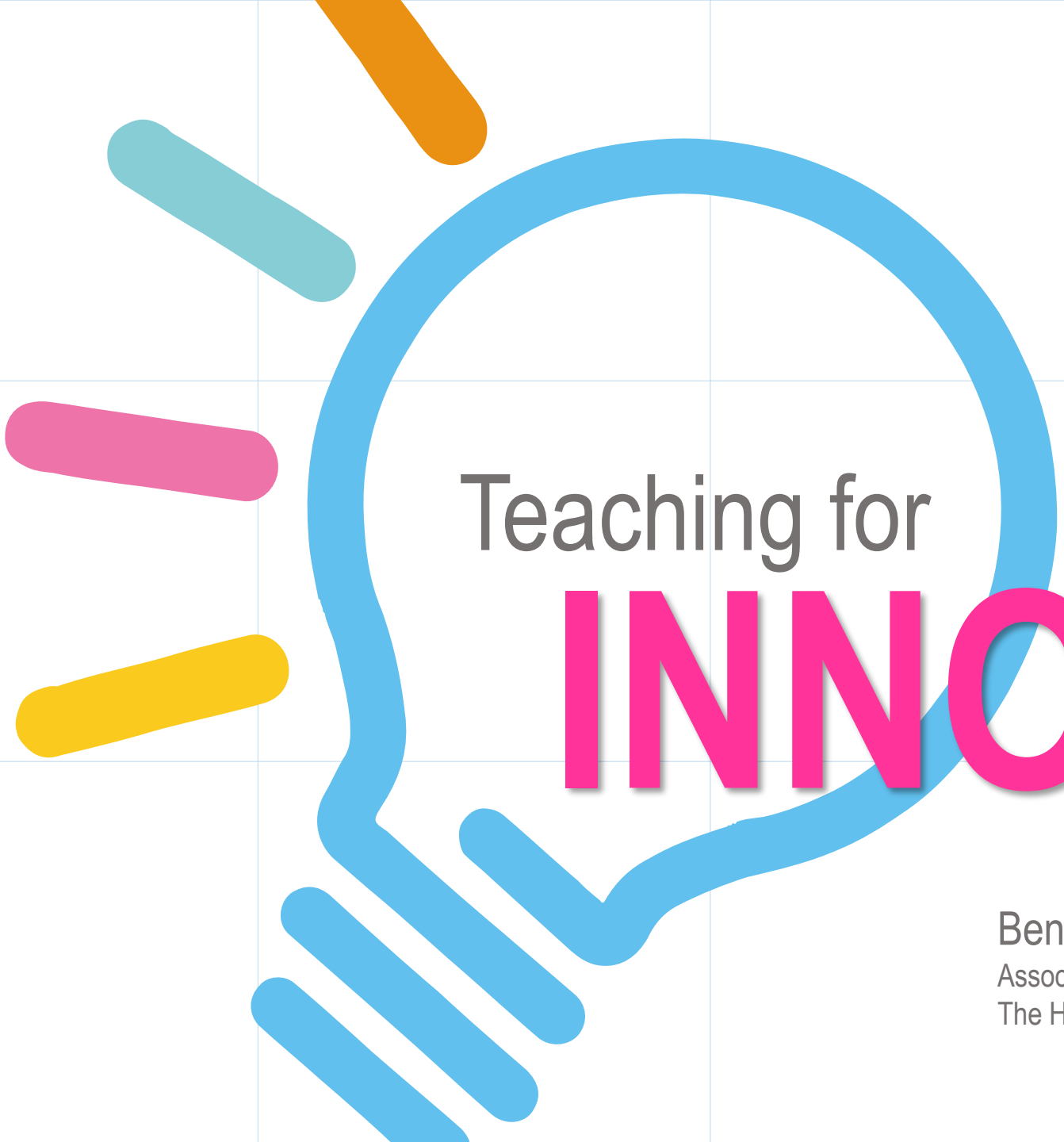


Teaching for INNOVATION

Ben Y B CHAN
Associate Director, Center for Engineering Education Innovation
The Hong Kong University of Science ad Technology

What is the impact of innovation?

95% Competition
feel innovation can drive a more competitive economy

91% Go Green
feel innovation can create a greener economy

88% Jobs
feel innovation is the best way to create jobs

86% Partnership
feel partnership is more important than stand-alone success

87% Society
feel we should bring value to society as a whole not only to individuals

Improve Lives
can successfully change citizens' lives in the next 10 years in:

- **90%** Communications
- **87%** Health Quality
- **84%** Job Market
- **84%** Environmental Quality

What drives Innovation?

66% Value of Innovation
believe that innovation will happen when the general public is convinced of the value that innovation will bring to their lives

65% Universities & Schools
feel that innovation happens when local universities and schools provide a strong model for tomorrow's leaders

62% Patent Protection
agree that when the protection of the copyright and patent are effective then innovation can occur

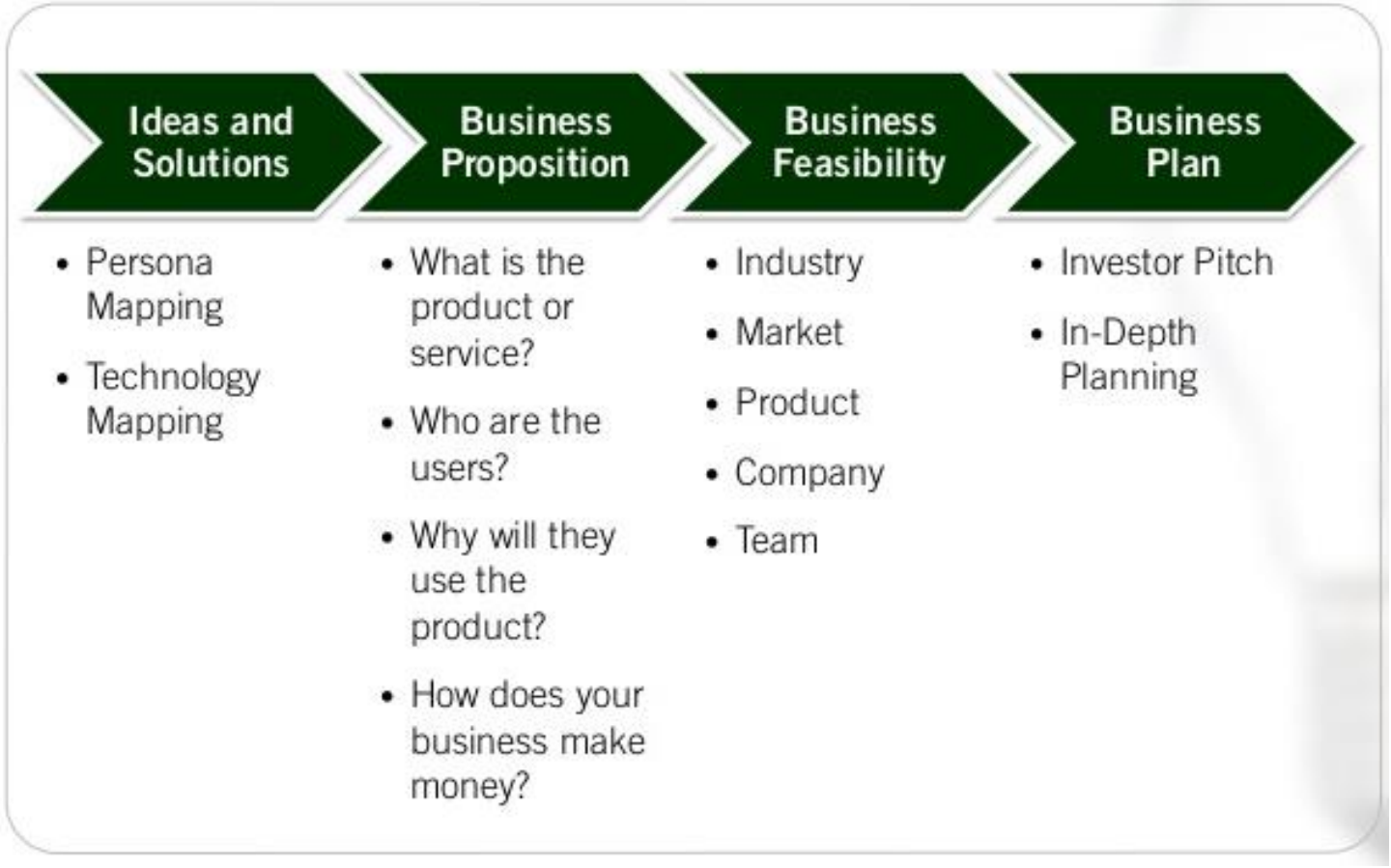
58% Private Investors
believe that innovation will occur when private investors are supportive of companies that need funds to innovate

