



Australian Government



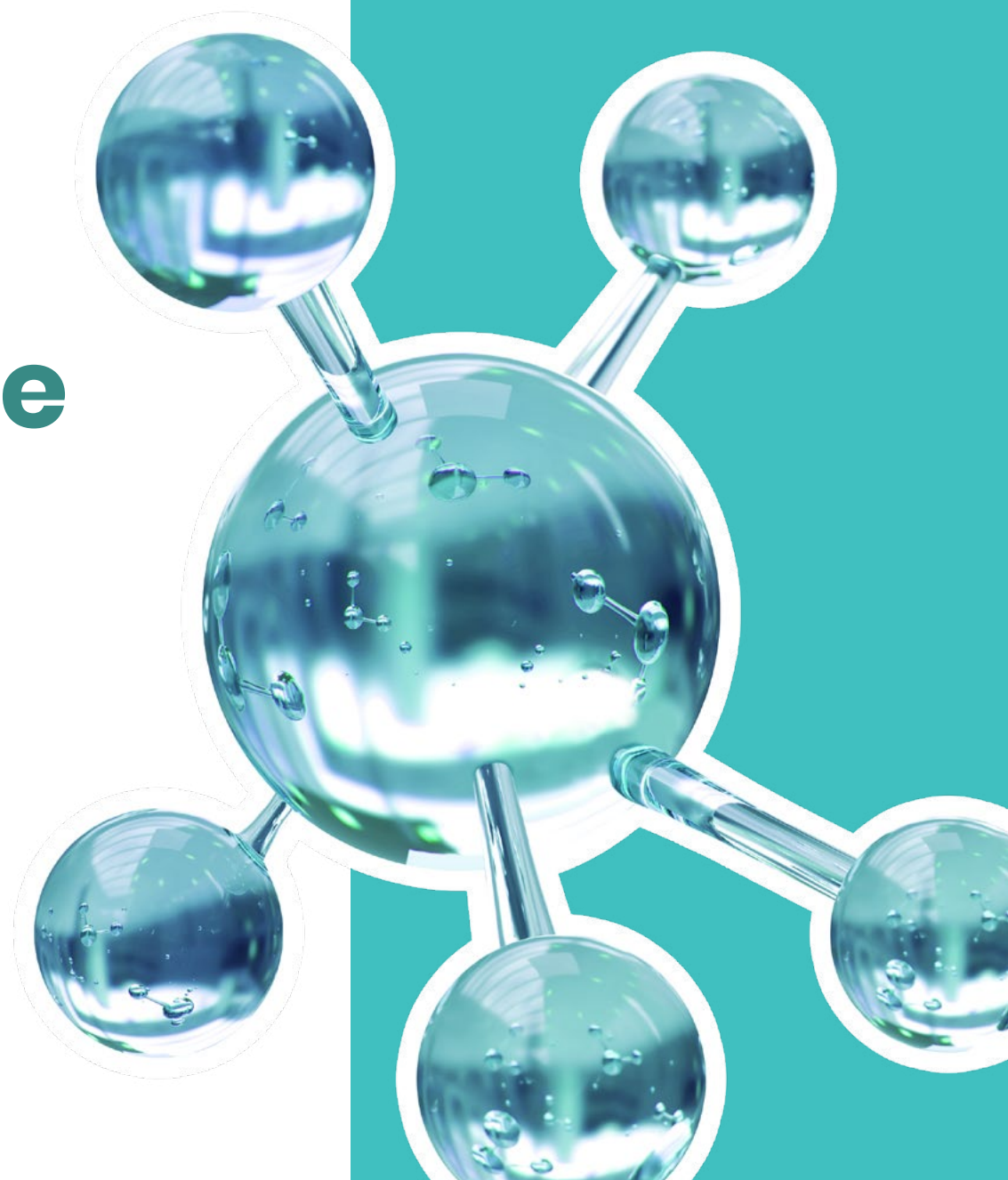
Design Mini-Challenge Toolkit

Teacher Edition

NATIONAL SCIENCE WEEK 2022 THEME

Glass: More Than Meets the Eye

 national science week



The 2022 **Resource Book of Ideas for National Science Week** (ASTA) offers teachers and students the opportunity to explore the scientific discoveries, inquiries, and innovative activities that focus on the uses and intrinsic nature of glass in science.

ANSTO is proud to be a collaborator for the Design Mini-Challenge activity based on reusing and repurposing glass waste on pp 61-64. Teachers can use the templates in this toolkit to guide them through the **Design Thinking** process and the Design Mini-Challenge activity. The Teacher and Student Editions of this toolkit can be used digitally or as a printed resource.






