Week 3–Design Thinking & School Engagement

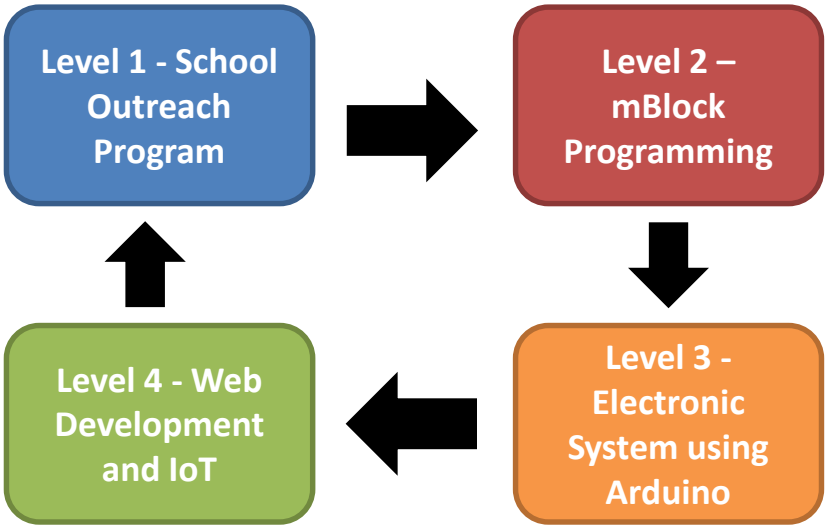
UMP STEM LAB
See . Think . Explore . Marvel

Universiti Malaysia PAHANG
Engineering • Technology • Creativity

Program Outline

Outcomes:-
participants are able to:-
1. describe how internet works
2. describe 'digital technology'
3. describe how computers work

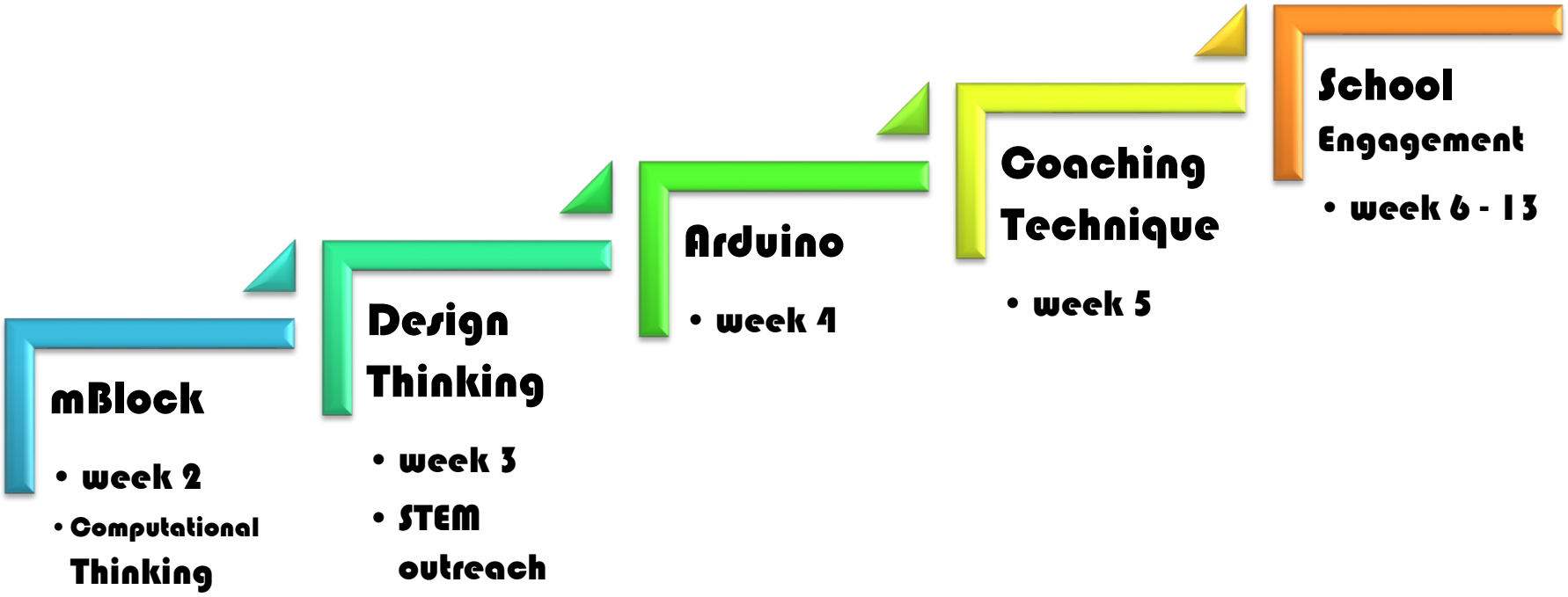
Outcomes:-
participants are able to:-
1. Able to execute simple programming functions
2. able to read digital and analog inputs
3. able to display digital output



Outcomes:-
participants are able to:-
1. describe IoT concept
2. develop small scale website
3. develop a small electronic system that is able to control via apps

Outcomes:-
participants are able to:-
ead data sheet of basic electronics components
2. construct simple electronic circuits
3. design a simple electronic system on open source platform

