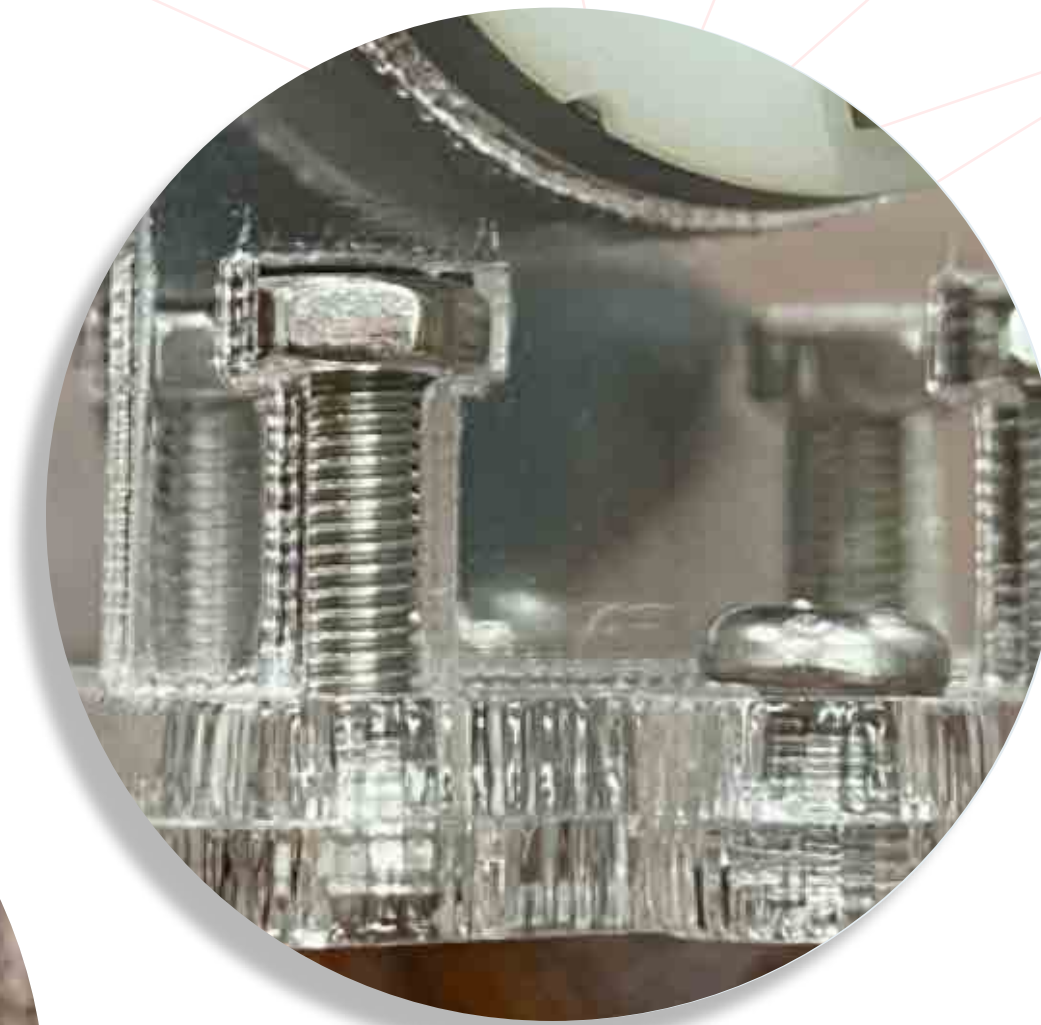
2D CAD: From 2D to 3D

Build on the basics of 2D Computer-Aided Design (CAD) and learn advanced techniques in drawing and design! Create innovative designs that can be printed and assembled into 3D objects. This workshop forms the building block of core skills required across all design disciplines!

Outline:

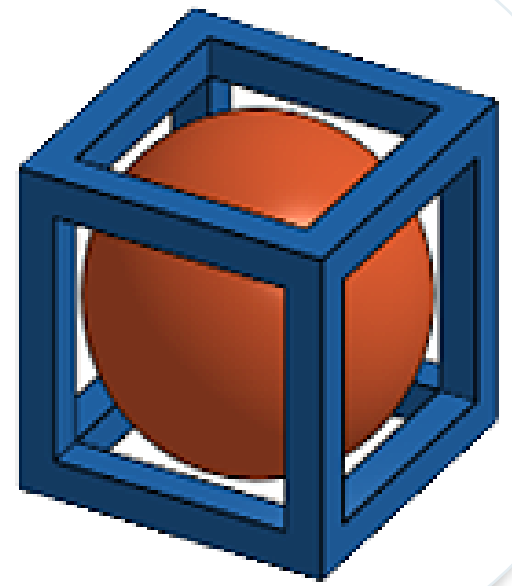
1. Introduction
2. Box joints
3. Cross-halve joints
4. Mortise-tenon joints
5. Jigsaw lock
6. Snap joints
7. Flex lock
8. Acrylic adhesives
9. Screw & nut reinforcement
10. Perpendicular brackets

- 💡 LEVEL 2-T ⌚ 6 hours 🎂 > 13 years old
- 📄 Fast prototyping with 2D 👥 8 to 15 pax
- 💻 Bring your own laptop with LibreCAD installed
- 📍 Einstein Room, Science Centre Singapore, Level 2
- 🔒 SGD 265 / pax (*check with us on your eligibility for subsidy*)



3D CAD Workshops

LEVEL 0 APPLICATION



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3D Design Fundamentals

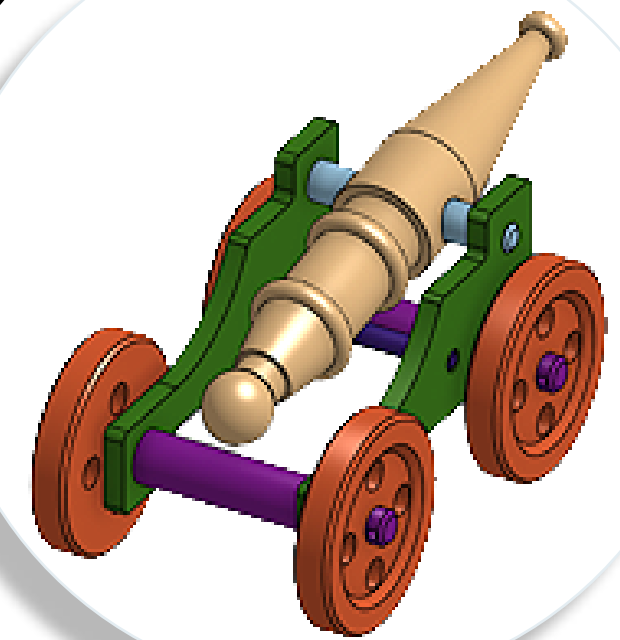
LEVEL 1 TECHNICAL



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Fast Prototyping with 3D

LEVEL 2 TECHNICAL



page 17

Advanced 3D Prototyping

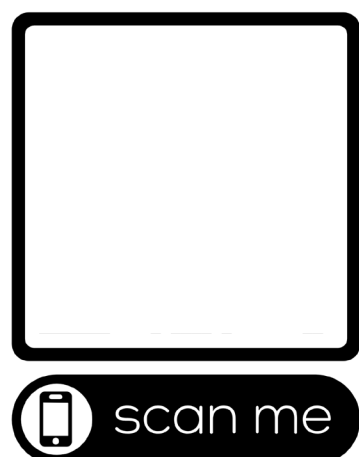
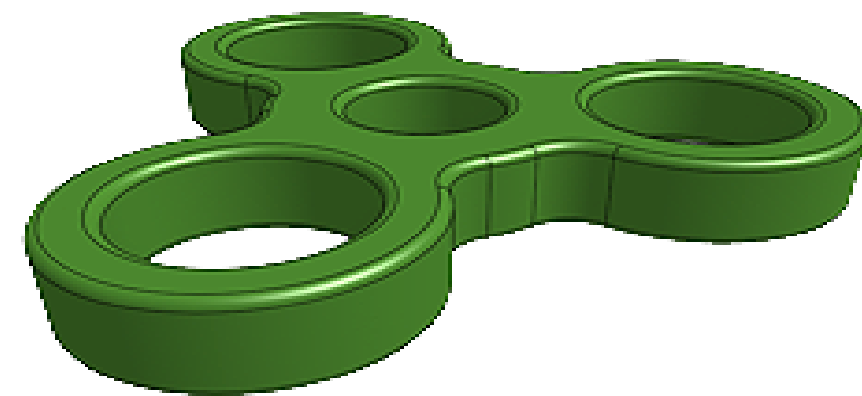
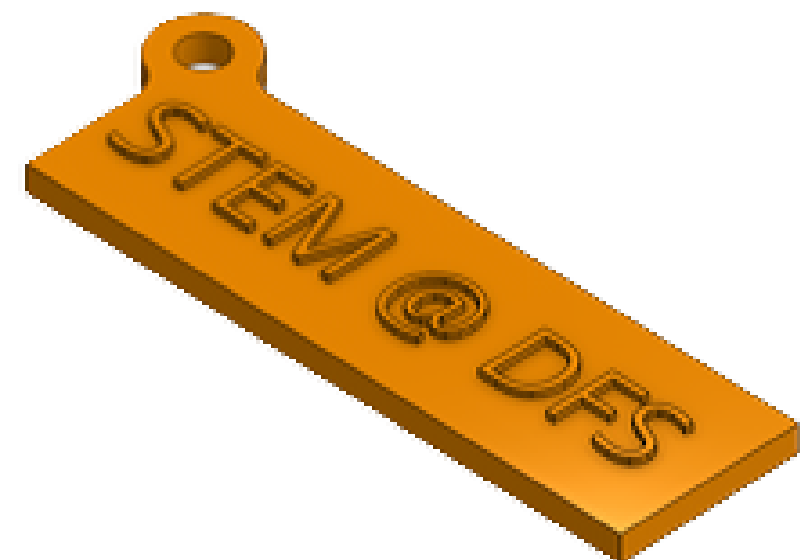
3D Design Fundamentals

The impact of 3D printing on manufacturing has positively impacted the affordability of 3D printers. However, basic 3D design principles tend to be neglected. 3D printed objects work well only when the basic fundamentals of 3D design are followed. In this workshop, you will apply the skills and knowledge learnt, to design a 3D object that can be 3D printed.

Outline:

1. Introduction
2. Computer Aided Design Software
3. 3D Space, geometry and modelling
4. 2D profile to 3D Model
5. Additive Manufacturing Technologies
6. 3D Printing and how its works
7. 3D Printing Process
8. 3D Printing constrain

- 💡 LEVEL 0-A ⌚ 3 hours 🎂 > 13 years old
- 📄 No prior experience required 👥 4 to 12 pax
- 💻 Bring your own laptop with onShape online account
- 📍 Einstein Room, Science Centre Singapore, Level 2
- 🔒 SGD 180 / pax (*check with us on your eligibility for subsidy*)