The Design Mini-Challenge can be used by teachers as a stand-alone activity OR as a precursor to **ANSTO's Hackathon event** during National Science Week (Aug 15-19th, 2022). To support both pathways, ANSTO will be offering **Teacher Professional Development sessions** in Design Thinking (both online and in person) in Term 3, prior to National Science Week 2022.

© ANSTO 2022. No part of this publication may be reproduced without the express permission of ANSTO.

To request ANSTO's permission to reproduce this publication for educational purposes, contact education@ansto.gov.au



Contents

About ANSTO About <i>nandin</i>	4	 Prototype	22
Design in the classroom	6	Sketching	24
Ideas for teachers	7	Planning for prototyping	25
The design thinking process	8	 Test	26
 Empathise	10	Test Option 1: “The Mini-Pitch”	28
Empathy mapping	12	Test Option 2: “Pitch Outline”	29
Personas	13	Case studies and reference material	30
 Define	14	Notes	31
The 5 why’s	16		
WWWWWH	17		
 Ideate	18		
Brainstorming ideas	20		

About ANSTO

ANSTO is the home of Australia's nuclear science and technology expertise.

ANSTO leverages great science to deliver big outcomes.

We partner with scientists and engineers and apply new technologies to provide real-world benefits. Our work improves human health, saves lives, builds our industries and protects the environment.

ANSTO is the home of Australia's most significant landmark and national infrastructure for research. Thousands of scientists from industry and academia benefit from gaining access to state-of-the-art instruments every year.

About *nandin*

nandin is ANSTO's Innovation Centre where science and technology entrepreneurs, startups and graduates come together, to challenge, design, innovate and commercialise, creating new jobs in the high-growth industries of tomorrow.

Located in the ANSTO Innovation Precinct in Sydney's south and set amongst Australia's most significant research infrastructure, *nandin* is home to a vibrant community of startups, graduates and industries developing ingenious solutions to solve unmet challenges in our world.

By connecting our community to forward-looking science and technology, *nandin* helps bring deep tech ideas to life.

Jermaine Abano, Supply Chain Technician from ANSTO's Target & Canning Laboratory, seals a high purity quartz glass ampoule with a hydrogen torch. The resulting product will be irradiated in the OPAL nuclear reactor to make Lu-177, which is used to diagnose and treat a variety of cancers that are unresponsive to other therapies.



Design in the classroom

Facilitation is a critical part of design in the classroom. By putting structure and intentionality around the wild creativity of design, we ensure that it is a useful, safe, and welcoming experience for everyone. Some key elements of design facilitation include:

Navigating collaboration in diverse teams by inviting all perspectives to the table, and creating spaces that are conducive to multiple working styles

Removing barriers to divergent thinking by ensuring there is no “conformation to the norm” and welcoming all ideas

Embracing “why” questions to encourage critical thinking and open-ended conversation

Adopting design as a “way of doing” – shifting the culture to encourage learning from mistakes, creativity, teamwork, and psychological safety

Ideas for teachers

The templates from the Design Mini-Challenge – Student Edition can be printed out as a booklet and used to guide the students through the activity

Teachers can use the reference material at the back of this document to introduce the Design Thinking process and give the students some examples

The mini-challenge can be done as an all-day workshop or broken up into smaller sections for students to engage with over several school periods