Course Outline – UQB 2011



Gaps in STEM Education

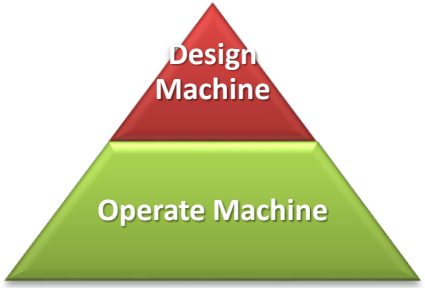
- As schools start to adopt digital literacy – coding, microcontroller, 3D printing - some schools will fall behind due to lack of resources and expertise
- School clubs which used to be able to provide life skills through informal learning are becoming dormant due to the lack of content and focus
- Low interest in STEM (Science, Technology, Engineering, Mathematics) jeopardizing talent pipeline in Technology driven industry
- Poor aptitude or life skills, not ready for workforce

Why 'Programming' Outreach

1st (18th century)	2nd (19th century)	3rd (20th century)	4th (21st century)
Steam	Electrical	Electronics/IT	Cyber-physical

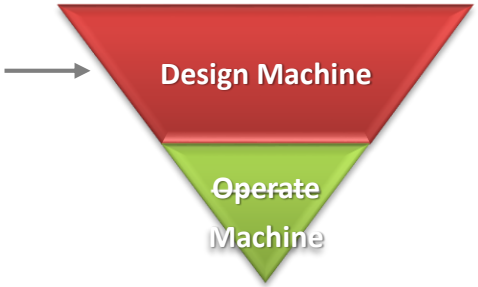
Muscle to Machine → **Mind to Machine**



Tech becoming core knowledge

Coding
Embedded system
Big data analytics
Cloud computing
Machine learning
Digital modelling



Why life skills

Practice

Principle

Phenomena

Previously	Now
	Don't waste time!
$v = u + at$ $s = ut + 1/2at^2$ $v^2 = u^2 + 2as$	School, Homework, Tuition, Exam Camp, Workbook, Enrichment Class
	Don't waste time!

- Problem solving
- Tenacity
- Leadership

UNDER-DEVELOPED LIFE SKILLS

- Curiosity
- Creativity
- Communication

Design Thinking

Empathize

What is the problem?
Identify the challenge
of human context

Define

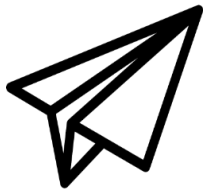
Why is it important?
Research, understand,
& develop statement

Ideate

How do we solve it?
Brainstorm your ideas
& get feedbacks

Prototype

How do we create it?
Start create, experiment,
& fail early



Test

Does it work?
Implement the idea, show,
don't tell, & reflect

https://youtu.be/yY96hTb8WgI

Empathize

What?
When you feel what the other people is feeling
Mirror their expression, opinions, and hopes

Why?
To discover people's explicit and implicit needs

How?
Without judgement, with a beginner's eye,
with curiosity, respectful

Empathize

Word association

Write anything comes to your mind

Food & Agriculture	Automotive/ Mobility	Healthcare

Empathize

Word association

Write anything comes to your mind

Home & Shelter	Heavy Equipment & Machinery	Retailer

Understand the challenge

Empathize

Write down the challenge

Breakdown the challenge:

- What are the possible **problems?**
- Who are the **end users** or customers
- Which **industries** are involved?
- **Why** do they face these problems?
- What are the possible **solutions**?

Empathize

Create questionnaire

Name :	Age:
Occupation :	Contact:
To bond with your subject so you can probe deeper. *Sample questions:* • *Is <<the challenge statement>> important to you?* • *Why is it important to you?*	
To understand what matters to this person. *Sample questions:* • *What are the problems that you face?* • *Why do you face these problems?* • *How do they affect you?*	
To gain insight into how she thinks. *Sample questions:* • *What have you done to overcome the problem?* • *What are the current solutions out there and what are the shortcomings?* • *What will you do differently to solve the problems?*	

Define

Physical and emotional necessities

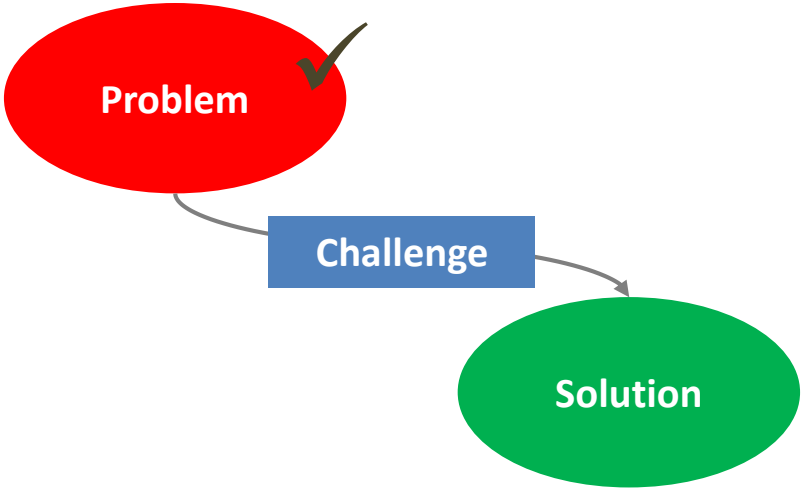
Capture the goals and motivations of the person
for whom you're designing