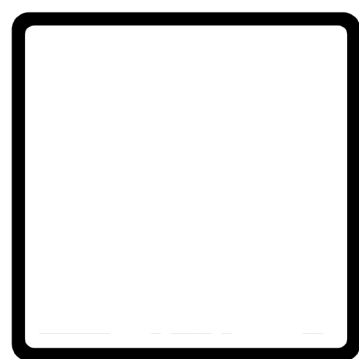
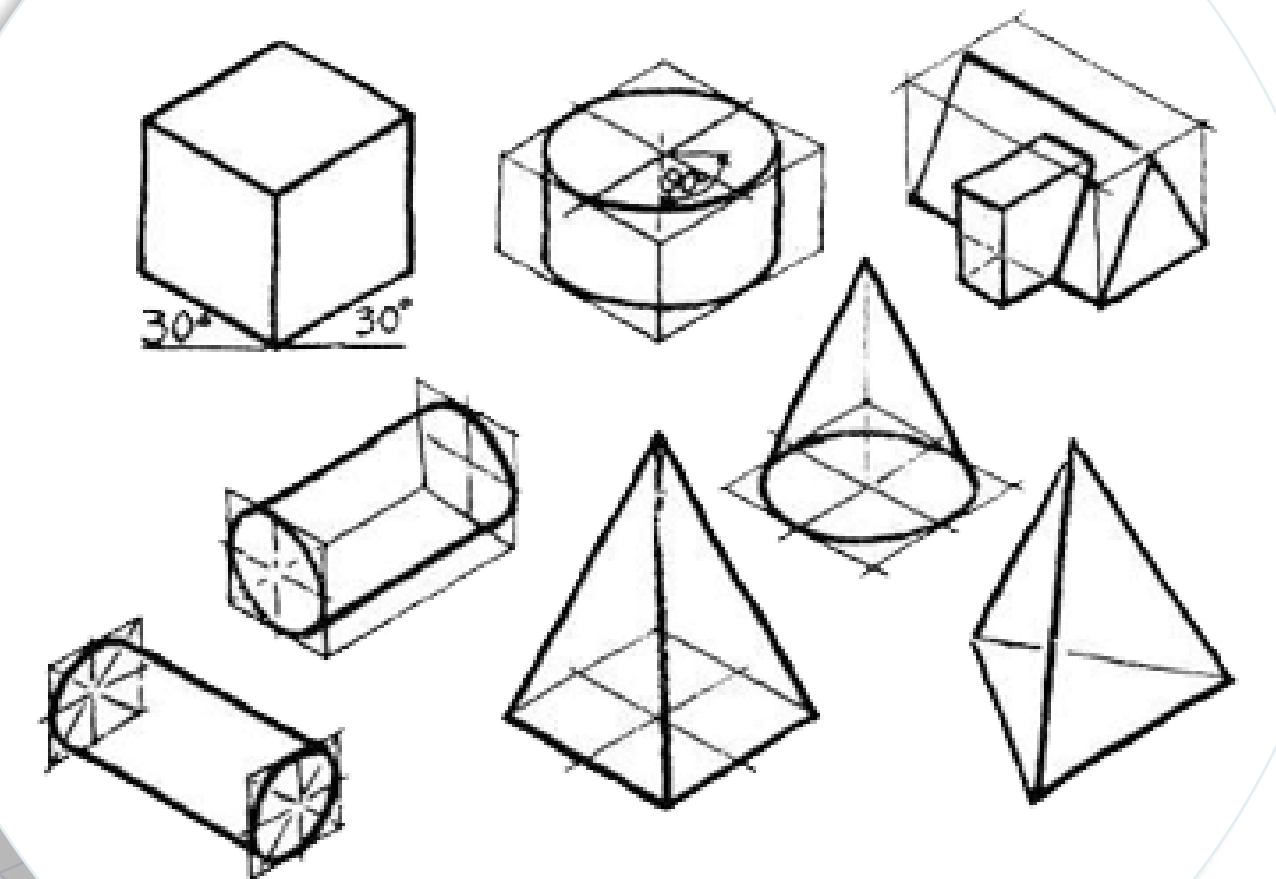
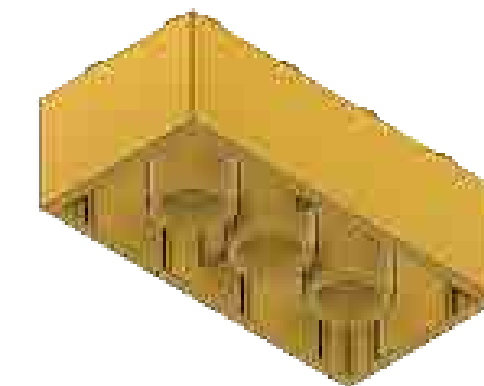
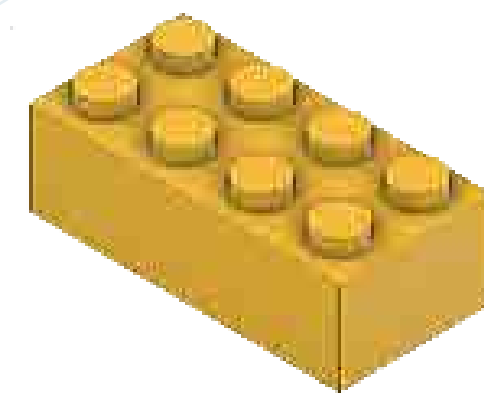
Fast Prototyping with 3D

3D printing is the future. It is a quick, easy and cost-effective way to turn ideas into products! You will learn how to create 3D shapes and quickly fabricate a scale model of them using 3D Computer-Aided Design (CAD). With this knowledge, you will be able to repair damaged items at home by simply drawing and 3D printing the replacement parts!

Outline:

1. Introduction
2. Product Design Concept
3. Principles of Good Design
4. Onshape 3D CAD software
5. Sketch-based modeling
6. 4 foundational features – Extrude & Revolve
7. Parts and Assembly
8. Design concept to Digital 3D Model

- 💡 LEVEL 1-T ⌚ 3 hours 🎂 > 13 years old
- 📄 No prior experience required 👥 4 to 12 pax
- 💻 Bring your own laptop with onShape online account
- 📍 Einstein Room, Science Centre Singapore, Level 2
- 🔒 SGD 230 / pax (*check with us on your eligibility for subsidy*)



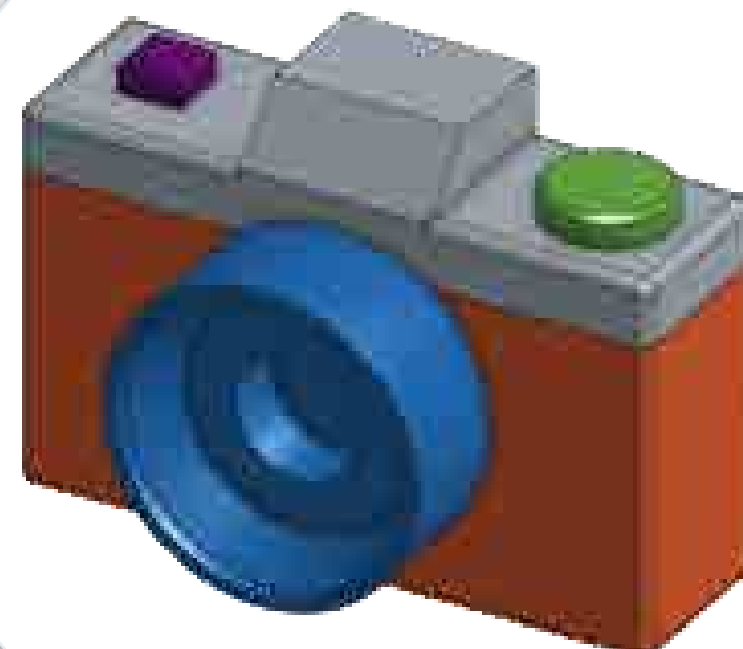
📱 scan me

Advanced 3D Prototyping

You can build on the fundamentals of Fast Prototyping by learning to draw curves and other complicated shapes! This will allow you to draw any shape you can imagine! With this ability, you can create all kinds of shapes to suit your needs! For example, you could design and print a money clip, headset holder or even a customised waterproof cast!

Outline:

1. Introduction
2. 4 foundational features – Sweep and Loft
3. Advanced Sketching
4. Advanced 3D Modelling techniques
5. Multi Parts Design
6. Exploded Views
7. Animation
8. Design Consideration



💡 LEVEL 2-T ⌚ 3 hours

🎂 > 13 years old

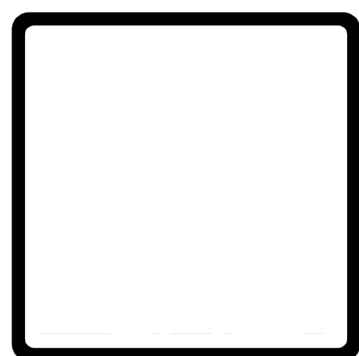
📄 Fast Prototyping with 3D

👥 4 to 12 pax

💻 Bring your own laptop with onShape online account

📍 Einstein Room, Science Centre Singapore, Level 2

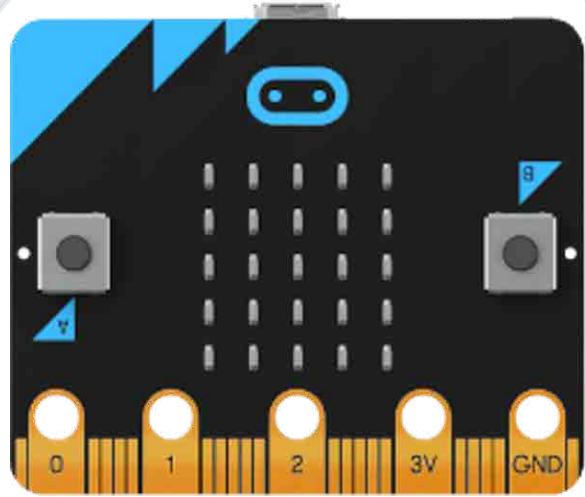
🔒 SGD 230 / pax (*check with us on your eligibility for subsidy*)