Budget Allocation 48%
believe that when government and public officials set aside an adequate share of their budget to support innovative companies, innovation can brew

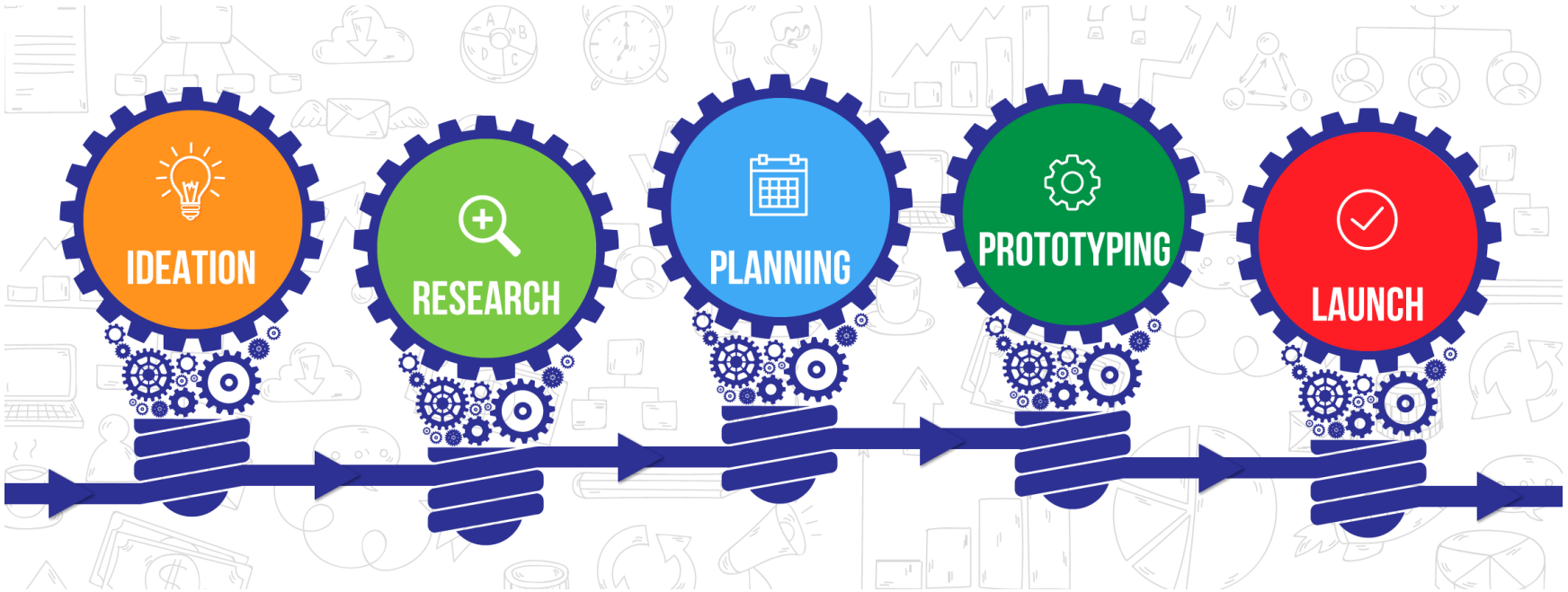
Government Support 43%
think innovation can occur when governmental support for innovation is efficiently organized and coordinated