Students can work in small teams or as a whole class group

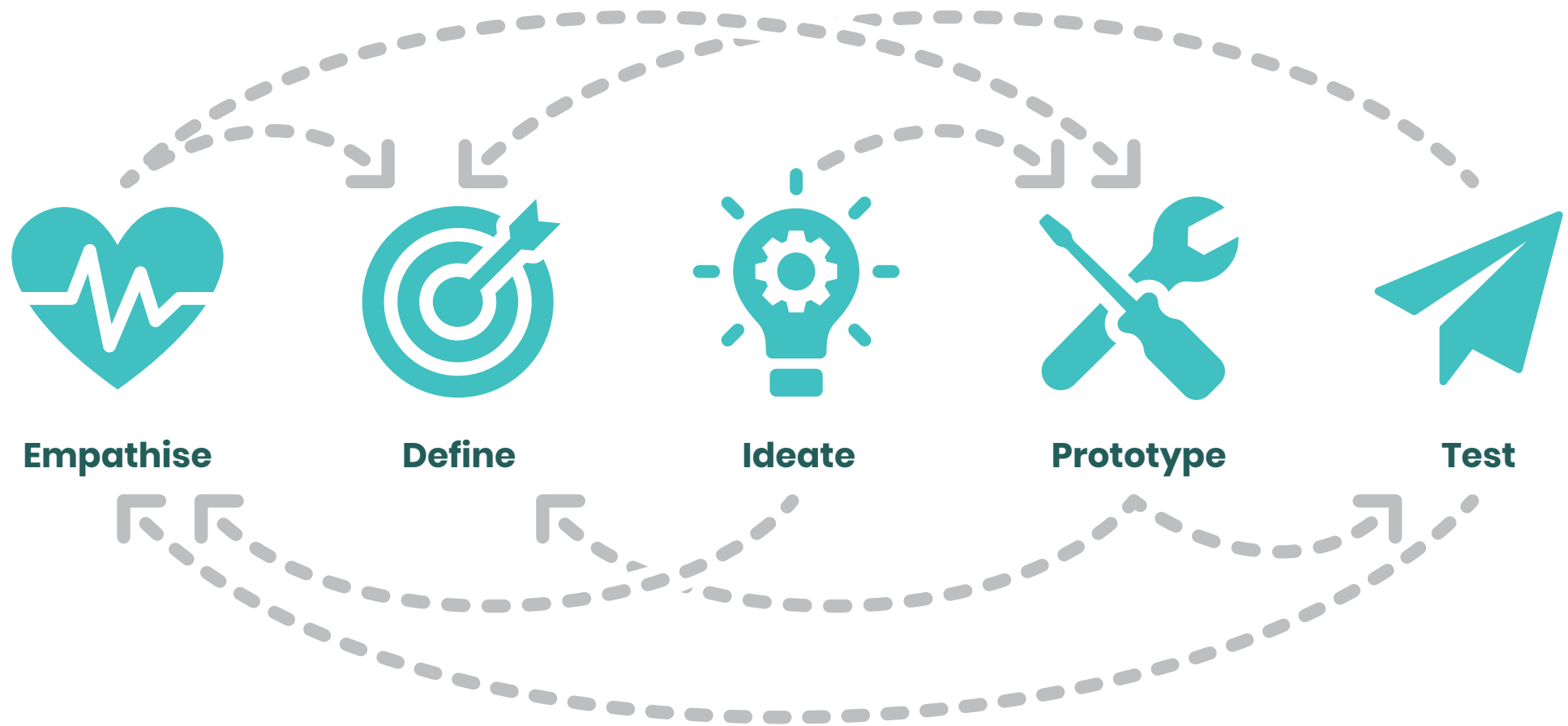
As a precursor to this activity, students can conduct an investigation into glass waste and how it is handled in Australia, their community (local councils), at their school and at home

Students can “pitch” their solutions to a judging panel, made up of school staff or community members. If the winning ideas are viable, they could be put into practice

Teachers can learn more about how to facilitate Design Thinking in the classroom by attending an **ANSTO Teacher Professional Development** session in Term 3, either online or in-person

Teachers can challenge students by applying for **ANSTO’s National Science Week Hackathon**, which is a fast-paced, extended version of the mini-challenge and includes access to Design and Industry mentors and prizes

The design thinking process



Empathise

Understanding your end users



One of the first things you should do before embarking on a design project is **understand your end-users** – who they are, what they do, why they do it, and what they need.

End-users are **almost always not the bigger stakeholder**, rather, the person who will handle and use your product. The more research you conduct, the clearer this distinction will be.

This is not as straightforward as it seems – who you might originally think are your end-users could be completely different to the actual end-user.

Try to approach this stage **without assumptions** or ideas for solutions, as this is just about trying to get to know your users, their experience, their pain points, and their journey. You will start to notice **patterns and themes** that hint at the **problem space** – take note of these “aha” moments.

EMPATHISE

Empathy mapping

Encourage students to use a few different methods to learn about their users if they have the time and access to do so. Remind students that there are likely multiple

possible users involved – what is each of their experience like? How are they different/similar?

<p>WHO are our users?</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<p>What do they need to DO?</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
<p>What do they THINK and FEEL?</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<p>What do they SEE?</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
<p>What do they HEAR?</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<p>What do they SAY?</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>


EMPATHISE

Personas

Activity tips:

Consider framing persona creation as similar to brainstorming a character for a movie or a story – they have a complex life history, background, needs and feelings.

Consider inviting students to think about extreme characters.

Details Name: _____ Age: _____ Occupation: _____ Gender: _____		Image Sketch or paste a photo of your persona 	Quote Write down a quote that summarises your persona's feelings/experience “ _____ ” _____
Background What is their life story? What was their journey before this moment? _____ _____ _____		Motivations What drives your persona? What do they need? _____ _____ _____	
Frustrations What problems do they experience? How does this impact their life? _____ _____ _____		Ideal experience What goals do they have? What would an “ideal” experience look like? _____ _____ _____	

Define

Uncovering the real problem



Many problems might have emerged from your empathise stage, but this is the time to select the **most important** problem for your user.

In the define phase, we make sense of a wicked (complex) **problem space** by learning why it is a problem, and what end-user needs a solution should address.

Remember, this process is **always iterative** – you may need to repeat the define phase a few times before you get to the right problem, or perhaps return to “empathise” to collect more user insights before defining again.