Are verbs (opportunities), **not** noun (solutions)

Tips
Short. Specific. Sexy

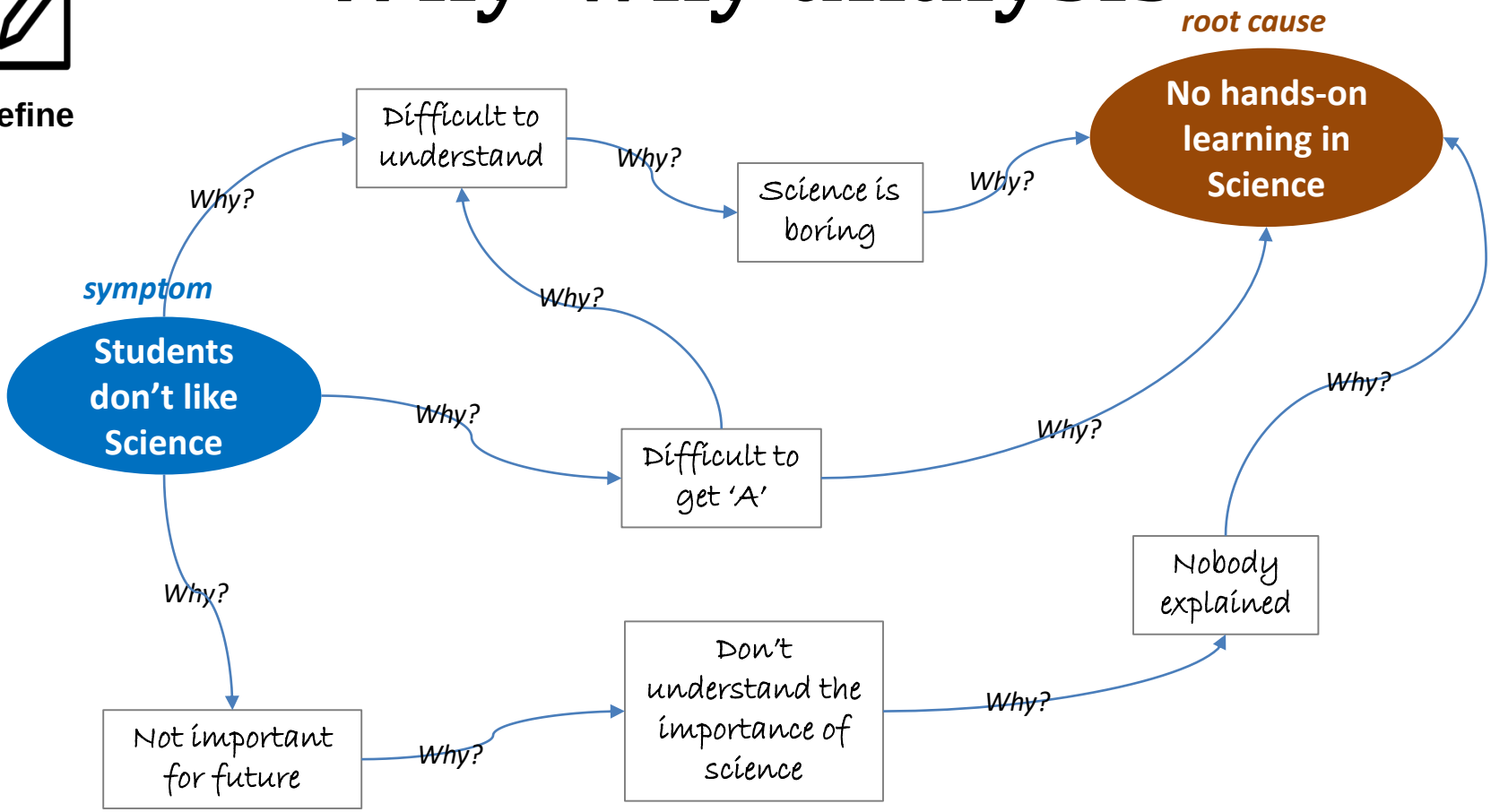
Define

Re-define the problem!



Define

Why-why analysis



Solve the problem at the **root**, not the symptom

Re-define problem statement

Define

1) **Group** similar symptoms/problems
2) Apply **WHY-WHY** analysis to find root cause
3) Based on root cause, re-define the **problem statement**