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Micro-controller Workshops

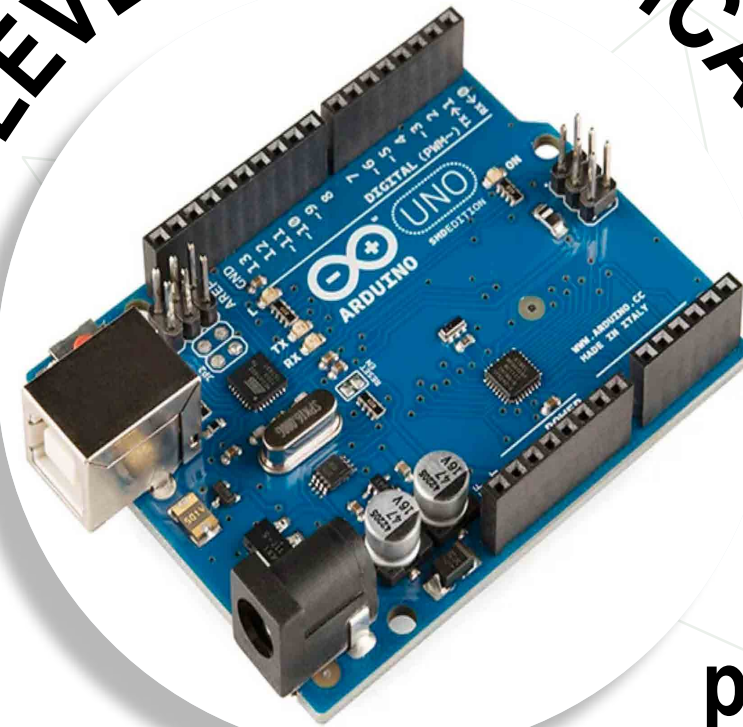
LEVEL 0 APPLICATION



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Start coding with
Micro:bit

LEVEL 1 TECHNICAL



page 20

μ -controllers 101

LEVEL 2 TECHNICAL



page 21

Intermediate μ -controllers

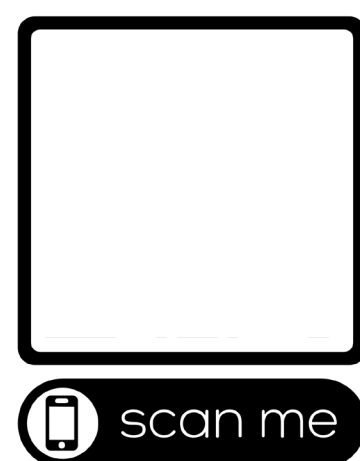
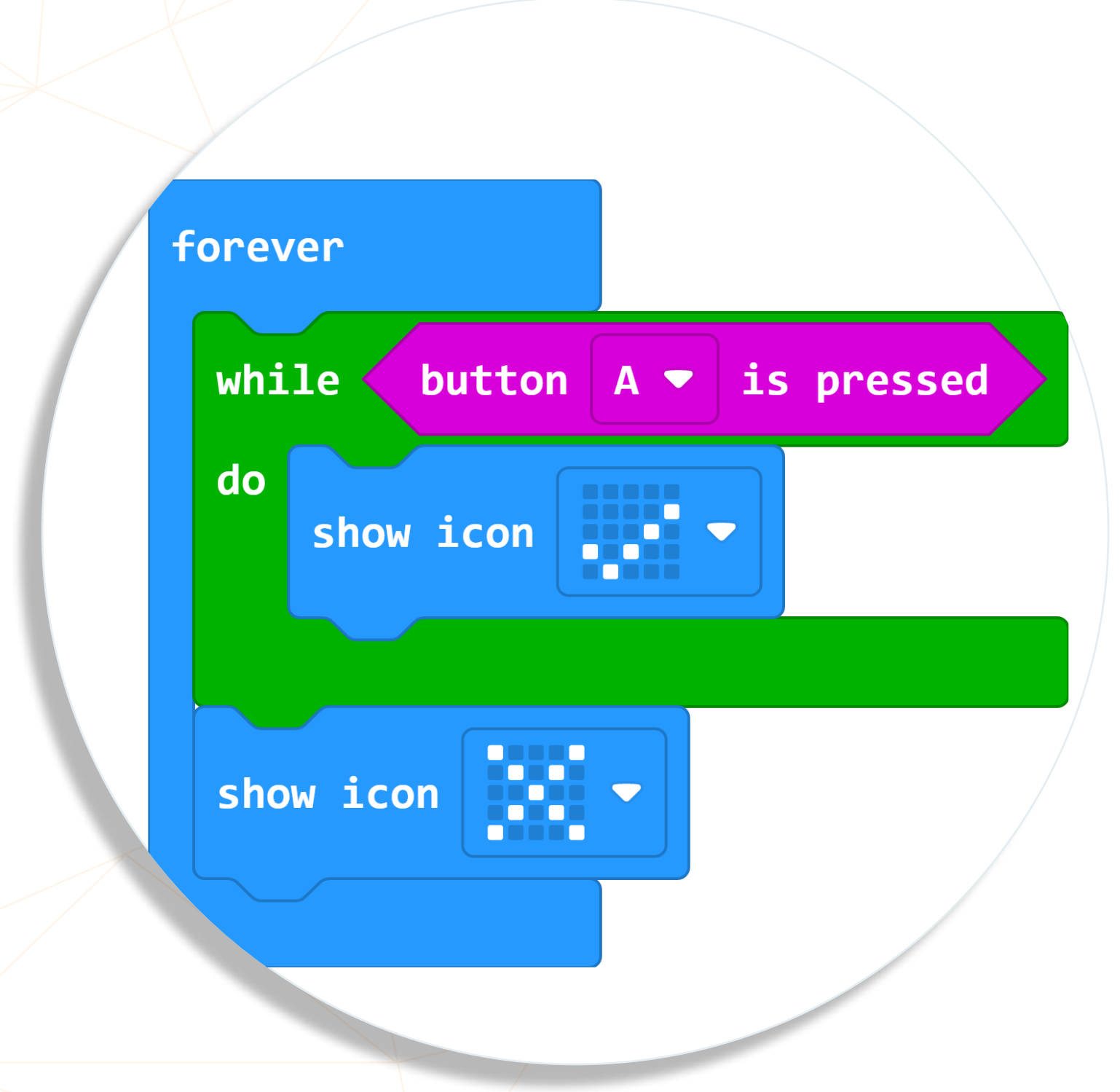
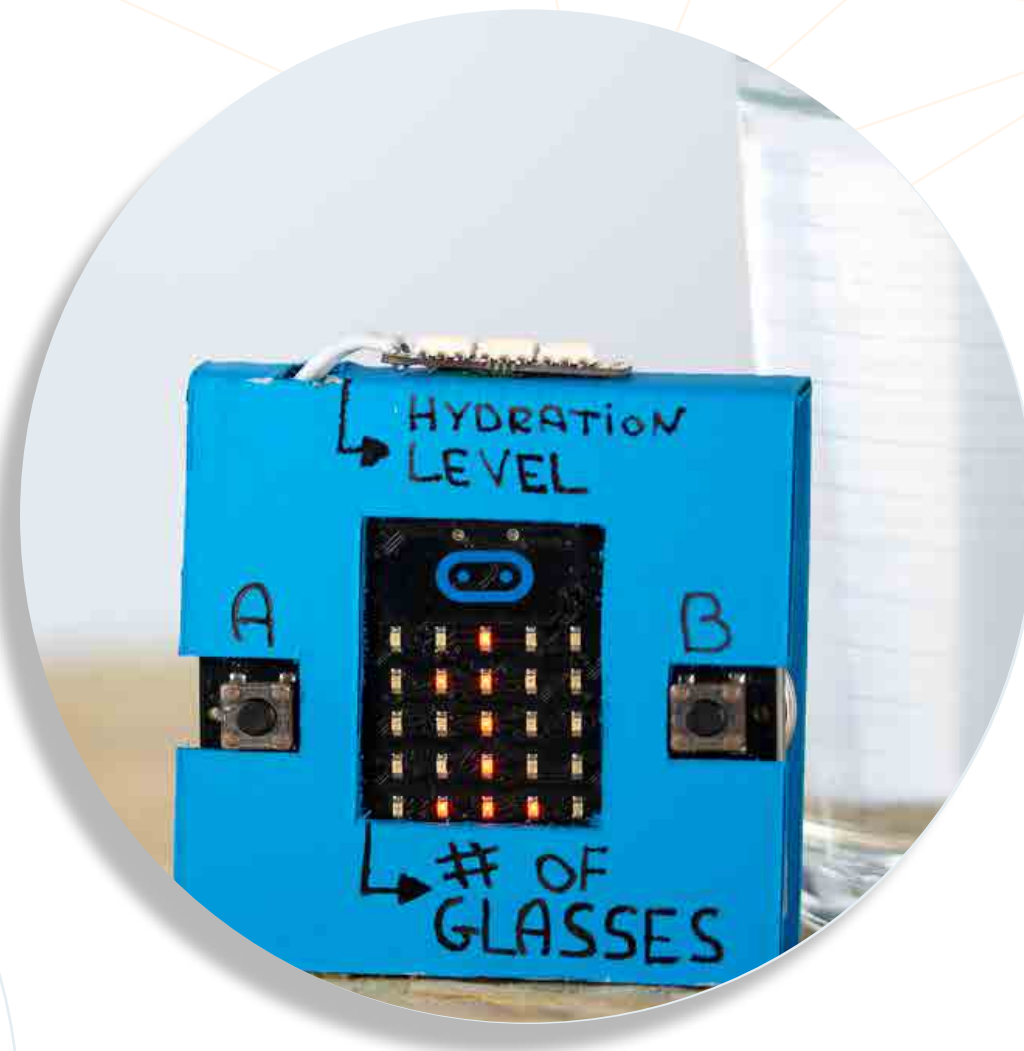
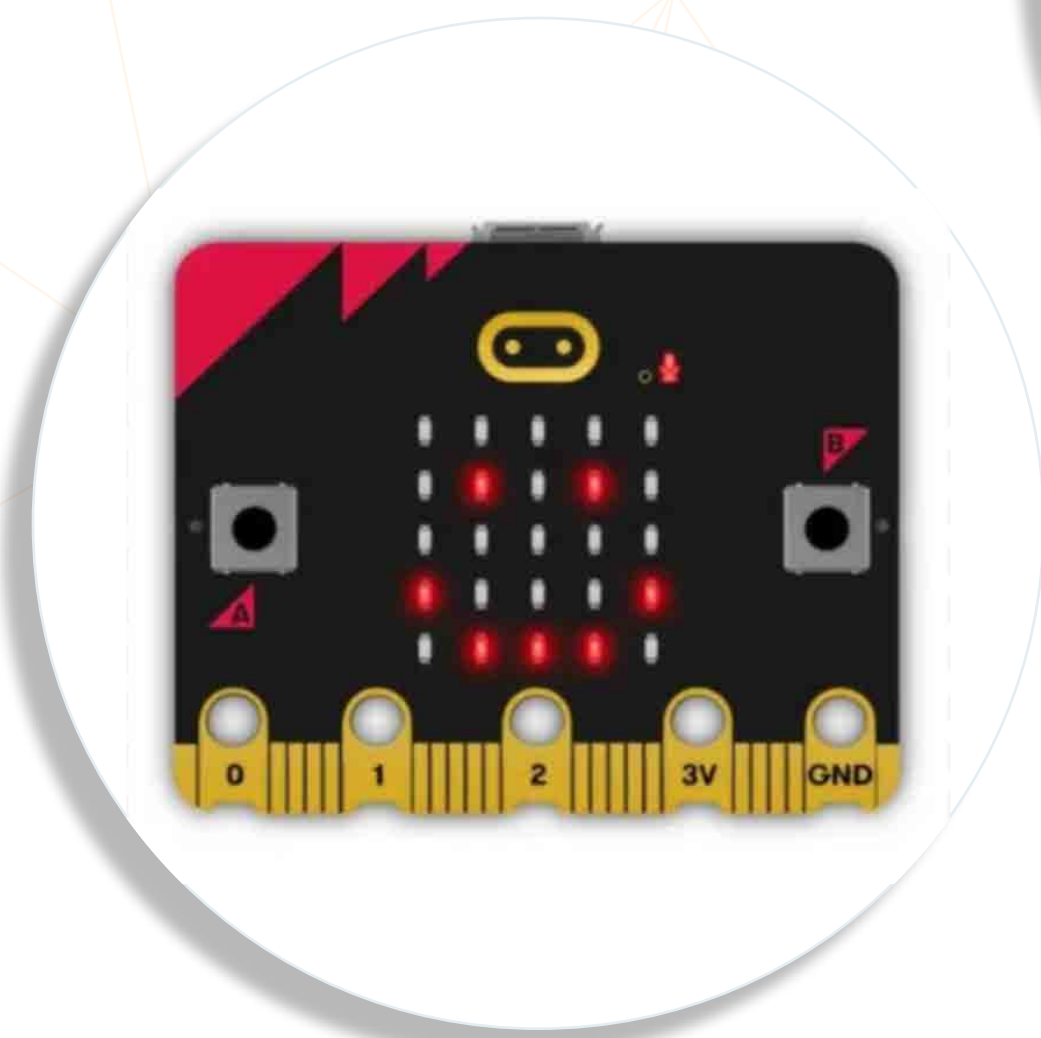
Start coding with Micro:bit

Are you new to programming? If you're interested to pick it up, but feel daunted by the task, fret not! Through intuitive block programming, you can activate the Micro:bit's features in seconds and in the process, learn things like basic syntax, conditional statements and logic commands.

Outline:

1. Introduction
2. MakeCode editor
3. Input / Output of Micro:bit
4. Mini projects

- 💡 LEVEL 0-A ⌚ 3 hours 🎂 > 10 years old
- 📄 No prior experience required 👥 10 to 20 pax
- 💻 Bring your own laptop
- 📍 Einstein Room, Science Centre Singapore, Level 2
- 🔒 SGD 145 / pax (*check with us on your eligibility for subsidy*)

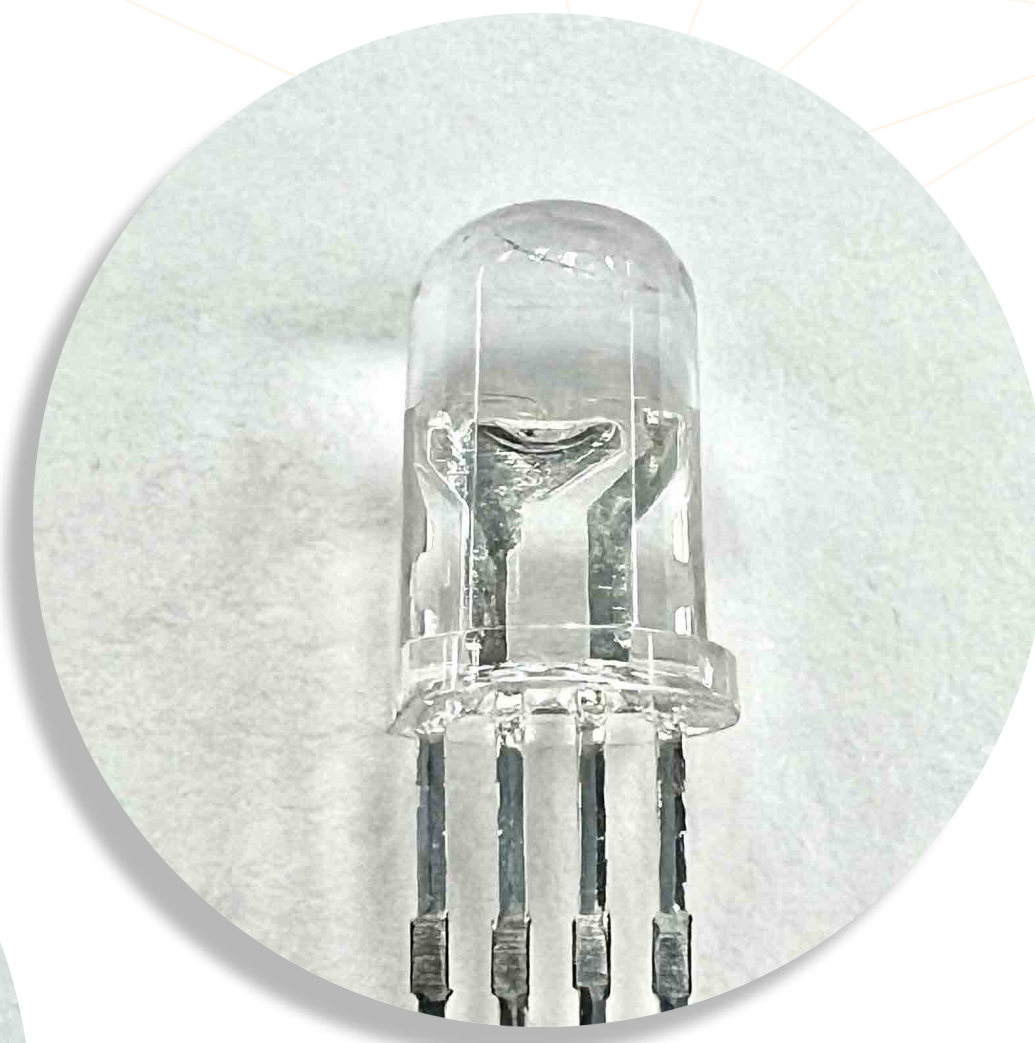


μ-controllers 101

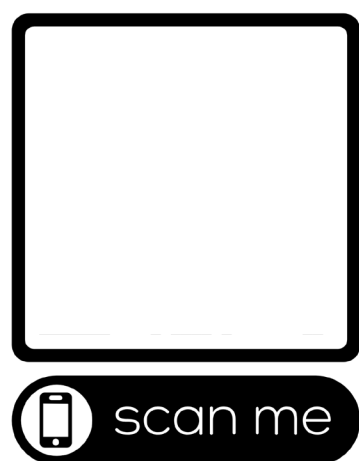
Microcontrollers are integrated circuit (IC) chips that are able to process input and control machines and devices based on their written program. This workshop will expose you to the C++ programming language, allowing you to write simple programs using Arduino's Integrated Development Environment (IDE). You will also be interfacing with simple electronics and circuits to kickstart your journey.