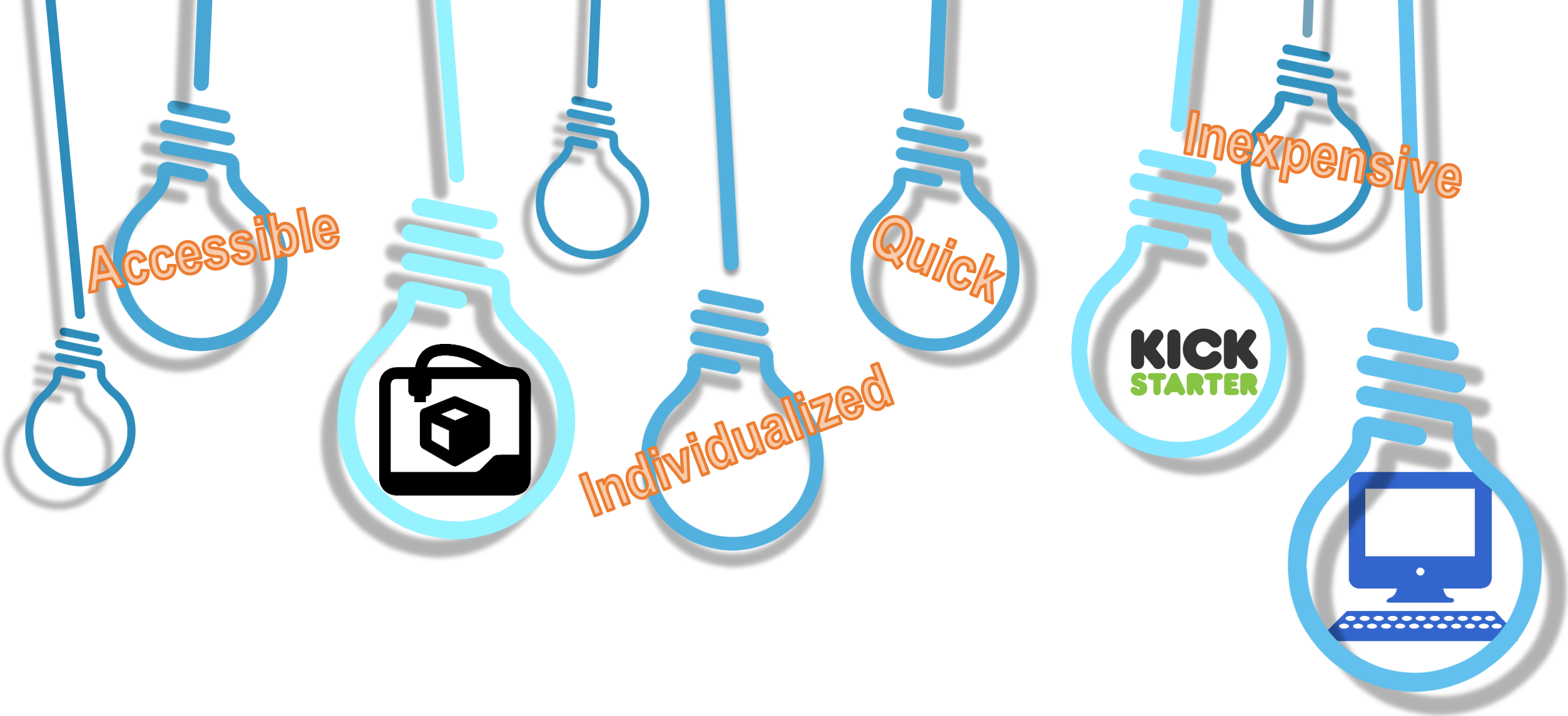
yr 1997

The Process of Innovation



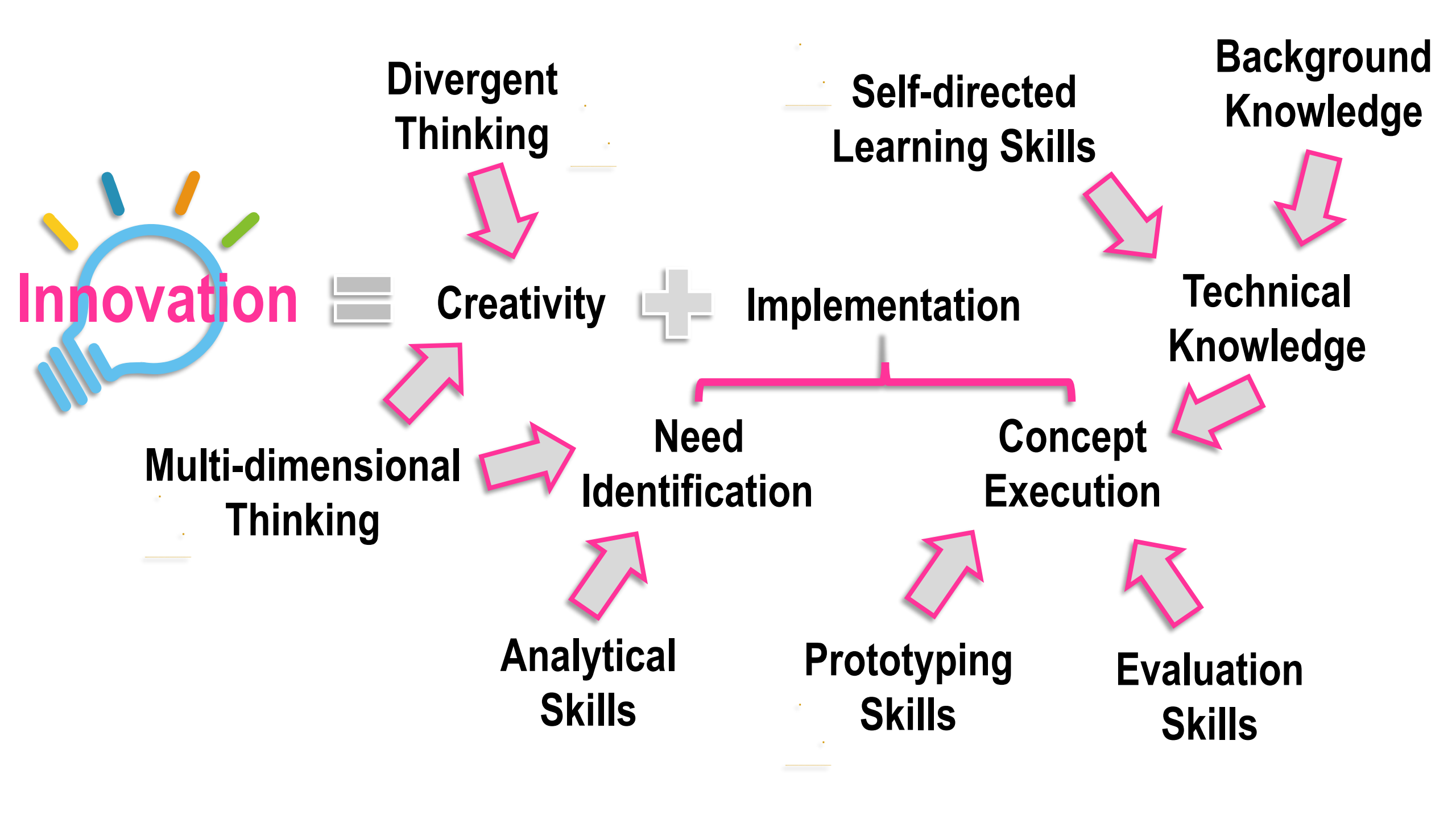
yr2017 The Process of Innovation



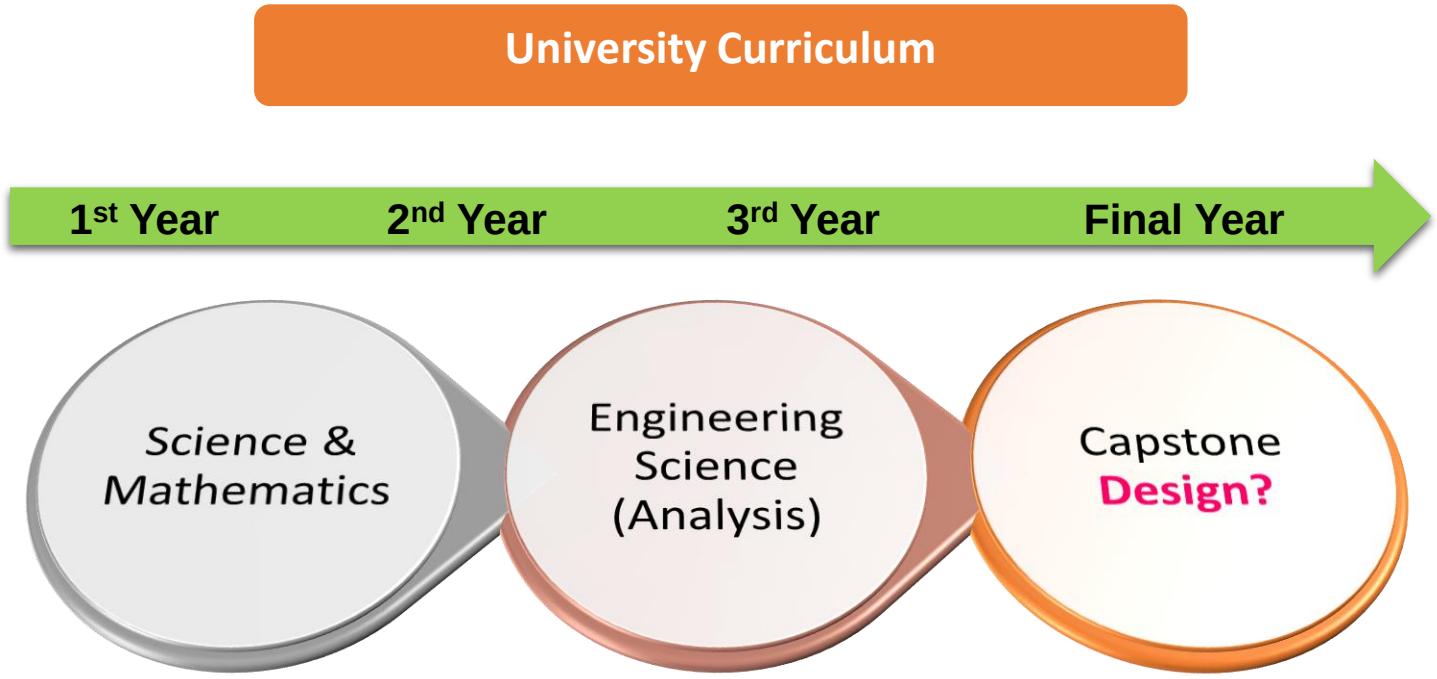


The New Generation of Innovation

Open Innovation Model

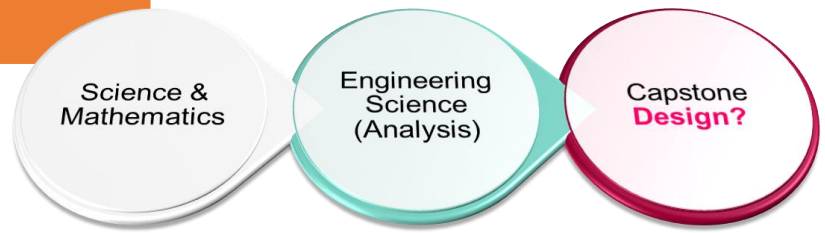

Innovation
=
Creativity
+
Implementation
Divergent Thinking
Multi-dimensional Thinking
Need Identification
Analytical Skills
Concept Execution
Prototyping Skills
Evaluation Skills
Self-directed Learning Skills
Background Knowledge
Technical Knowledge

Too often design occupies the top drawer to be opened only when Accreditation time approaches. Our higher education curriculum remains unchanged over the past 150 years.



University Curriculum
In last 150 years

Direct

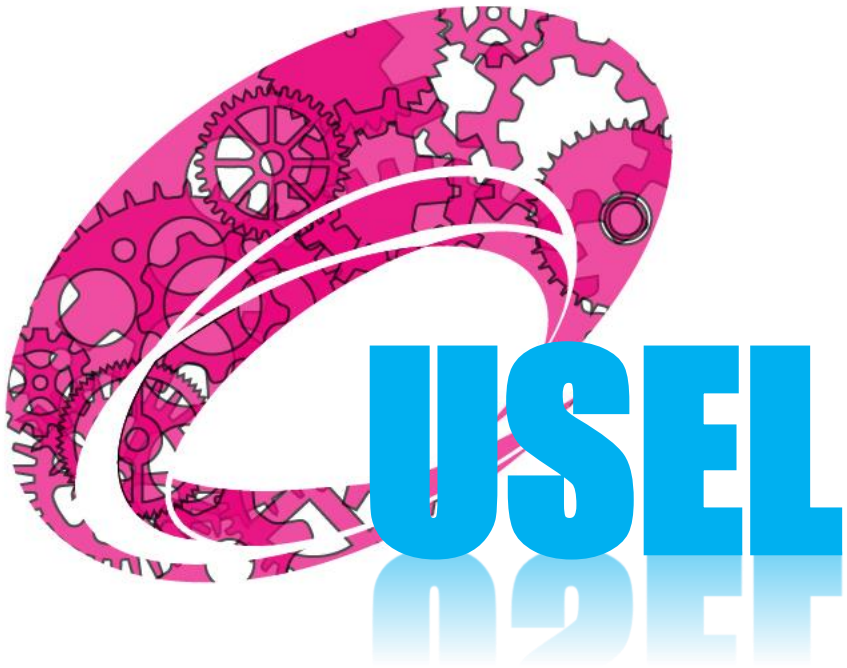


Deterministic Process ≠ Design

MAKER SPACE

Undergraduate Student-initiated Experiential Learning Laboratory

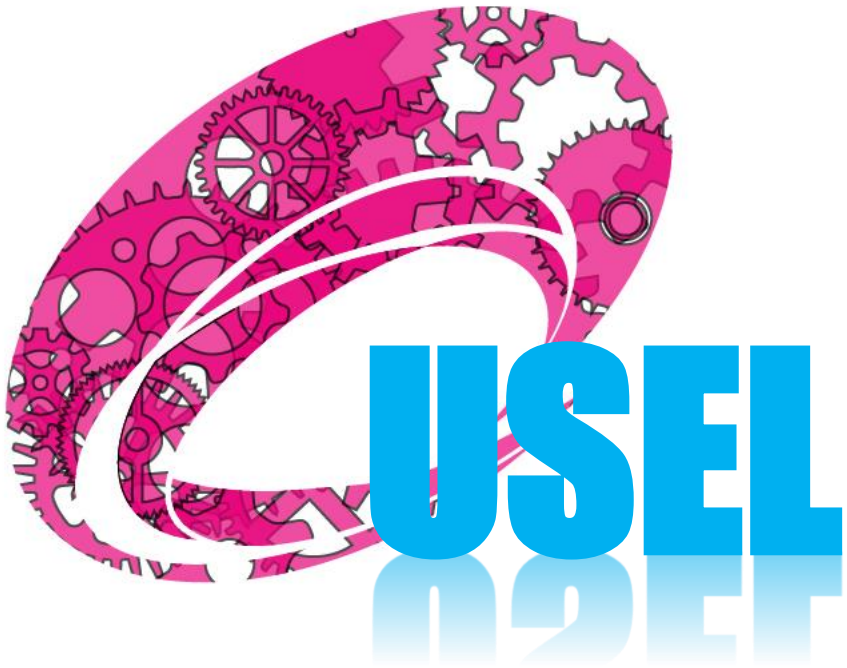
Undergraduate Student-initiated Experiential Learning (USEL) Laboratory



USEL is a student-managed and operated MakerSpace with all the necessary power tools and equipment for quick prototyping, which allows students to get their hands dirty whenever they have an idea in mind. Senior Students from different engineering disciplines will be recruited and trained to provide training and professional service to junior students. The USEL Lab concept is an engineering hub with innovators and senior students in different areas to provide professional advices and prototyping supports. This is not just a place for engineering students and it will be distinctive in Hong Kong and will serve as a critical milestone for innovation and entrepreneurship development

USEL Lab is not a conventional space for students to gather and do their projects. It is a reconfigurable learning environment which serves the functions of a design studio, a prototyping studio, a training center, a co-op shop and a demonstration studio. It will be operated and managed by senior engineering students 24 hours a day, 7 days a week. Certified students will conduct self-financed training workshops and provide original equipment manufacturer (OEM) service for other students.

Undergraduate Student-initiated Experiential Learning (USEL) Program



In order to encourage students to develop their own project idea, the School of Engineering is providing student-driven practicum opportunities to UG students through the Undergraduate Student-initiated Experiential Learning Program. Students may initiate projects of their interest under guidance of a faculty member.