Write down Problem Statement

Developing Problem Statement / Point-of-View

User: Be specific

Need: Use verbs

Insight: Observation + interpretation

Ideate

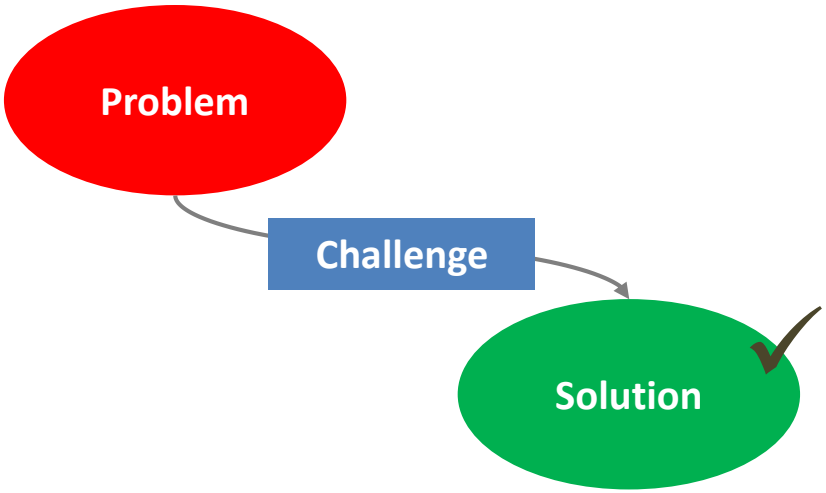
Achieve ideas through **brainstorming**

More ideas are better, crazy ones are encouraged

Must able to be visualized, keep on the topics

Ideate

Generate ideas to test out !



Ideate

There is no bad idea…

https://youtu.be/Hxdqp3N_ymU

Ideate

Generate alternatives

Sketch 4 radical ways to meet your user's needs.

A

B

C

D

Share your sketches and get feedback with your users.

Ideate

Re-define into ONE idea

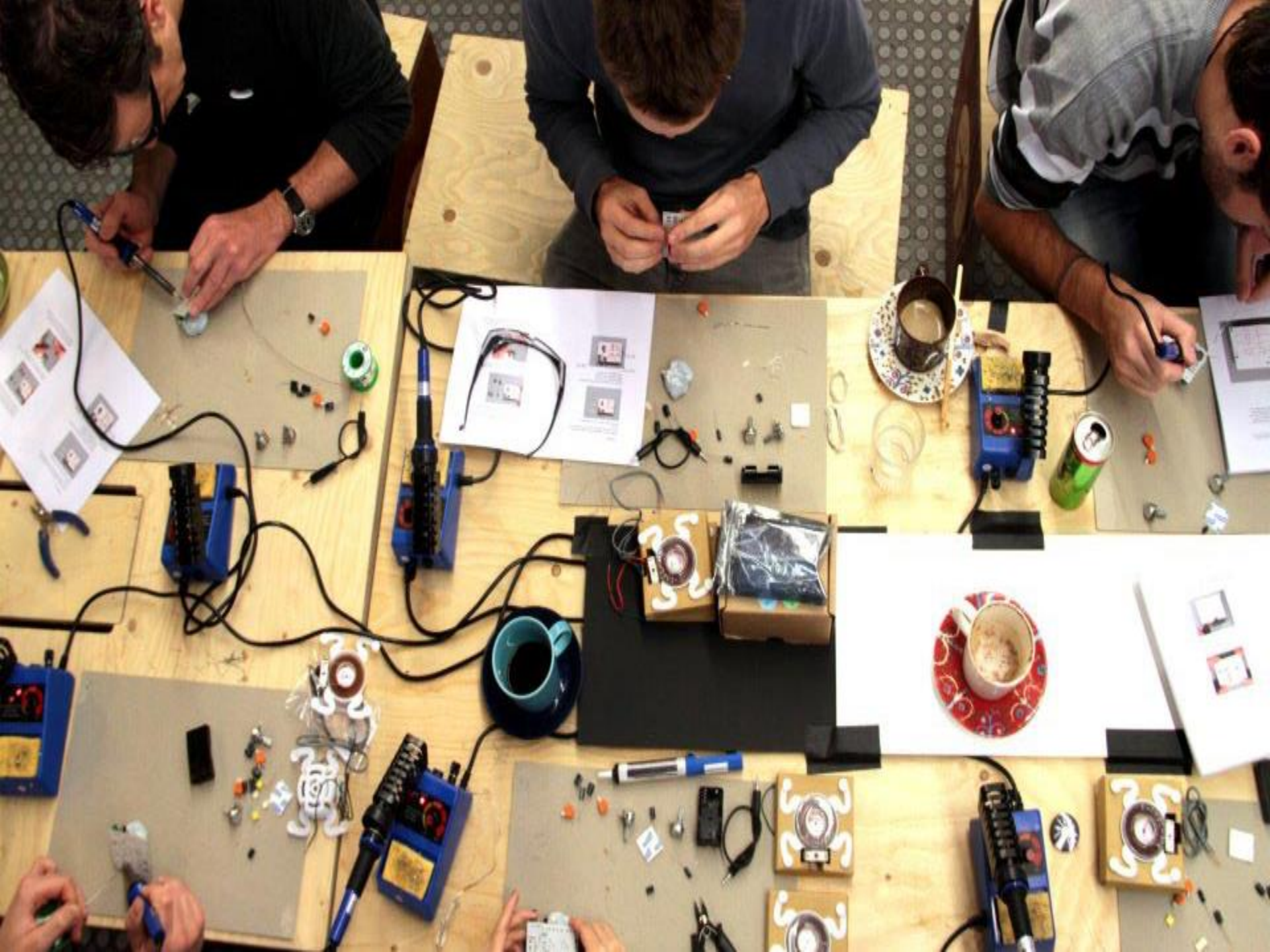
Re-define alternative from user feedbacks