Outline:

1. Introduction
2. IDE and basic electric circuits
3. Program structure
4. Making sound
5. Lighting LED
6. Light sensing circuit
7. While loops
8. Mini project



- 💡 LEVEL 1-T ⌚ 6 hours 🎂 > 13 years old
- 📄 No prior experience required 👥 10 to 20 pax
- 💻 Bring your own laptop with Arduino IDE installed
- 📍 Einstein Room, Science Centre Singapore, Level 2
- 🔒 SGD 165 / pax (*check with us on your eligibility for subsidy*)



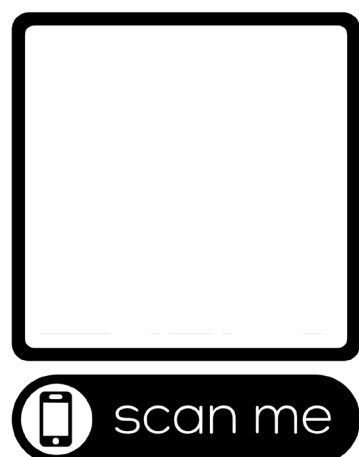
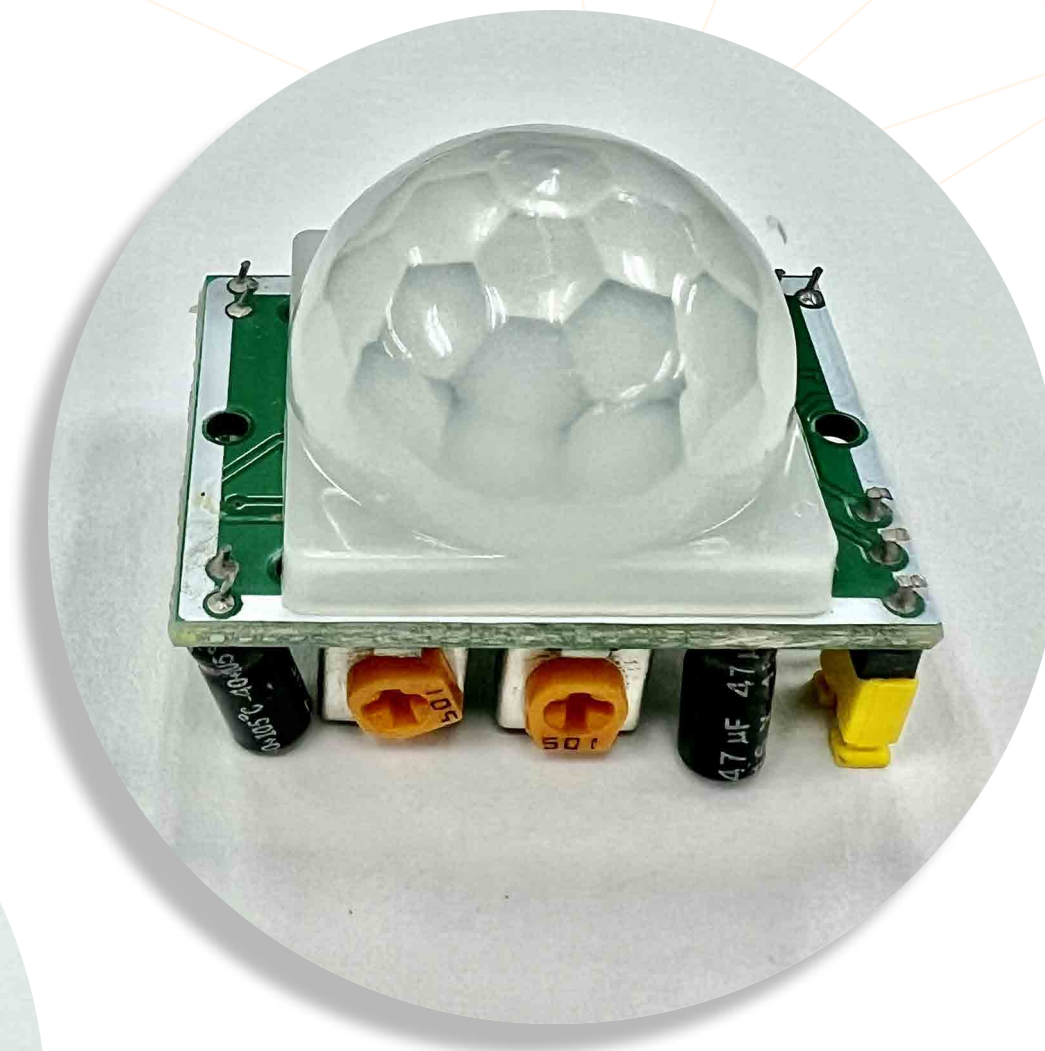
Intermediate μ -controllers

This workshop will delve deeper into the C++ programming language, allowing you to create more complicated programs using code. There will be an introduction to more complicated concepts and a more challenging mini project that replicates a commercially available product.

Outline:

1. Introduction
2. Bits & bytes and data types
3. Local & global variables
4. Pin configurations
5. Pulse-width modulation (~)
6. Map function
7. If-else conditions
8. For loops
9. Mini project

- 💡 LEVEL 2-T ⌚ 6 hours 🎂 > 13 years old
- 📄 μ -controllers 101 👥 10 to 20 pax
- 💻 Bring your own laptop with Arduino IDE installed
- 📍 Einstein Room, Science Centre Singapore, Level 2
- 🔒 SGD 180 / pax (*check with us on your eligibility for subsidy*)



School-based Programs

WORKSHOP ADOPTION PROGRAM



page 23

DFS In Curriculum

DFS x ARTIST PROGRAM



page 25

Abstract Art - Sculpture

DFS @ SCHOOLS



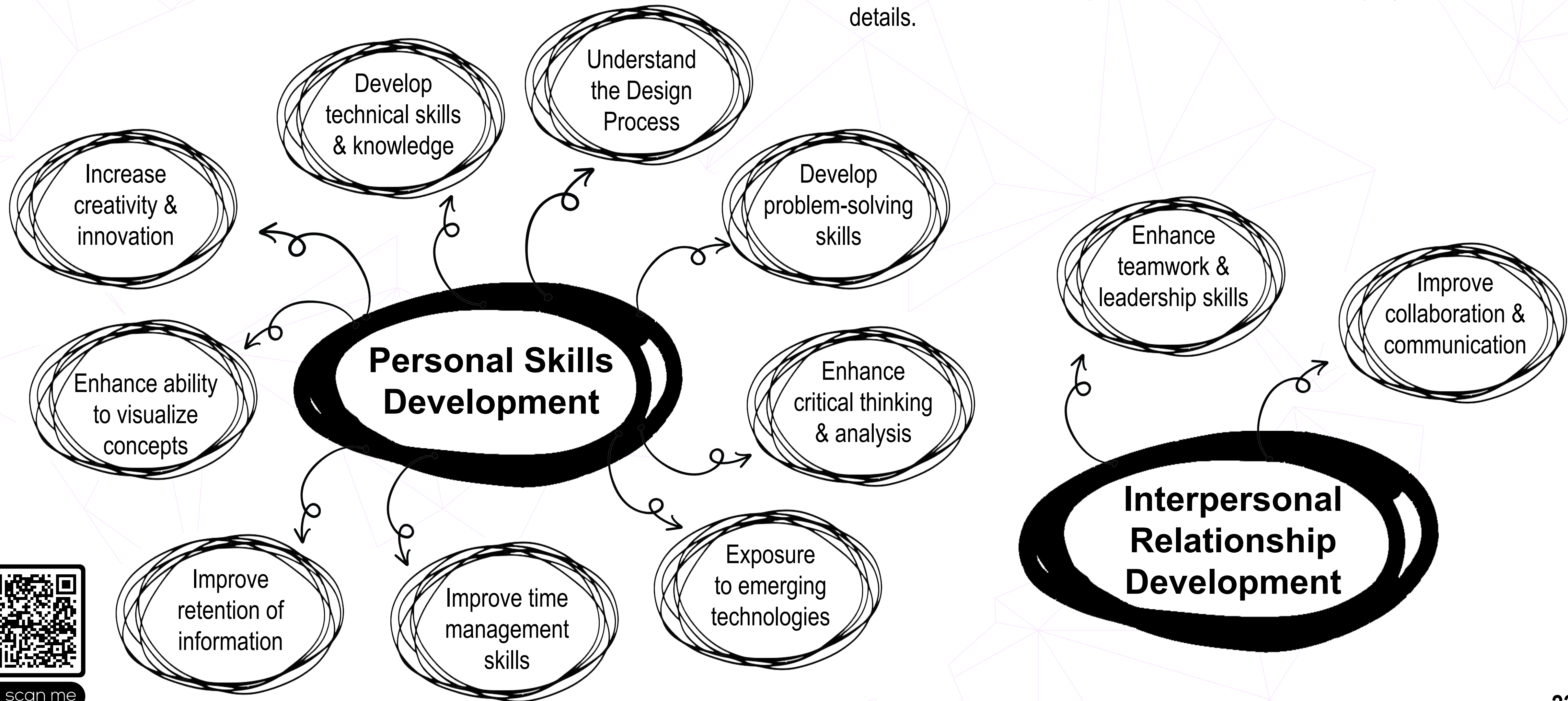
page 26

Pop-Up Booths

DFS In Curriculum

Since DFS's inception, we have been working closely with institutions to incorporate our workshops into their curriculum. This initiative is borne from our deepset belief that our content adds value to classroom learning.

Below are 20 reasons why it is so. Scan the accompanying QR code for more details.

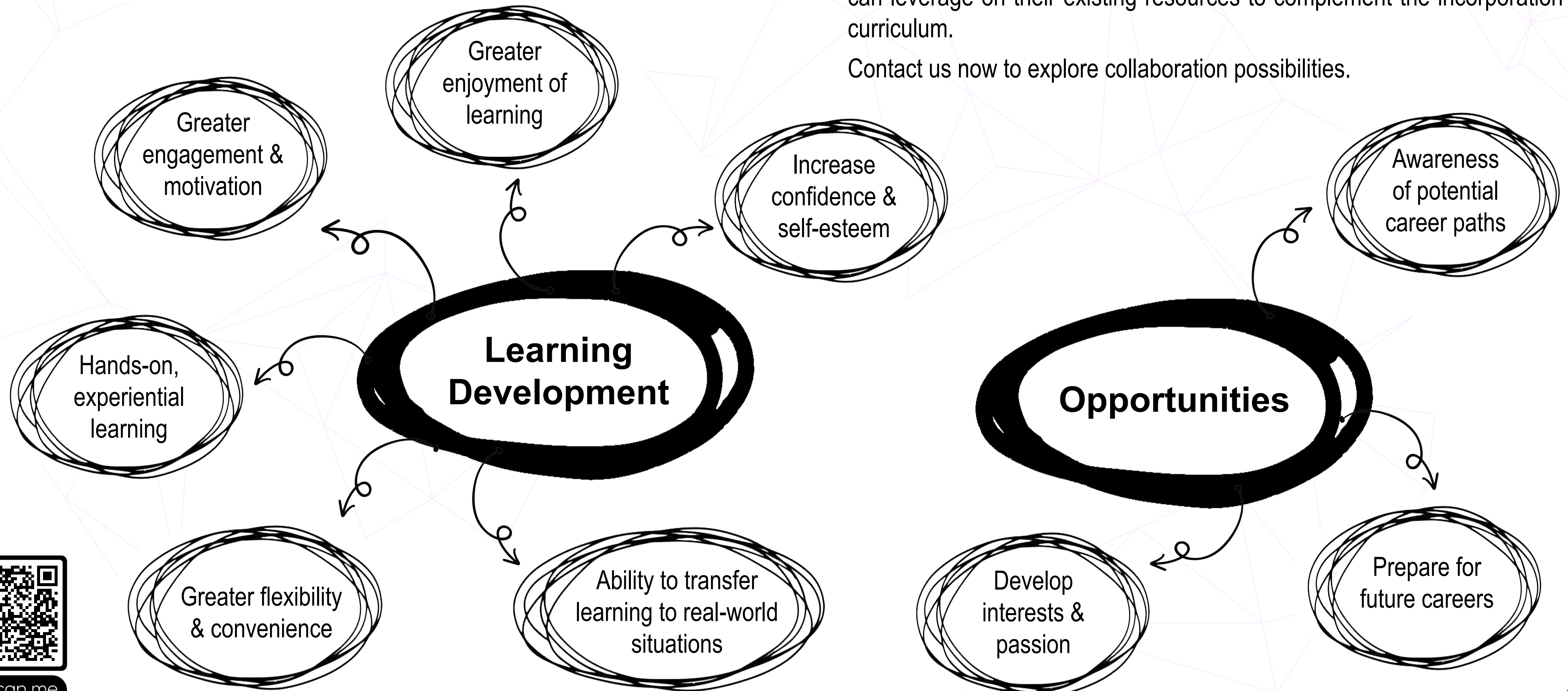


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DFS In Curriculum

By incorporating content into their curriculum, institutions have control of the quality of the education they provide, creating a greater alignment with the institution's goals and standards. They can tailor their instruction to the needs and abilities of their students, and in the process, build relationships to maintain a consistent learning environment. Besides cost savings, institutions can leverage on their existing resources to complement the incorporation of curriculum.

Contact us now to explore collaboration possibilities.