- Faculty Advisor Pairing
- Startup Funding Support
- Technical Skill Training
  - 3D printing
  - Power tools operation
  - Laser cutting
  - 3D scanning

Facilities

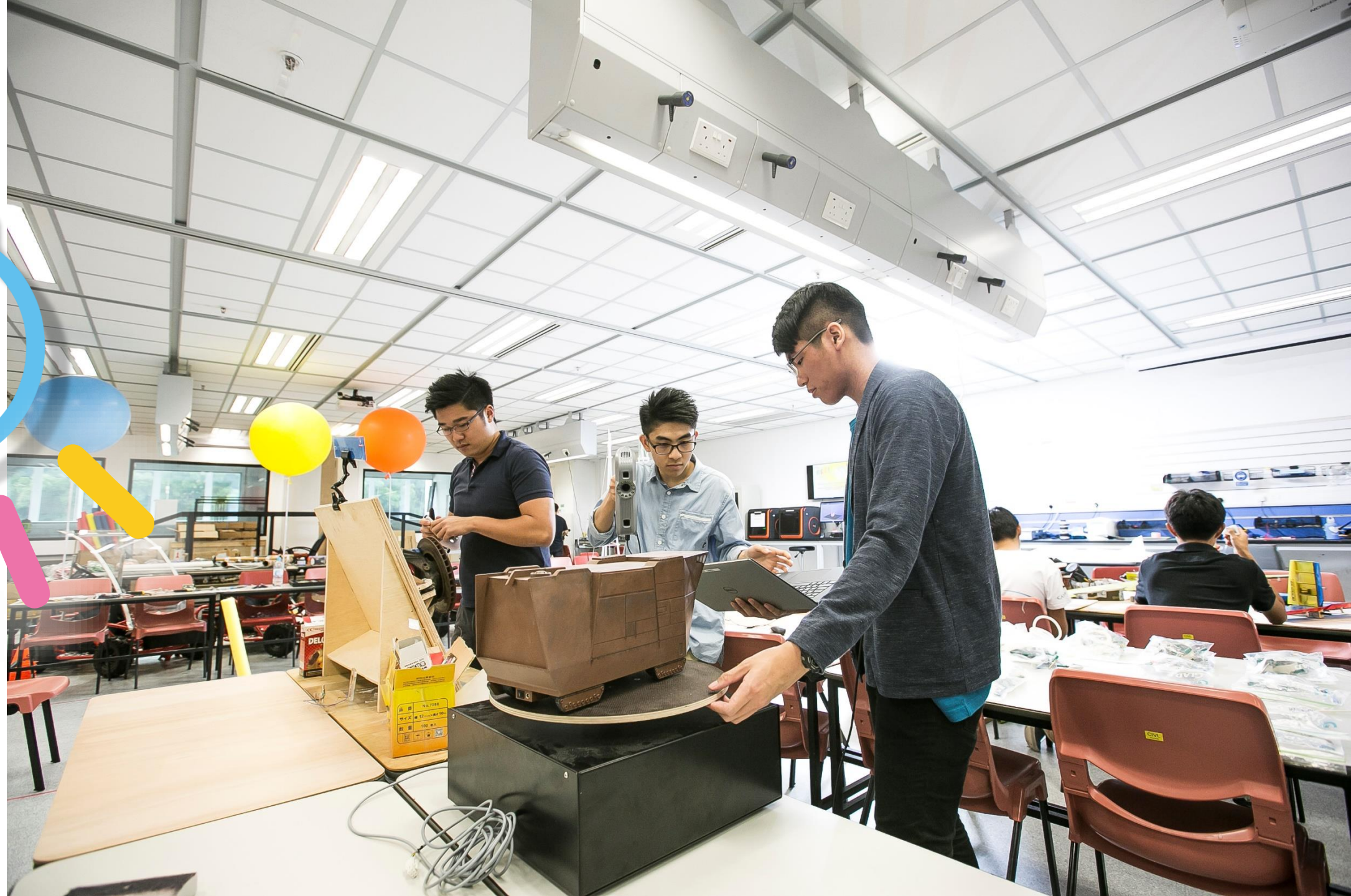
- Video projectors positioned around the room for group presentation and discussion
- 3D design studio
  - Computers with design software
  - 3D scanners
  - 3D printers, etc
- Manufacturing studio
  - Large layout tables
  - Hand tools
  - Power tools
  - Drill press
  - Laser cutter, etc
- Circuit design equipment
  - image processing
  - fabricating measuring probes
  - LabView etc
- VR and AR equipment
- Motion detection and analysis devices.

Equipment List

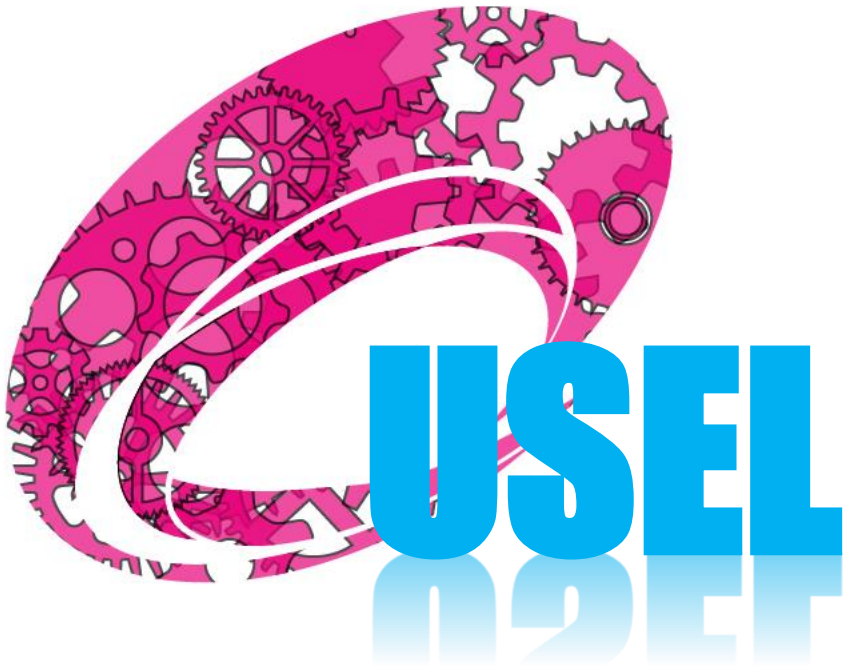
- Digital multi-meters
- Soldering Stations
- Refrigerator
- 3D Printers
- 3D Scanner
- Laser Cutter
- Oculus Rift Sets
- Hotplate
- Hacksaws
- Oven
- Mantle
- Electronic Balance
- Vortex Genie
- Leap Motion Controller
- Kinect Sensor
- IAQ monitor
- Sound and Vibration monitor
- Resin Infusion Catch Pot
- Cordless Mulit-tool
- Shaking Table
- Orbital Shaker
- Incubator
- Benchtop Vise
- Oscilloscopes
- Portable Cordless Drill
- Soldering irons
- Hacksaw, Cordless
- Cordless Drills
- Compact Bandsaw, Cordless
- Cordless Screwdrivers
- Compact Vacuum, Cordless
- Cordless Blower
- Cordless Hex Impact Driver
- Cordless Screw/Hex Driver
- Cordless Jigsaw
- Cordless Vacuum 7.5L
- Angle Grinder, Cordless
- Straight grinder
- Wind Tunnel

PUSH

390



Undergraduate Student-initiated Experiential Learning (USEL) Program



There are 3 USEL courses carrying different numbers of credits (a different suffix will be added to the course code for different academic terms):

- ENGG2991 - Undergraduate Student-initiated Experiential Learning (1 credit)
- ENGG2992 - Undergraduate Student-initiated Experiential Learning (2 credits)
- ENGG2993 - Undergraduate Student-initiated Experiential Learning (3 credits)

If students on the same USEL project have different preferences for credit-bearing and non-credit bearing project, 2 separate applications must be submitted to the School. For the credit-bearing project, the role played by each group member should be described clearly so as to justify the granting of credits. One fixed credit value will be approved for all members in the same credit-bearing project.