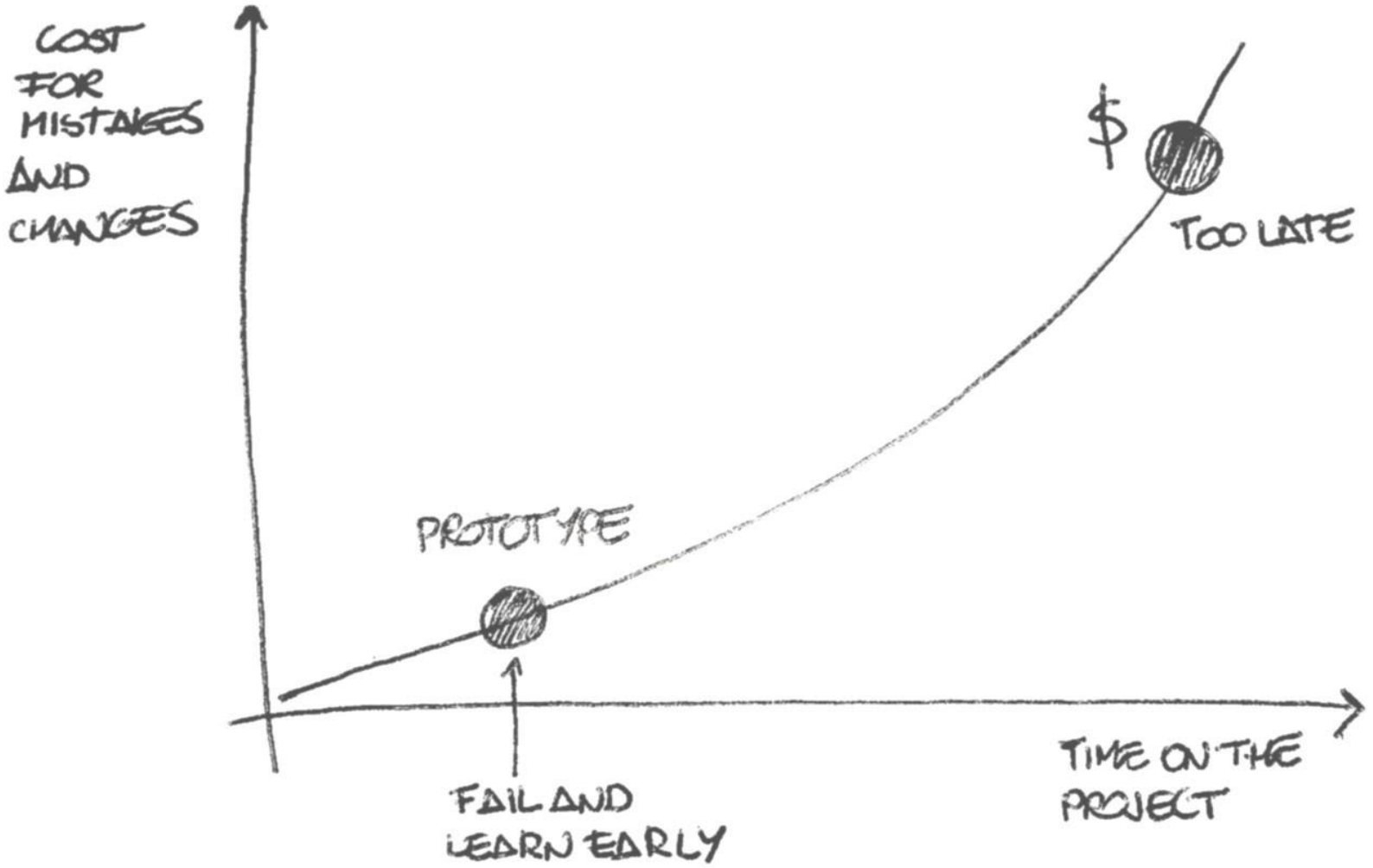
Prototype

To proof the ideas are **tangible**

Should fail early, more experiments

To explore and inspire
- create **experience**



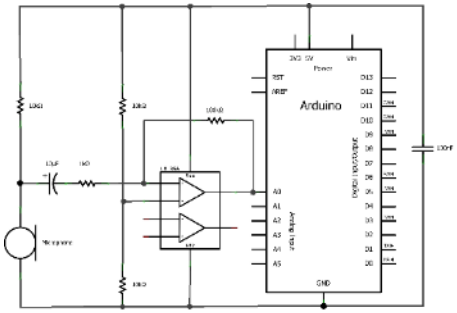

COST FOR MISTAKES AND CHANGES
$
TOO LATE
PROTOTYPE
FAIL AND LEARN EARLY
TIME ON THE PROJECT

Plan before you build

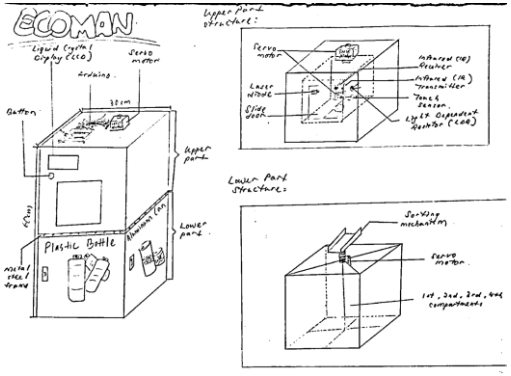
1. Electronic Components

Input

Output



2. Circuit Diagram



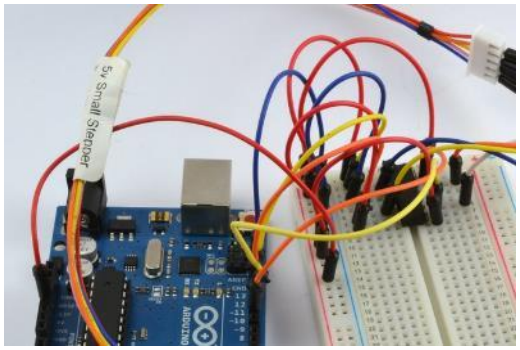
3. Sketch Mock-up

Prototype

Good practice