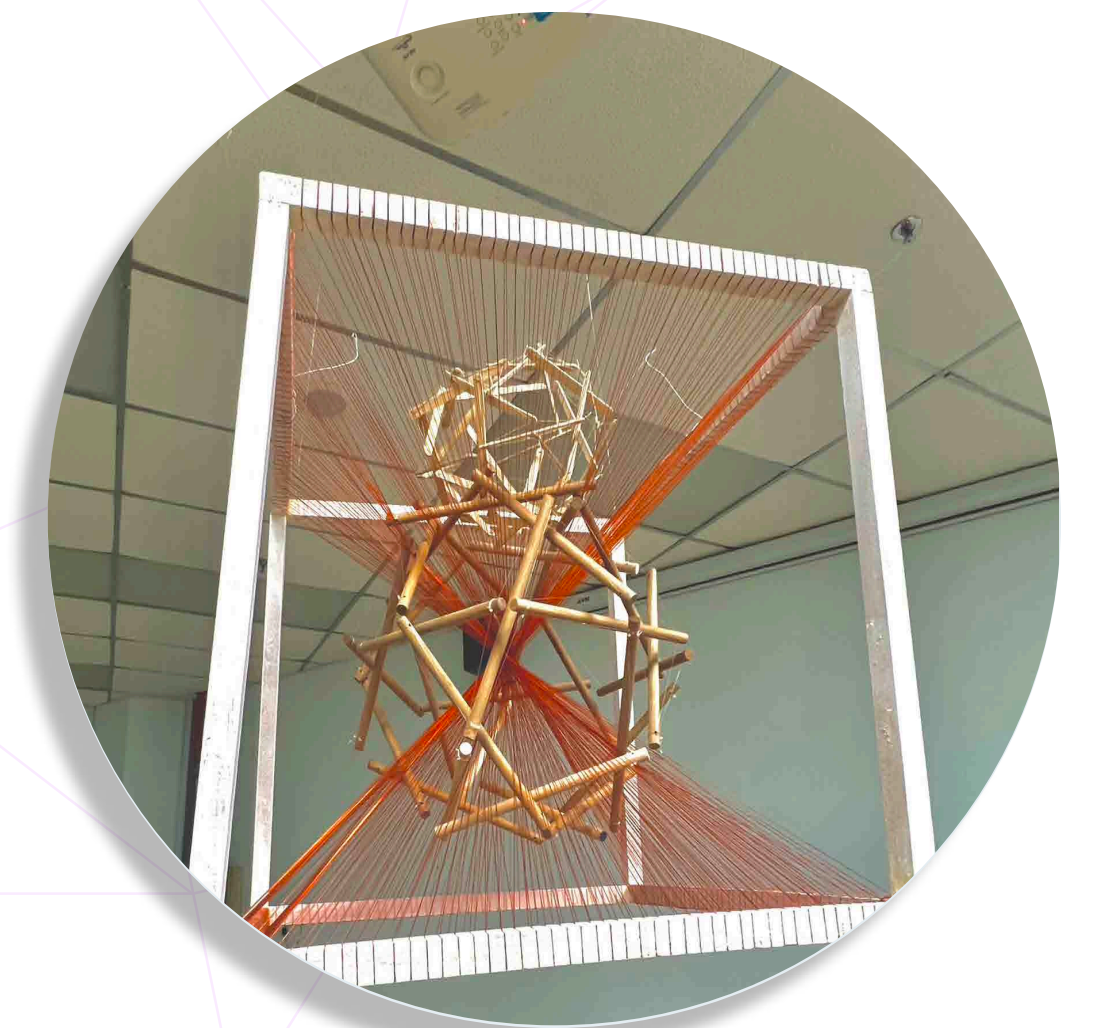
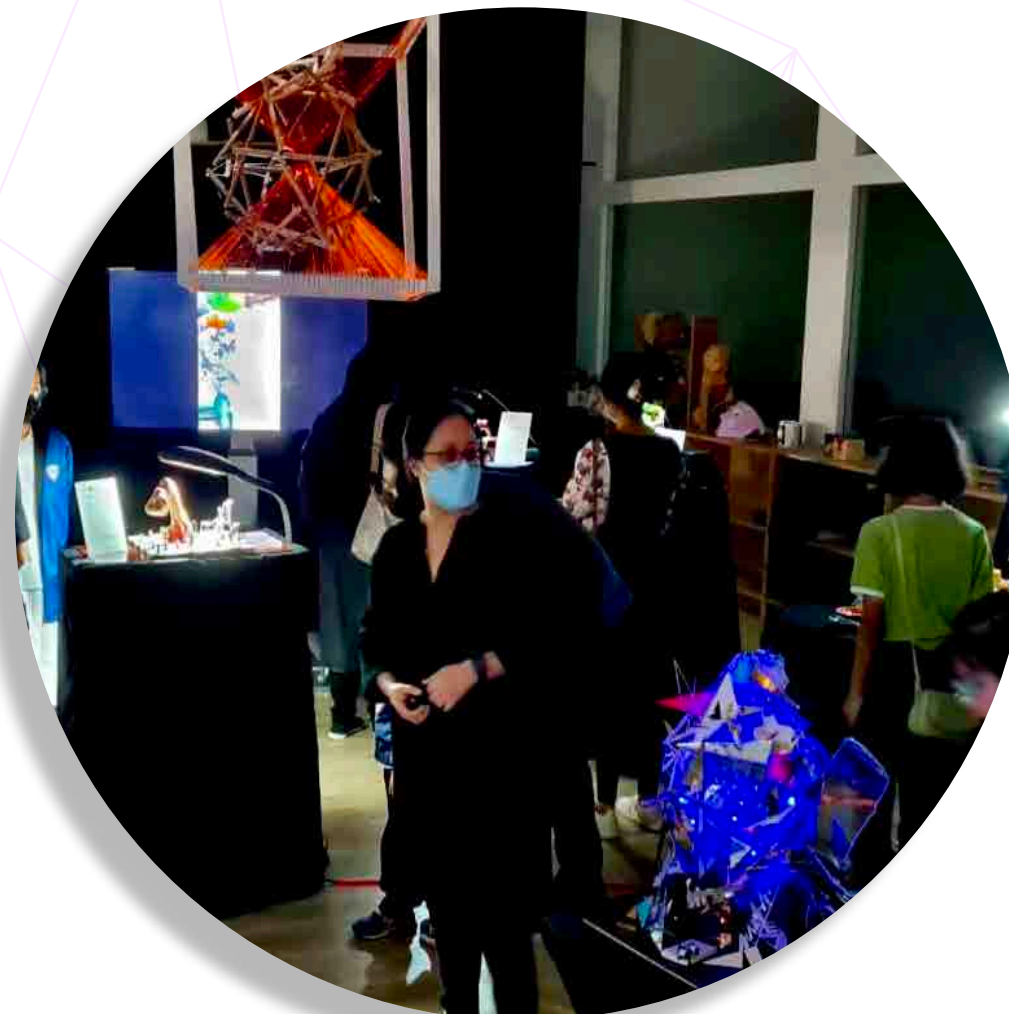


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Abstract Art - Sculpture

DFS X Artist is Digital Fabrication Space's (DFS) latest student program. It aims to expose students to both digital fabrication and art. Through hands-on experience with digital fabrication and mentorship under a full-time artist, students gained skills that allows them to create workpieces that merged elements of art and STEM.

Under the mentorship of an artist, the students learned how to engage their senses to bring about a visualization of their future self, which is also the theme for the program for this run. Concurrently, DFS staff taught the students skills related to digital fabrication, such as laser cutting, coding and basic electronics. These skills were then used by the students when they fabricate their artwork.



Pop-Up Booths

The DFS Pop-Up Booth is our mobile outreach activity that showcases a currently available technology at the DFS. There are explanations and demonstrations to drive awareness of the technology amongst the visitors. This versatile station is not only deployed within Science Centre, but can be brought to external locations. Institutions can make use of the pop-up booth to engage their students, parents as well as the community, alleviating the institution's reputation and visibility, promoting partnerships and collaborations.

Adapting the concept of roadside stalls and road shows, the pop-up booth consists of a pushcart surrounded with small tables and stools. Two successful runs have had been carried out in Science Centre, featuring 3D printing and heat press design.



“Technology and tools are useful and powerful when they are your servant and not your master.”

- Authour of The 7 Habits of Highly Effective People, Mr Stephen R Covey

Equipment @ DFS

LASER CUTTER



page 30

3D PRINTER



page 31

VINYL PRINTER & CUTTER



page 32

CNC MACHINE



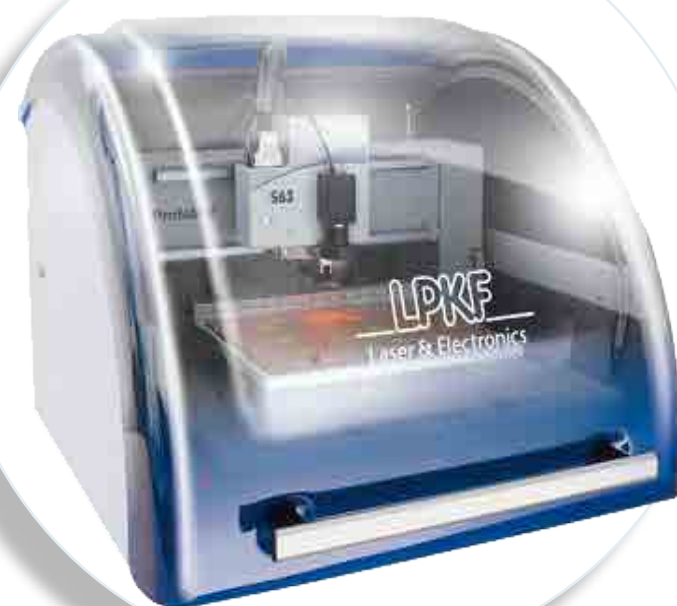
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PROGRAMMABLE SEWING MACHINE



page 33

PCB MILL



page 33

OTHER TOOLS



page 34

3D SCANNER & TURNTABLE



Equipment Usage Overview

Further enhancements

Equipment: Strip heater
Materials: Acrylic

Equipment: Heat press
Materials: Fabric

2D manipulation

Equipment: Laser cutting machine
Materials: Wood, acrylic, paper

Equipment: Vinyl printer/cutter
Materials: Vinyl, paper

Equipment: Sewing machine
Materials: Fabrics

Intermediate prototyping

Equipment: Dremel, sanding machine
Materials: Wood, plastics, foam

3D manipulation

Equipment: Vacuum forming machine
Materials: ABS, PC, PE

Equipment: 3D printer
Materials: PLA

Equipment: CNC machine
Materials: Wood, plastics, foam

Equipment: Lathe, milling machine
Materials: Wood, plastics

Quick prototyping

Equipment: Cutters, glue gun, 3D pen
Materials: Cupboard, paper, acrylic, craft materials

Programming

Equipment: Micro:bit (Beginner)
Arduino (Intermediate)

Equipment: Solder stations
Materials: Circuit boards

Prototype ideation

Suitable for Primary level students or for low level modelling.