Status of USEL Projects (up to 15 Feb 2017)

	Project Title	Project Advisor	Project Start Date	Project End Date	Project Status	Credit Bearing ? Y/N, (no. of students)
1.	Real time Display of machine status	Dave Rossiter	Sept 2015	Dec 2015	Finished	N (4) + (4)
2.	AIG-AIAA Design/Build/Fly Competition	Larry Li	Nov 2015	Apr 2016	Ongoing	N (16)
3.	Portable Drug Box	Tim Woo	Nov 2015	Mar 2016	Finished	N (3)
4.	Salt Analysis	Marshal Liu	Nov 2015	Dec 2015	Finished	N (5)
5.	Large Scale Early Warning System for Deadly Environmental Elements	Dave Rossiter	Dec 2015 Feb 2016	Mar 2016 May 2016	Finished	N (3) Y (2 with 3 credits)
6.	Real Time location Tracking of Vehicles	Cindy Li	Feb 2016	Aug 2016	Finished	N (1) Y (3 with 2 credits)
7.	Cheese Making	Marshal Liu	Feb 2016	Apr 2016	Finished	N (3)
8.	Sea salt analysis and production	Marshal Liu	Mar 2016	Jul 2016	Finished	N (5)
9.	Powered Wheelchair	Robin Ma, Michael Wang, Chris Chao	Apr 2016	Oct 2016	Finished	N (5)
10.	The fabrication of chemical reaction powered car	Tom Luo	Apr 2016	Nov 2016	Finished	N (13)

Status of USEL Projects (up to 15 Feb 2017)

	Project Title	Project Advisor	Project Start Date	Project End Date	Project Status	Credit Bearing ? Y/N, (no. of students)
11.	Smart Luggage	S. H. Song	Oct 2016	Jan 2017	Finished	N (4)
12.	2016 Redbull Flugtag	Ben Chan	Oct 2016	Jan 2017	Finished	N (2)
13.	Milling Industry Handling Robot	Robin Ma	Oct 2016	Mar 2017	Ongoing	N (4)
14.	The fabrication of chemical reaction powered car (2)	Tom Luo	Feb 2017	Nov 2017	Ongoing	Y (9 with 1 credit)
15.	Design, Build and Test and Electrical Vehicle (EV)	CN Ko	Feb 2017	Jun 2017	Pending approval	N (13)
16.	Effects of grinding frit size and speed on steel	Ben Chan	Feb 2017	Aug 2017	Pending approval	N (1)
17.	Synchronization of capillary jet for 3D printing	Larry Li	Feb 2017	May 2017	Pending approval	N (2)

Online Prototyping Bite-size Training

Online Prototyping Bite-size Training

- On-line Learning (HKMOOC, CANVAS)
- Data Analytic (VisMOOC)
  http://vis.cse.ust.hk/vismooc/#!/

Online Prototyping Bite-size Training

Engineering Experiential Learning Laboratory Training Modules › Quizzes › Quiz: 3D Printer

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Syllabus

Outcomes

Files

Conferences

Collaborations

Settings

Quiz: 3D Printer

This is a preview of the published version of the quiz

Started: Nov 21 at 5:40pm

Quiz Instructions

If you wish to become a registered user for the 3D printers in USEL lab, you will first have to complete w
videos and quizzes. After you have completed the quiz, screen capture your result (example shown belo
one of the USEL Lab assistants and he/she will help you to complete the registration process.

Video: Initialization

Manual: ep_box_user_manualInitialization(20170721).pdf

Engineering Experiential Learning Laboratory Training Modules › Quizzes › Quiz: Laser Cutter

Quiz: Laser Cutter

This is a preview of the published version of the quiz

Started: Nov 21 at 5:40pm

Quiz Instructions

If you wish to become a registered user for the laser cutter in USEL lab, you will first have to complete watching the videos and quizzes. After you have completed the quiz, screen capture your result (example shown below) and show it to one of the USEL Lab assistants and he/she will help you to complete the registration process.