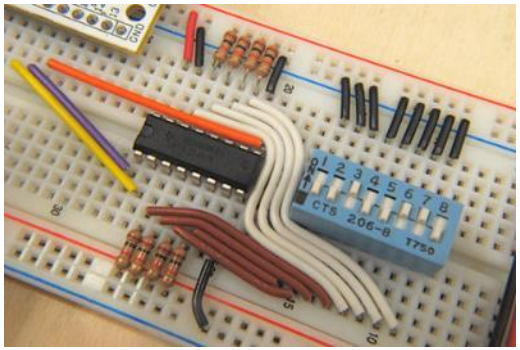
Prototype

STEP **1**



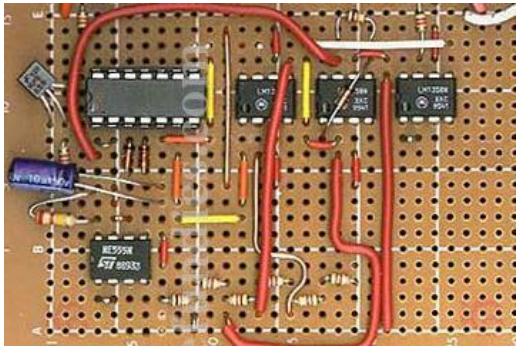
Use **jumper wire** to see if circuit works
Fast but not reliable.

STEP **2**

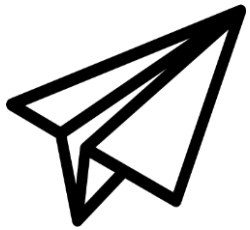


Convert to **short wire**.
More reliable.

STEP **3**



Solder on prototyping board (if components not on loan!)
Most reliable!



Test

To evaluate the **feasibility** of the ideas

Measure the capability

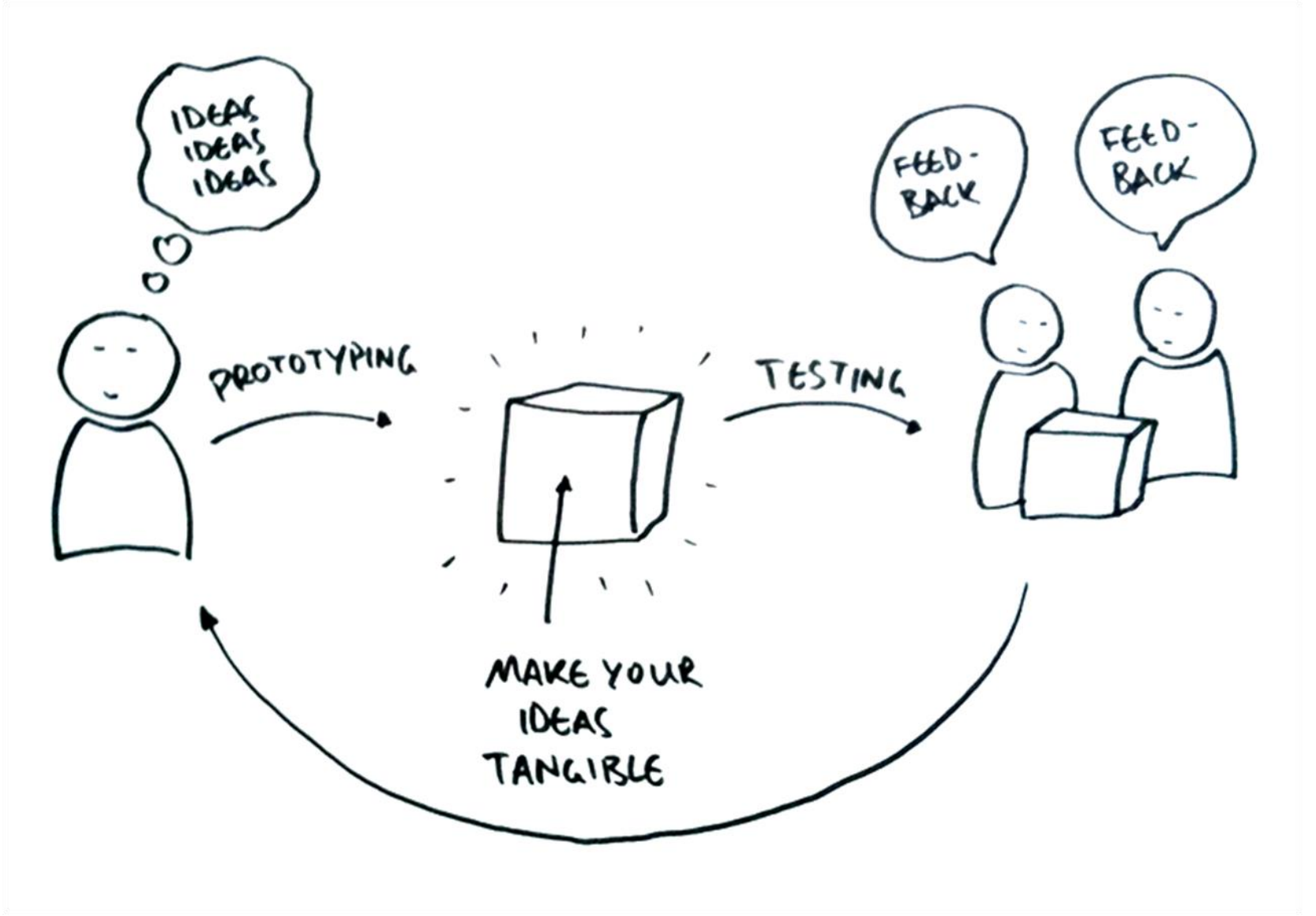
To learn why things don’t work
- create **reflection**