Suitable for Secondary level students or for Appearance / Engineering prototype

Equipment: PCB mill
Materials: Copper coated fiberglass

UNIQUE

REPLICABLE, MINI PRODUCTION

Products, Techniques

PAPER STACK ART



PAPER PACKAGING



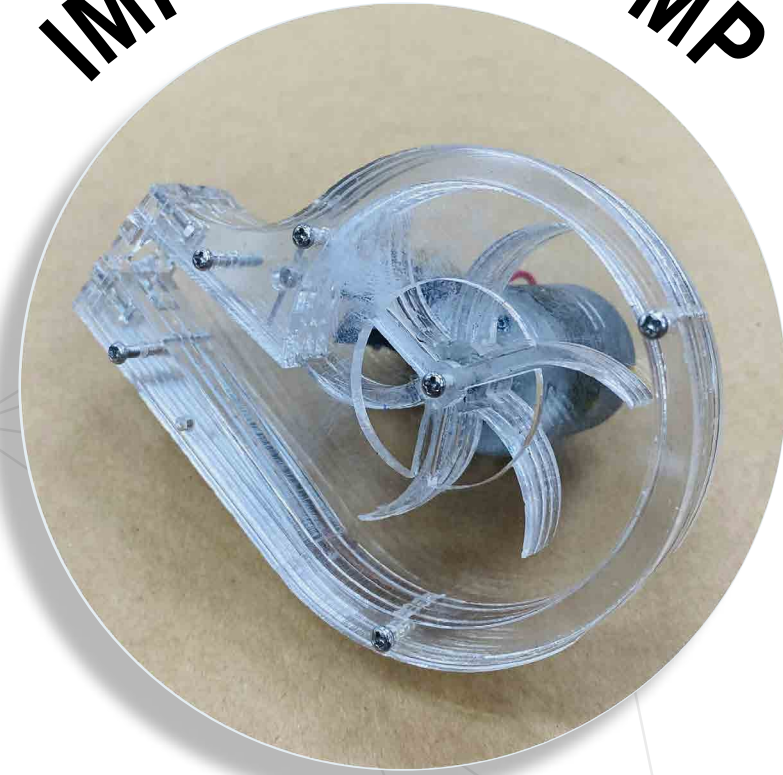
LATTICE HINGES



LASER ENGRAVING



IMPELLER PUMP



LASER CUTTER



CUT-OUT

JOYCE
#ZACHARY

RELIEF ENGRAVING

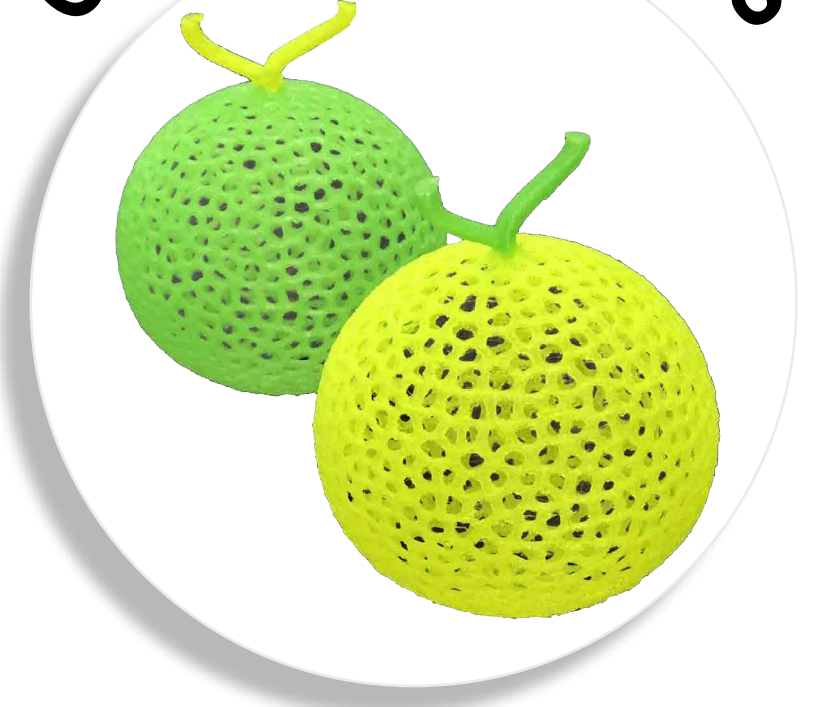


STRING ART



Products, Techniques

ORGANIC SHAPES



FIGURINES



ENGINEERING GEARS



PUZZLES



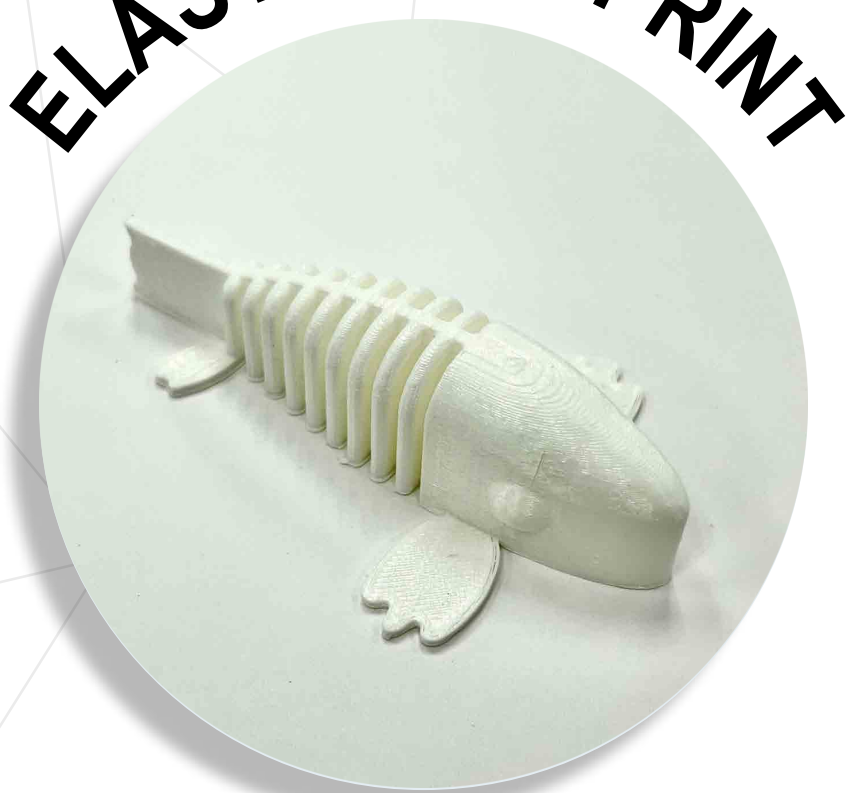
3D PRINTER



RESIN PRINT



ELASTIC PLA PRINT



DUAL EXTRUSION PRINT



AIRCRAFT TURBINE ENGINE



Products, Techniques

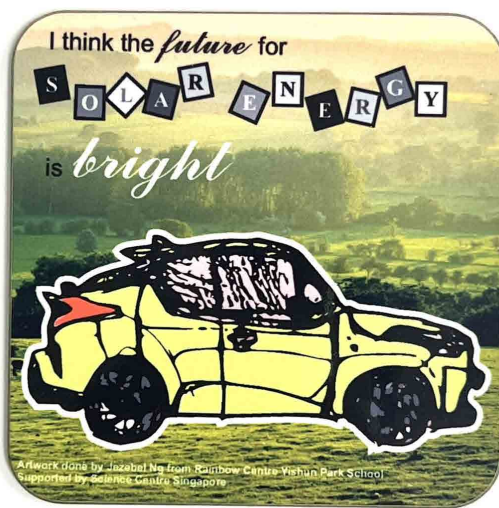
VINYL PRINTER & CUTTER



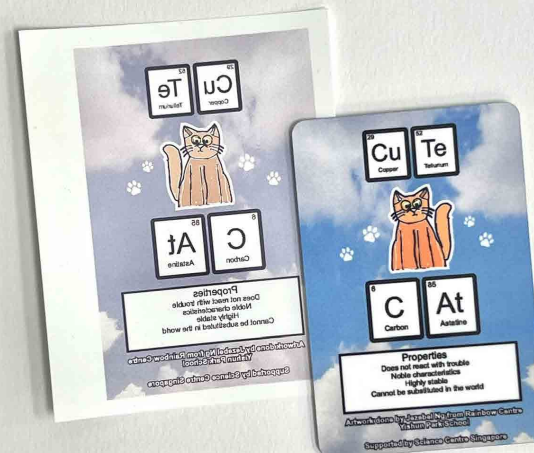
STICKERS



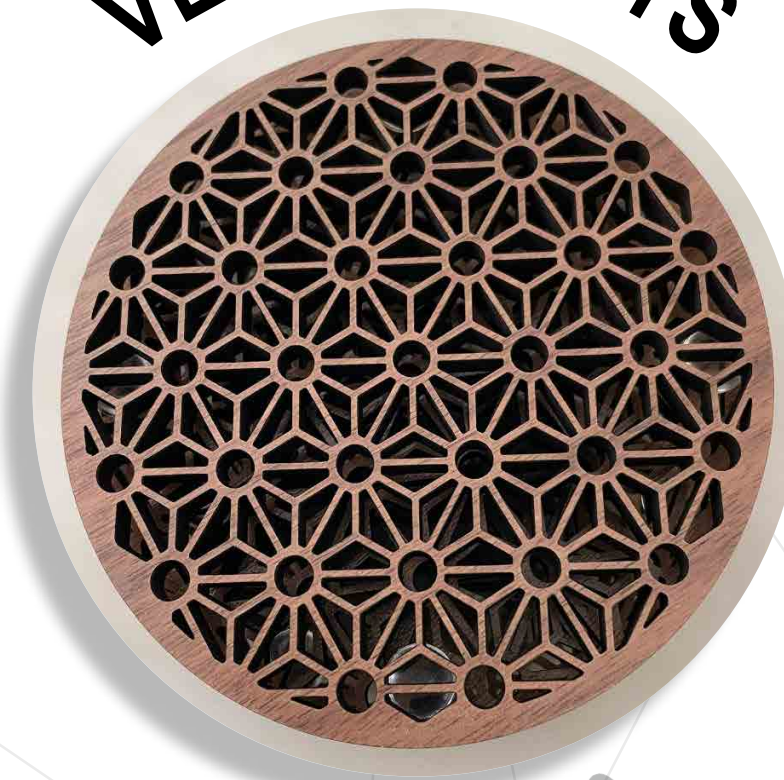
COASTERS



METAL CARDS