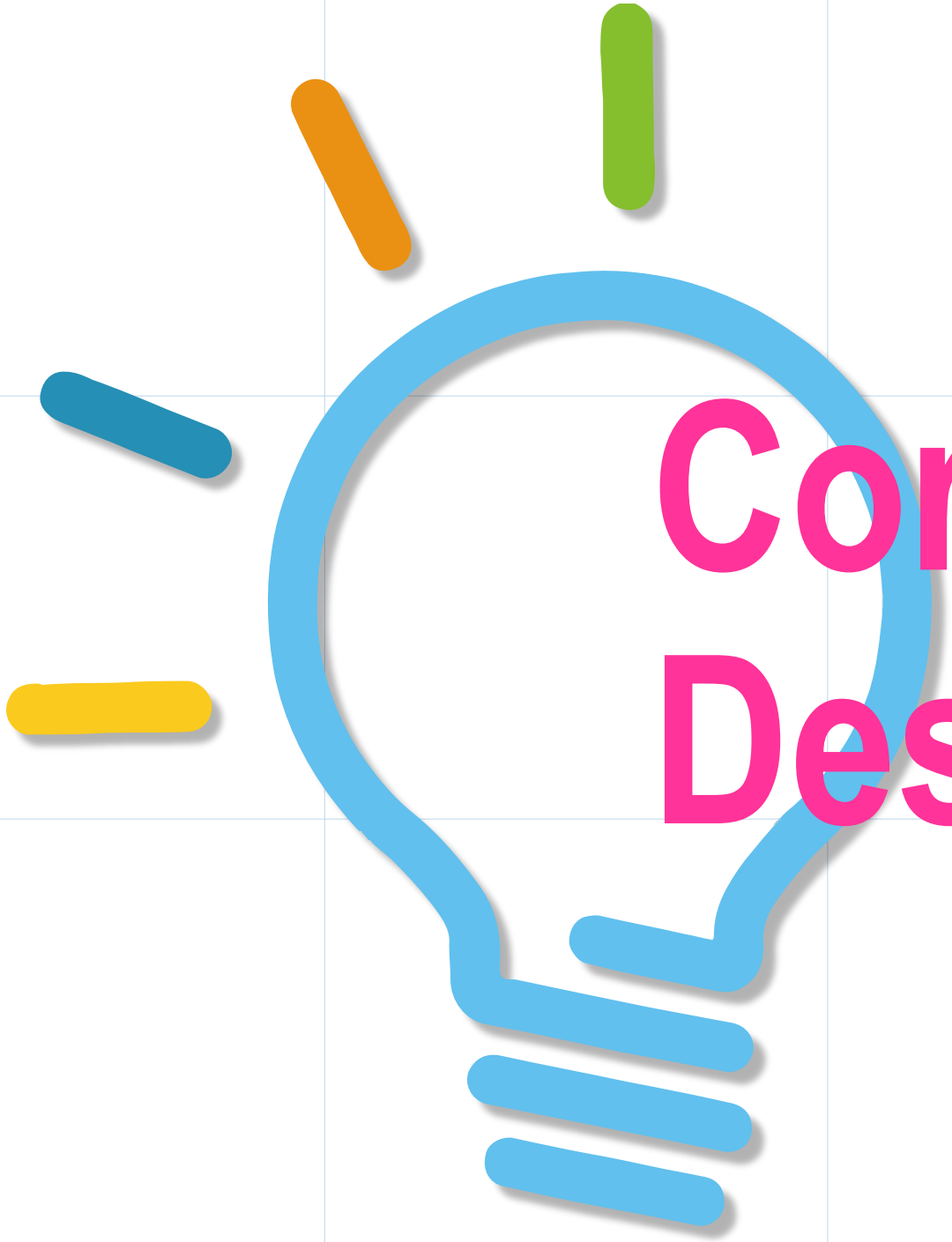
Keep Editing This Quiz

Questions

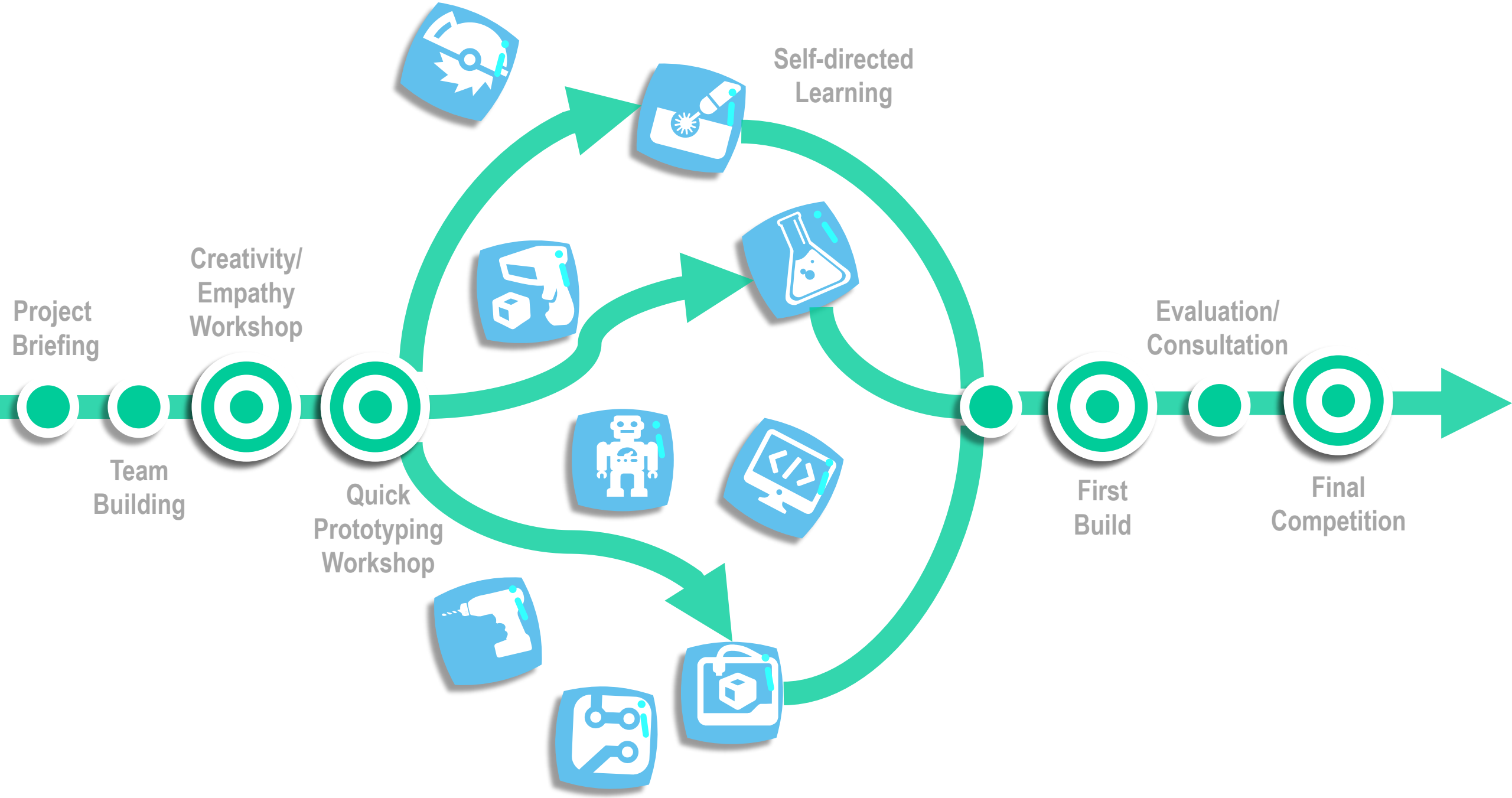
Spacer
Spacer
Question 1
Question 2
Spacer
Question 3
Question 4
Question 5

Time Elapsed Hide

0 Minutes, 2 Seconds

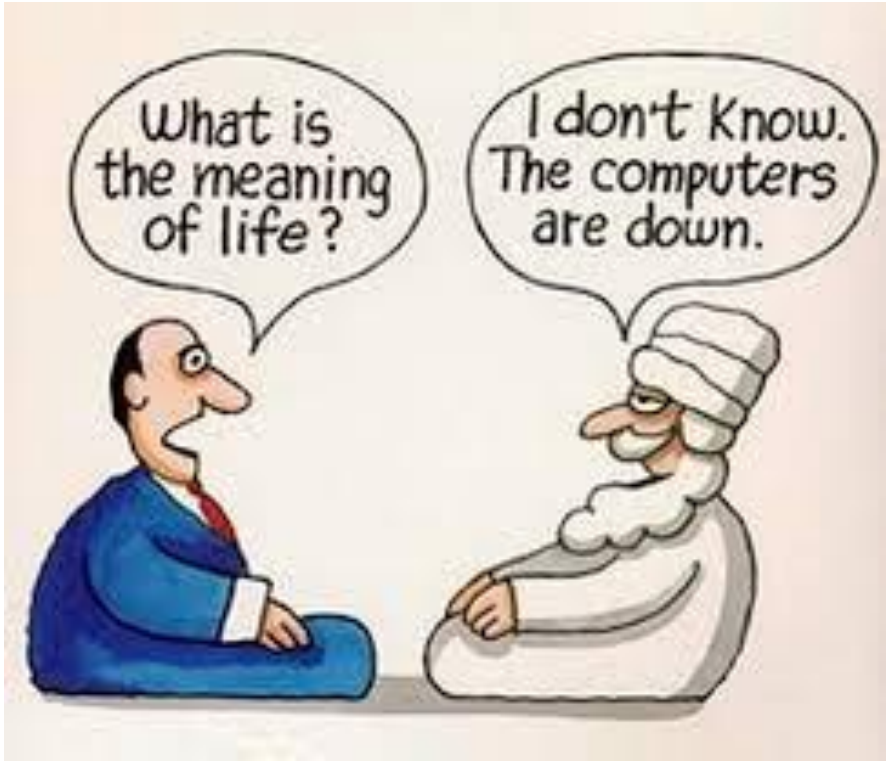


Cornerstone Design Courses


Project Briefing
Team Building
Creativity/ Empathy Workshop
Quick Prototyping Workshop
Self-directed Learning
First Build
Evaluation/ Consultation
Final Competition