Feedbacks

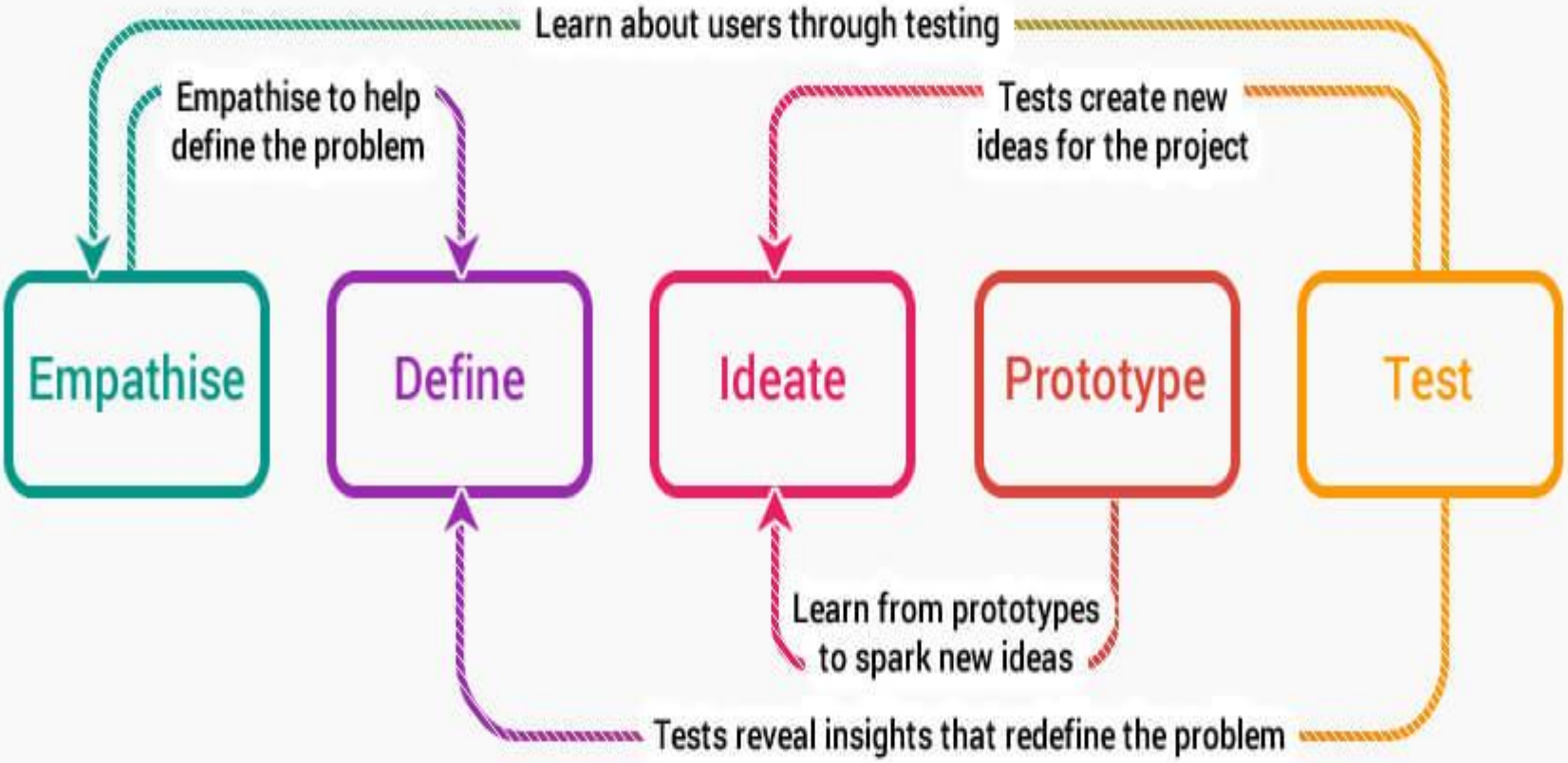
Test

Show, tell and get feedback.