VECTOR CUTS



TOPOGRAPHY



CNC MACHINE

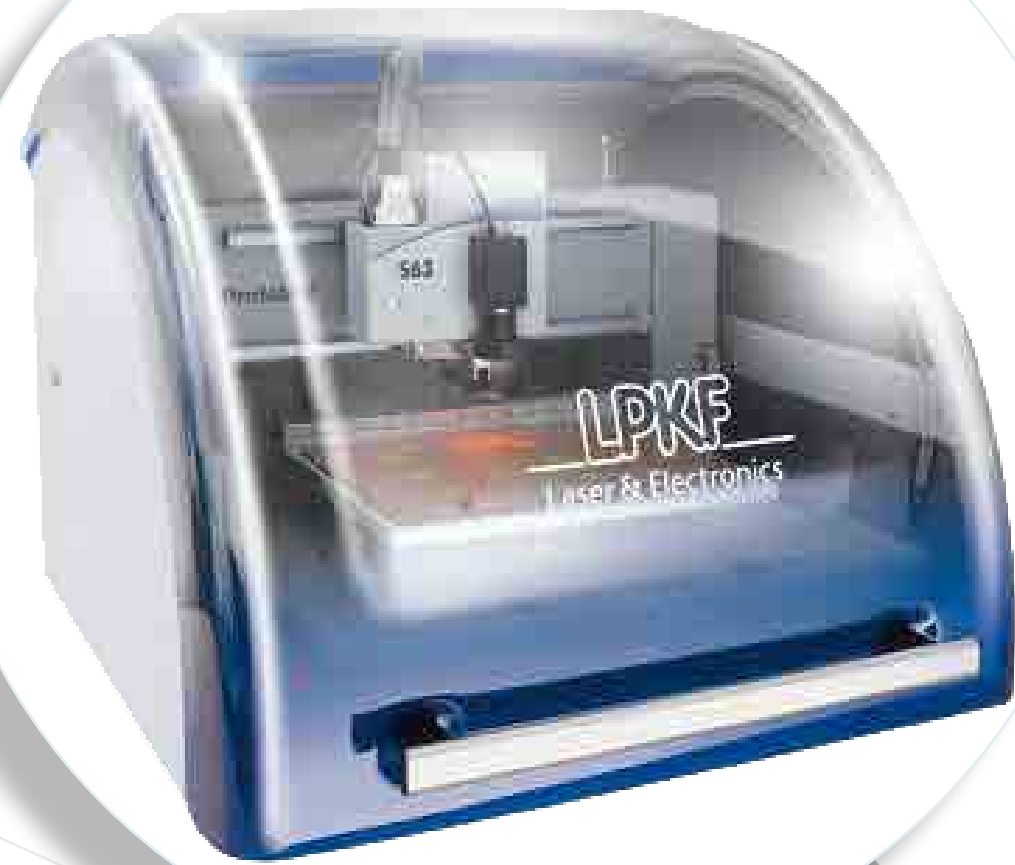


CASTING MOLD



Products, Techniques

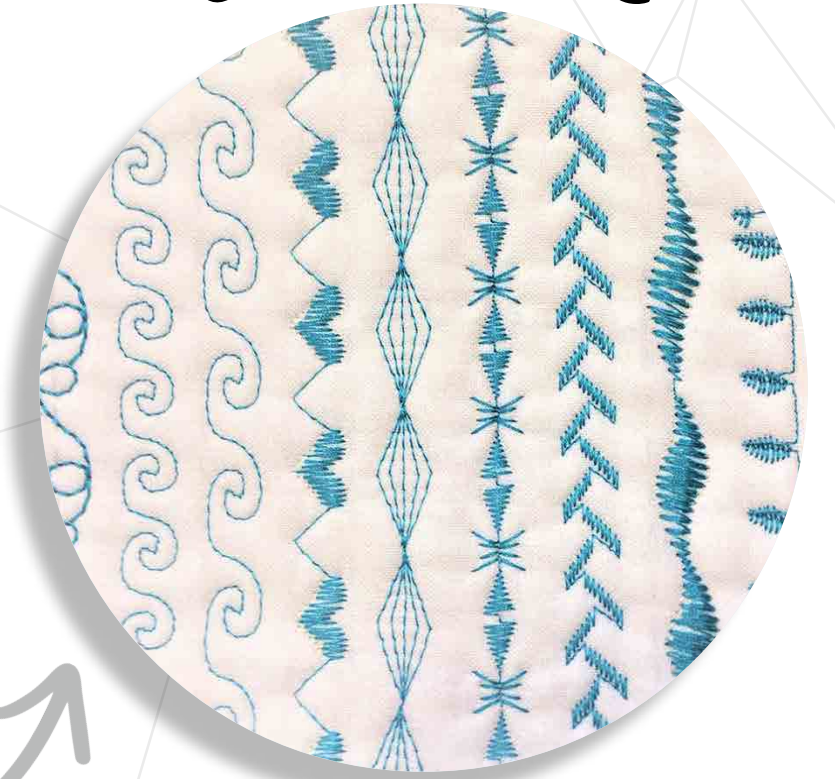
PCB MILL



EMBROIDERY



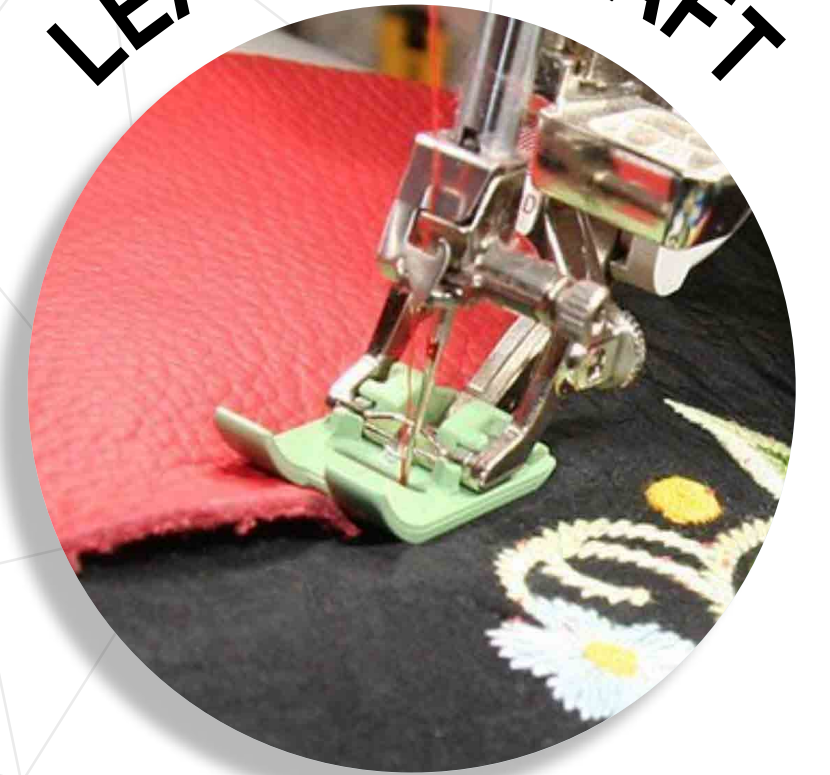
STITCHING



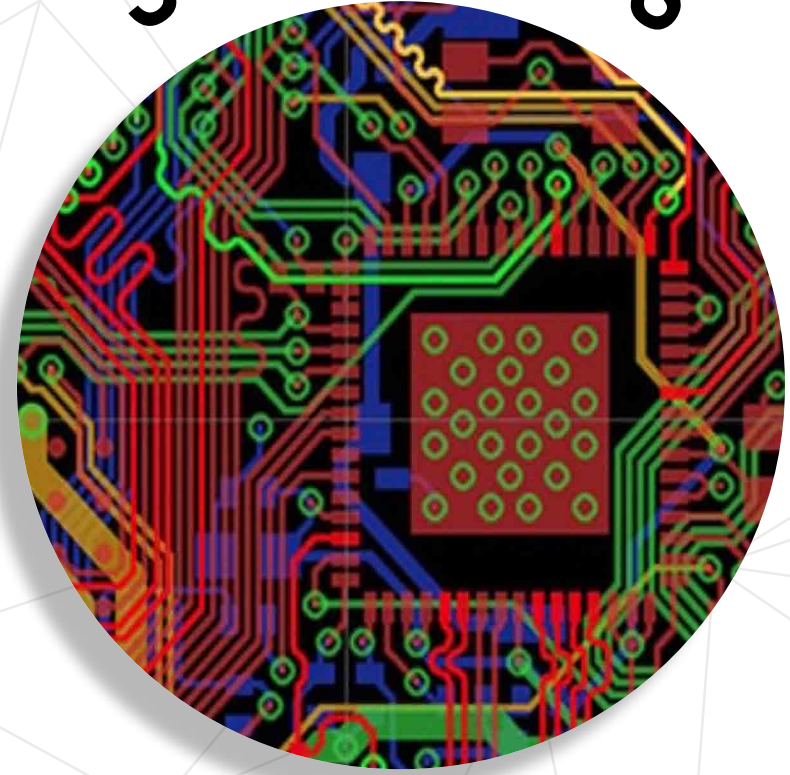
SEWING MACHINE



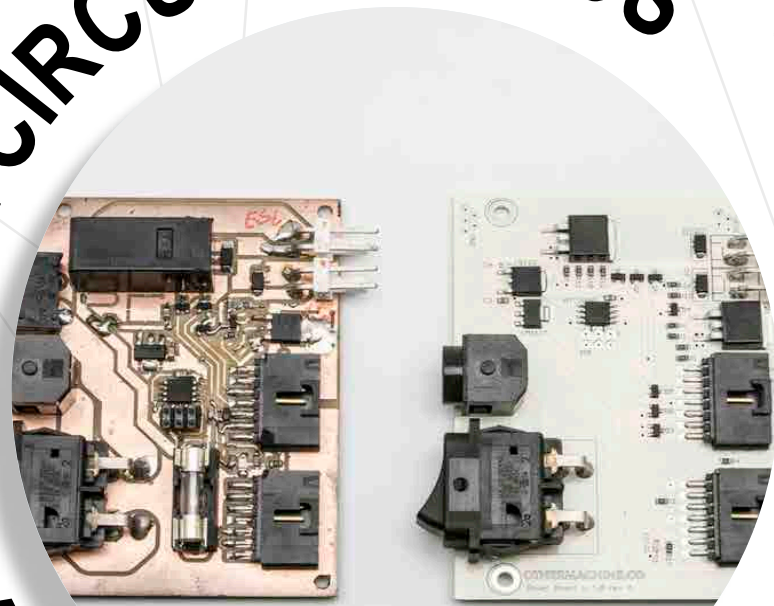
LEATHER CRAFT



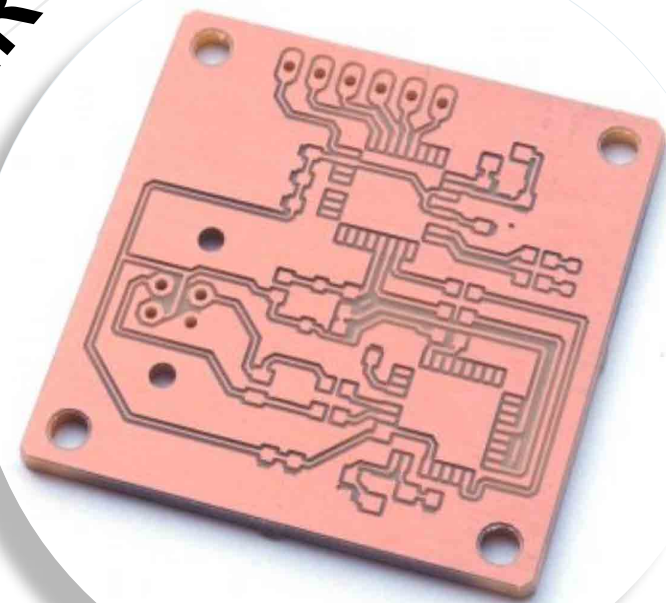
SCHEMATICS



DUAL LAYER
CIRCUIT BOARDS



CIRCUIT BOARD



Other Tools

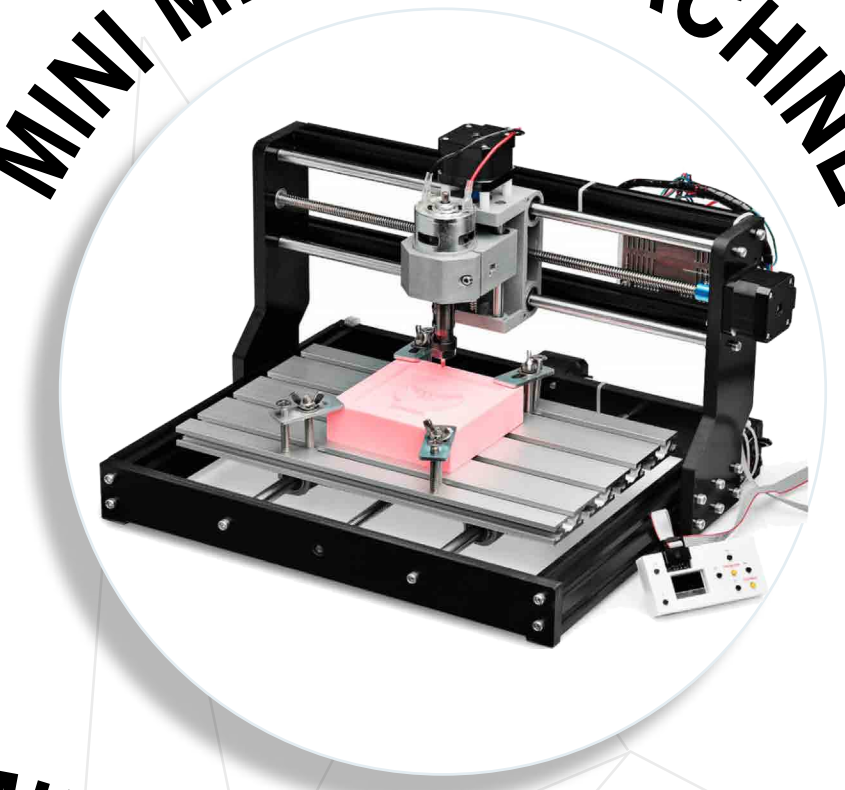
JIGSAW



MINI LATHE



MINI MILLING MACHINE



PRESS DRILL



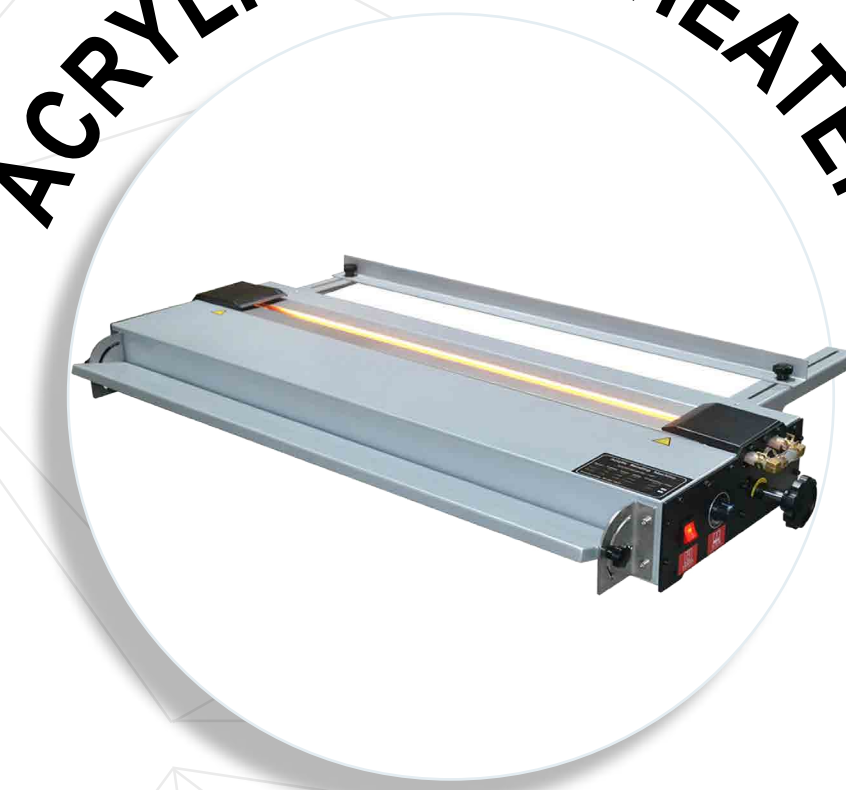
DREMEL KIT SET



VACUUMING FORMING MACHINE



ACRYLIC STRIP HEATER



SOLDER STATION



HEAT PRESS & IRONS



SEWING MACHINE



SUBLIMATION PRINTER



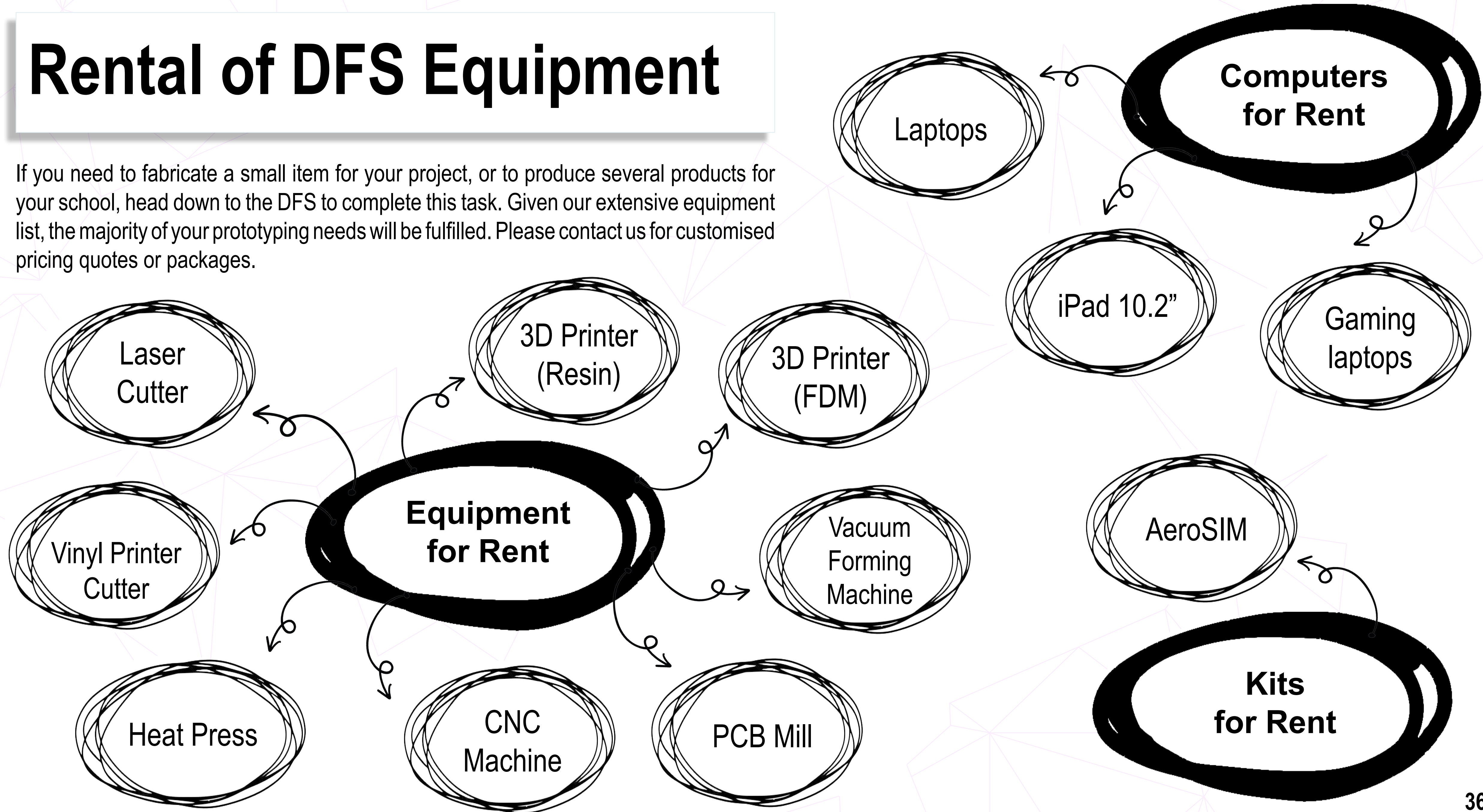


“Give every day the chance to become the most beautiful in your life.”