TEAMWORK

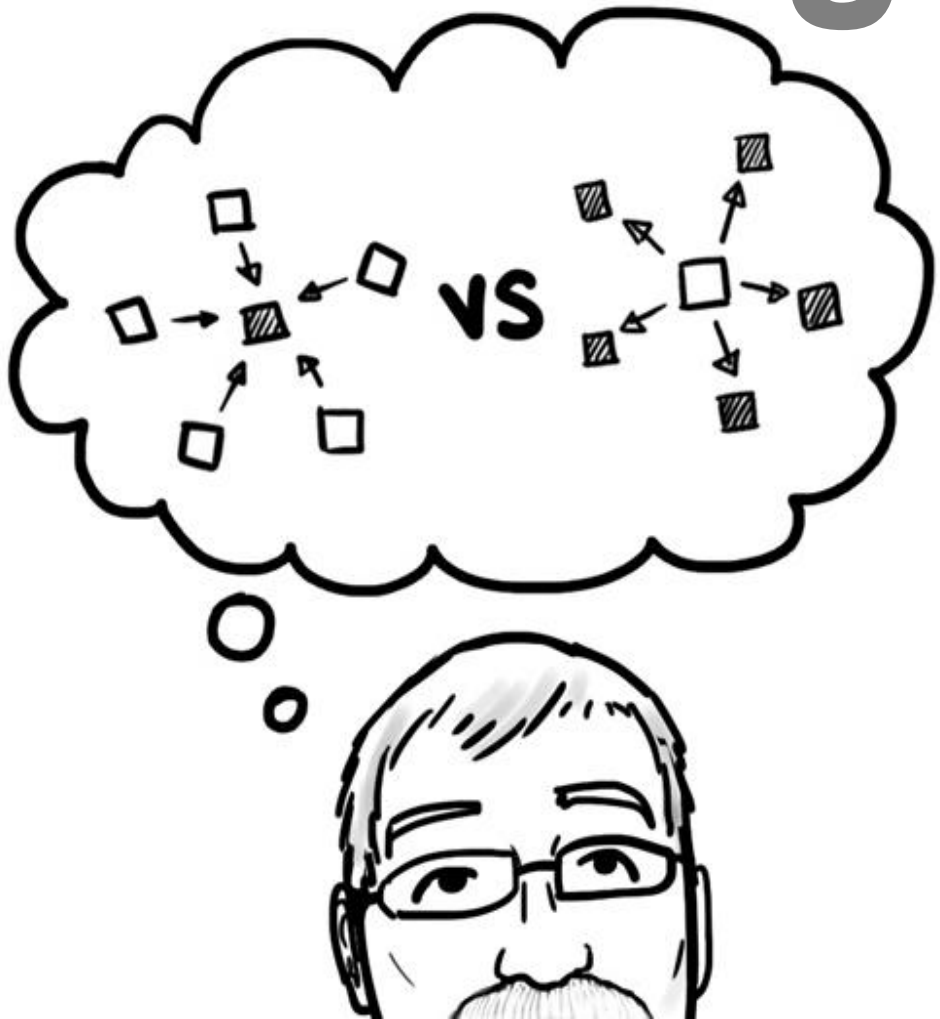
Make ~~Money~~ Meaning



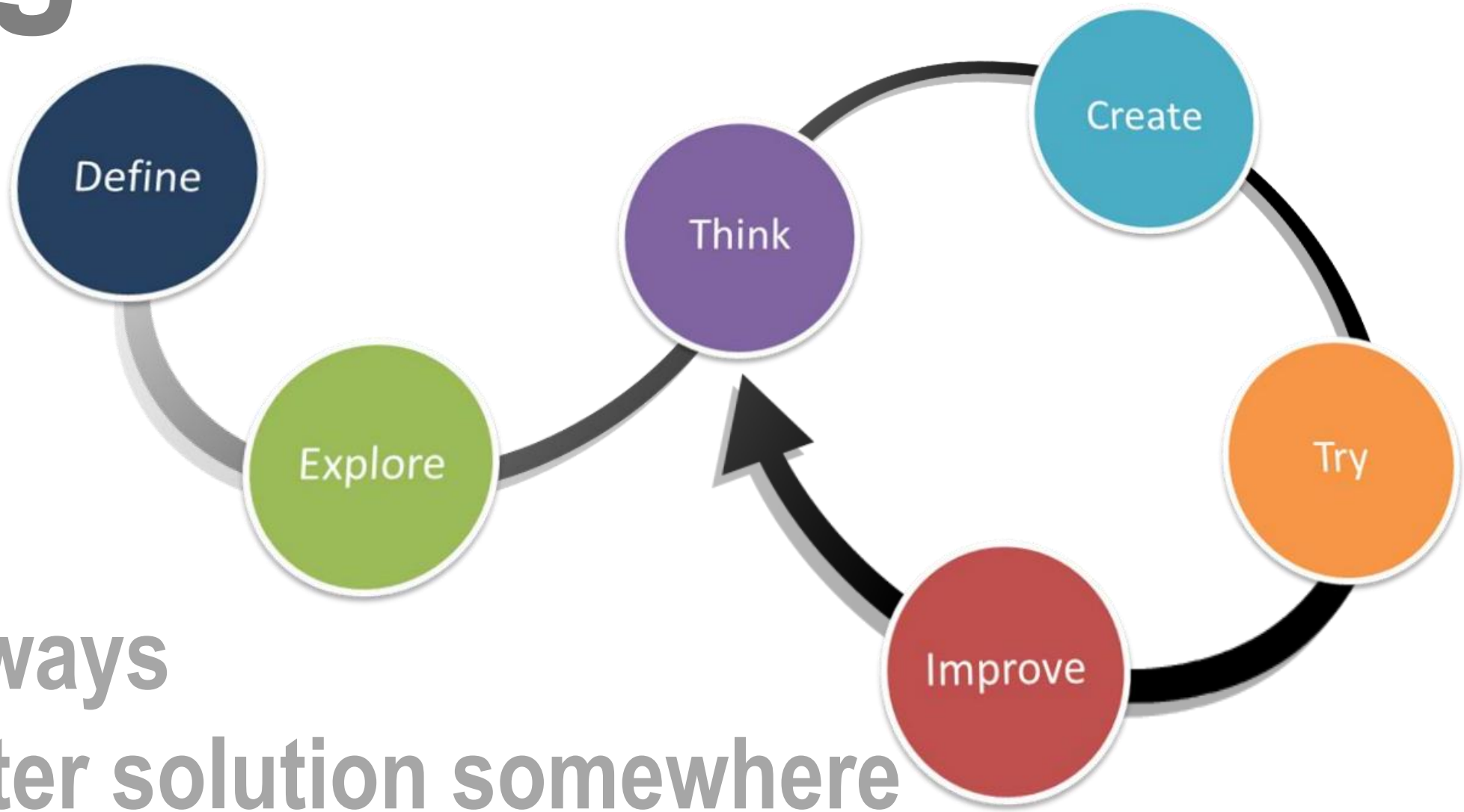
Creativity

Quick Prototyping

Divergent/Convergent Thinking



Design Process



There is always
a better solution somewhere