+ What worked…	− What could be improved…
? Questions	! Ideas


IDEAS
IDEAS
IDEAS
PROTOTYPING
TESTING
FEED-
BACK
FEED-
BACK
MAKE YOUR
IDEAS
TANGIBLE

DESIGN THINKING: A NON-LINEAR PROCESS



Source: interaction-design.org

How do they start?

Starting a Pitch (Offline)

Pitching skills

Hook

Constraint

Solution

Impact

- Begin with a joke
- Make a startling statement
- Make a bold declarative statement
- Evoke a suspense or curiosity
- Surprising statistic
- Tell a story
- Quotation
- Visual Aid

Pitching Template

Problem Statement

Your Solution

Unique Selling Point (USP)

Solution Impact

Market Validation

Learning from YIC Program

Hook

Constraint

Solution

Impact

- What happen if problem not solved?

Pitching Template

Problem Statement
Your Solution
Unique Selling Point (USP)
Solution Impact
Market Validation
Learning from YIC Program

Hook

Constraint

Solution

Impact

- What is your idea?
- What is your proposal?

Pitching Template

Problem Statement

Your Solution

Unique Selling Point (USP)

Solution Impact

Market Validation

Learning from YIC Program

Hook

Constraint

Solution

Impact

- What is the expected impacts?
- Don't end your speech with a just a Thank You!
  - #1 Call to action
  - #2 Call to Question
  - #3 Story to anecdotes
  - #4 Contrast
  - #5 Quotes

YIC Pitching Template

Problem Statement

Your Solution

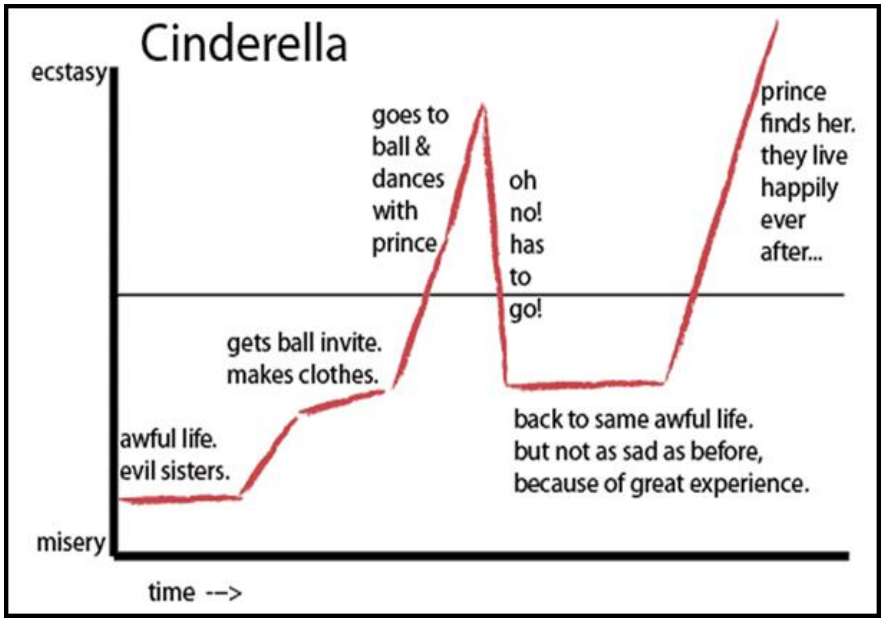
Unique Selling Point (USP)

Solution Impact

Market Validation

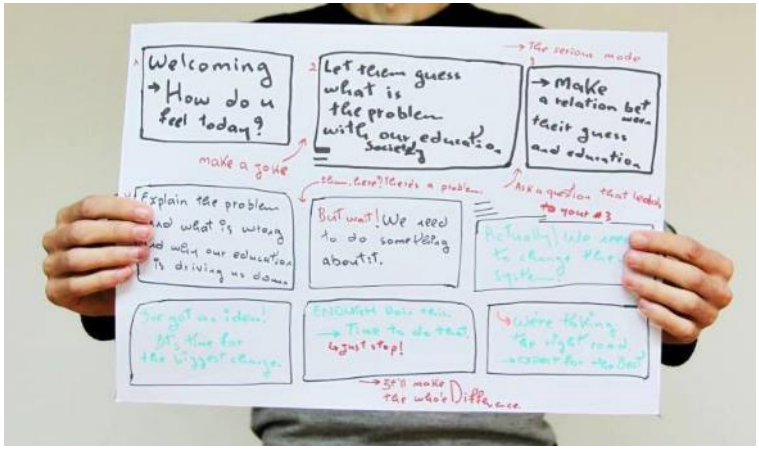
earning from YIC Program

Preparing your pitch



Create your own story board!

1. Have a beginning
2. Detail out your middle part
3. Have an ending



10/20/30 Rules of Pitching

https://youtu.be/51TLge2peLc

How to be more confident?

https://youtu.be/tShavGuo0_E

School Engagement Schedule

28 March 3 pm mBlock	29 March 3 pm Arduino	11 April 3 pm App Inv	12 April 3 pm App Inv

3 April 2.30 pm mBlock	10 April 2.30 pm Arduino	17 April 2.30 pm App Inv

Time	7 May 3 pm mBlock	8 May 3 pm Arduino	9 May 3 pm App Inv	10 May 3 pm App Inv
AM				
PM				