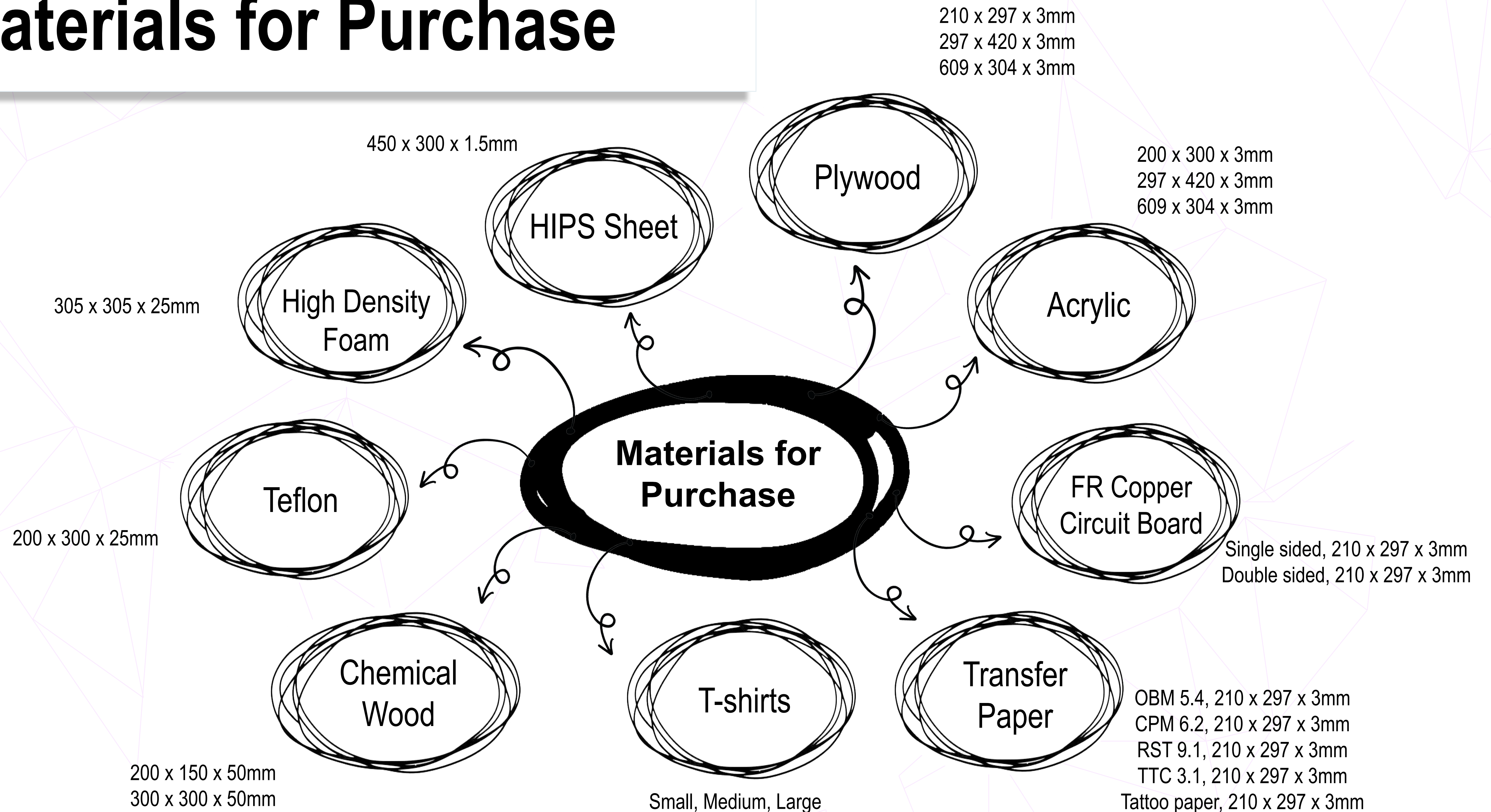
- Mark Twain

Rental of DFS Equipment

If you need to fabricate a small item for your project, or to produce several products for your school, head down to the DFS to complete this task. Given our extensive equipment list, the majority of your prototyping needs will be fulfilled. Please contact us for customised pricing quotes or packages.



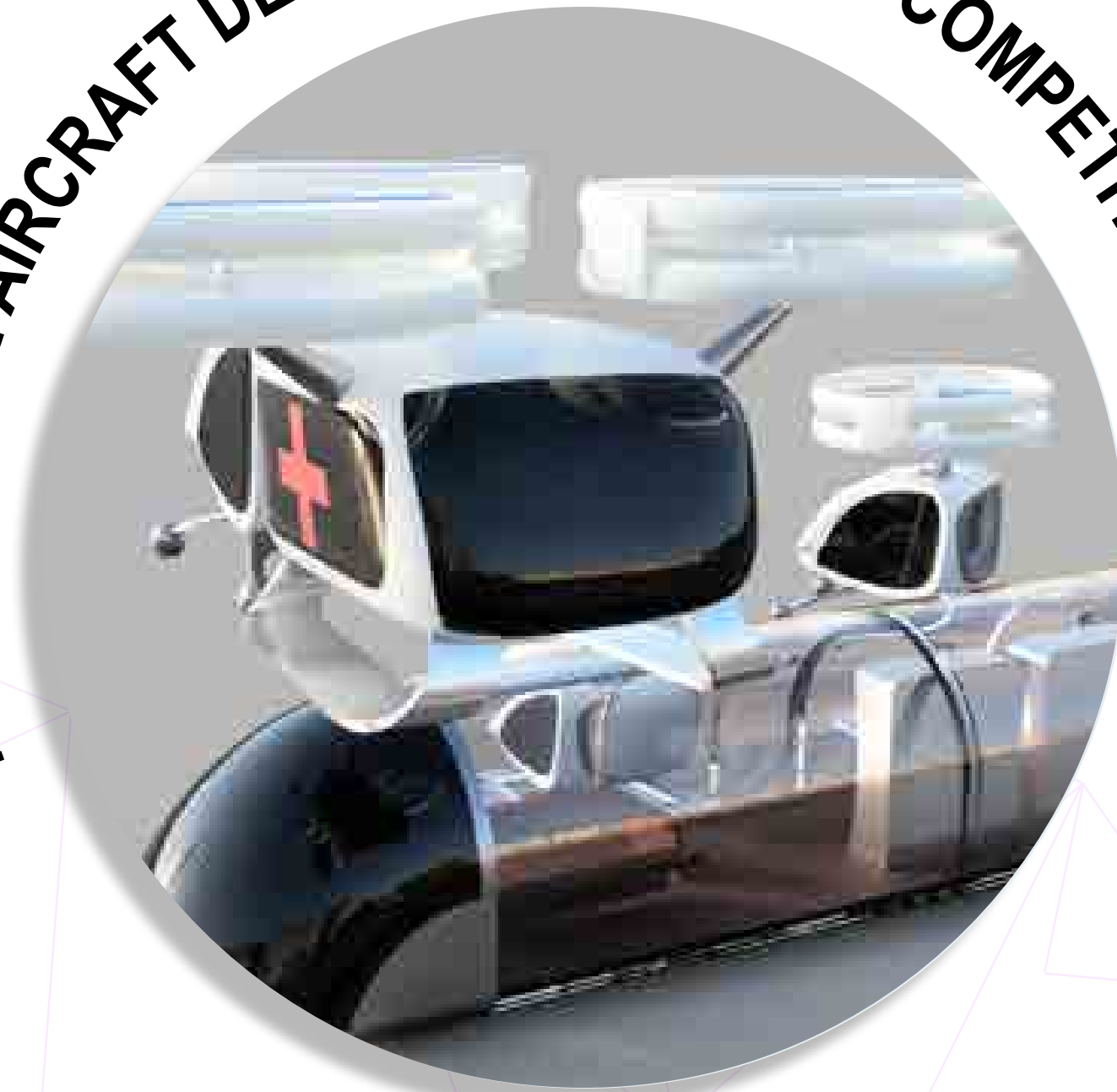
Materials for Purchase



Project Consultation

With our diverse staff profile, we are able to provide consultations on the projects undertaken. We provide multiple perspectives so that students are able to see the project from a fresh angle. They can also gain valuable insights to further improve their thought processes.

ICAO FUTURE AIRCRAFT DESIGN & CONCEPTS COMPETITION



A student from Hwa Chong Institution was crowned the regional winner of the Asia-Pacific for his revolutionary entry in the competition. Themed on urban city transport, it involves passenger drones that integrate in-air and connect with metro systems, optimizing energy efficiency for longer distances.

RAFFLES GIRLS SCHOOL SCIENCE MENTORSHIP PROGRAM (SMP)



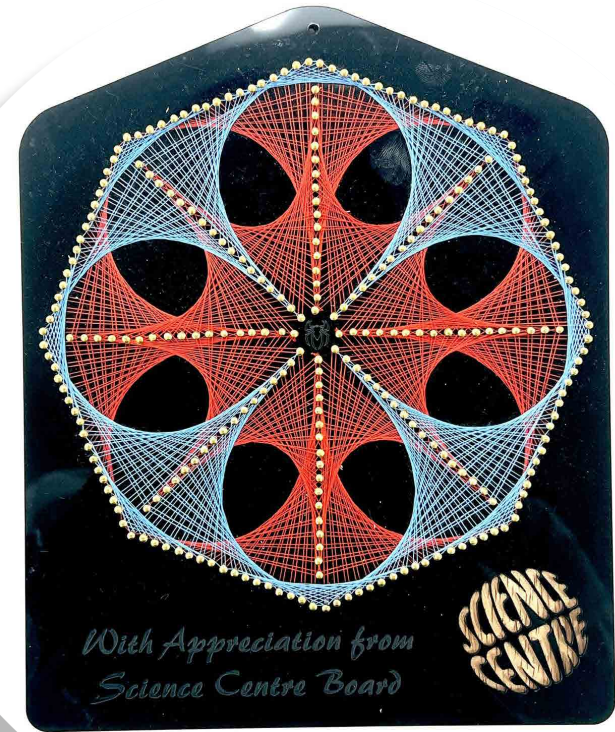
Two students from Raffles Girls' School embarked on a year-long Science Mentorship Program (Engineering) (SMP-E), culminating to the Youth Science Conference (YSC). Their project idea won praise from the judges. The girls also submitted their project for the Singapore Science & Engineering Fair (SSEF).

Commissioned Artworks

Trophy - NXplorer



TOA - Spiderman String Art



TOA - Staff Appreciation



TOA - Young Scientist 40th Anniversary



TOA - Youth STEM Empowerment Program



TOA - Gold SCS Building



TOA - SCSA 1998 Winner Toy



TOA - SCB Board Member



“Do not be embarrassed by your failures, learn from them and start again.”

- Billionaire founder of Virgin Group, Sir Richard Charles Nicholas Branson



singapore



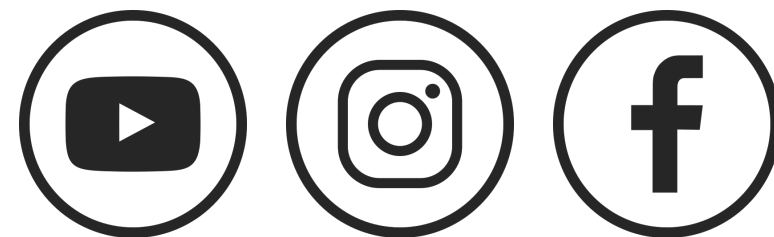
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Einstein Room (Level 2)