We already have a rough idea about the problem based on the challenge areas, but **this might not be the root problem** – we need to uncover the real problem at stake so we can tackle it effectively and bring real value.

If you can already think of a solution or if there is only one way to solve it, it is probably not the right problem – keep digging.

DEFINE

The 5 why's

Activity tips:

Encourage students to ask more detailed questions than just “Why” – let the answer to the previous question frame the detail for the next question (e.g. “why does that happen? Why is access an issue here? Why is that stressful? Etc.)

Starting problem statement: _____ _____
Why? _____
Why? _____
Why? _____
Why? _____
Why? _____
Aha! So the root problem is: _____

DEFINE

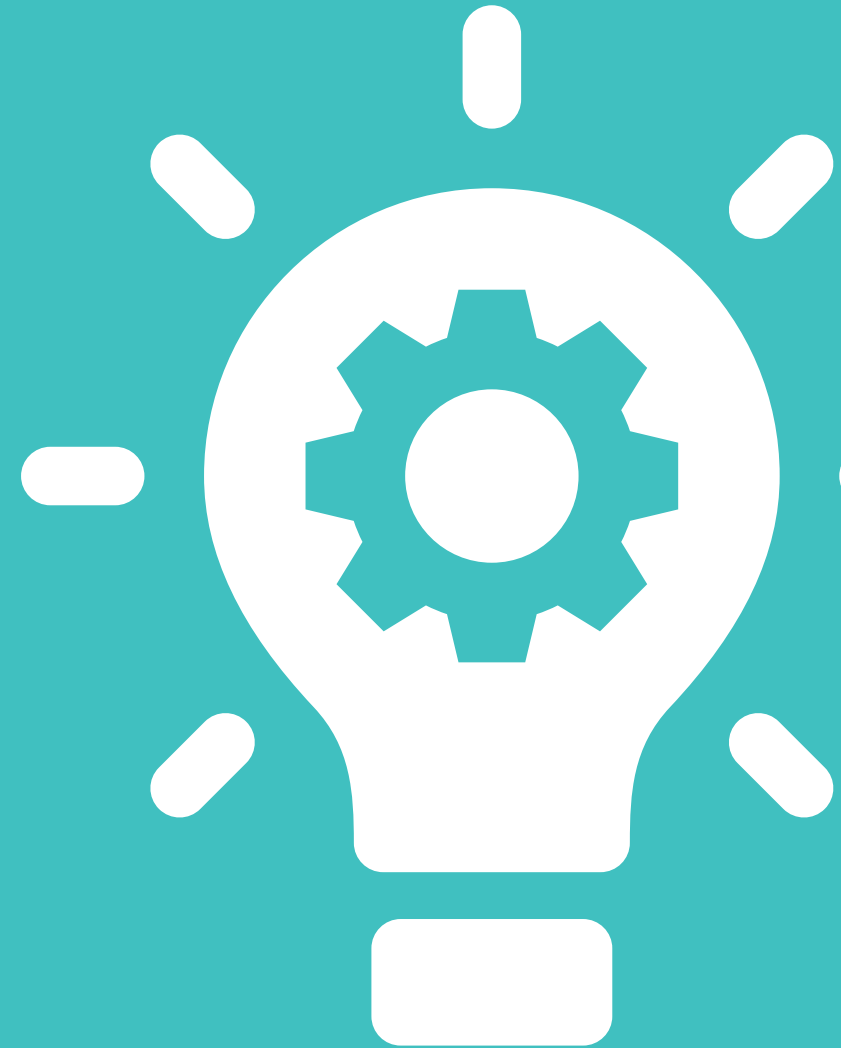
WWWWWH

Now that we have a basic idea of what the problem might be, let's consider it from all angles to make sure it is fully uncovered.

WHO is involved? _____ _____ _____ _____ _____	WHAT happens? _____ _____ _____ _____ _____	WHEN does it happen? _____ _____ _____ _____ _____
WHERE does it happen? _____ _____ _____ _____	WHY does it happen? _____ _____ _____ _____	HOW does it happen? _____ _____ _____ _____
What does this say about our problem statement? What further information or questions are required? _____ _____ _____		

Ideate

Challenge assumptions
and generate ideas



Equipped with your problem statement and your understanding of the end-user, you can now start to **brainstorm ideas**.

An atmosphere of **collaboration and respect** is really important for your team in this phase – avoid phrases like “that won’t work” or “we’ve already tried that”.

Ideation is where you should **think outside the box** and be as **creative** as possible – this is just brainstorming, so the crazier the better. Don’t discount any ideas just yet.

You can also start to **sort and group ideas** based on their **feasibility, importance** to the user, and **relevance** to the problem.

IDEATE

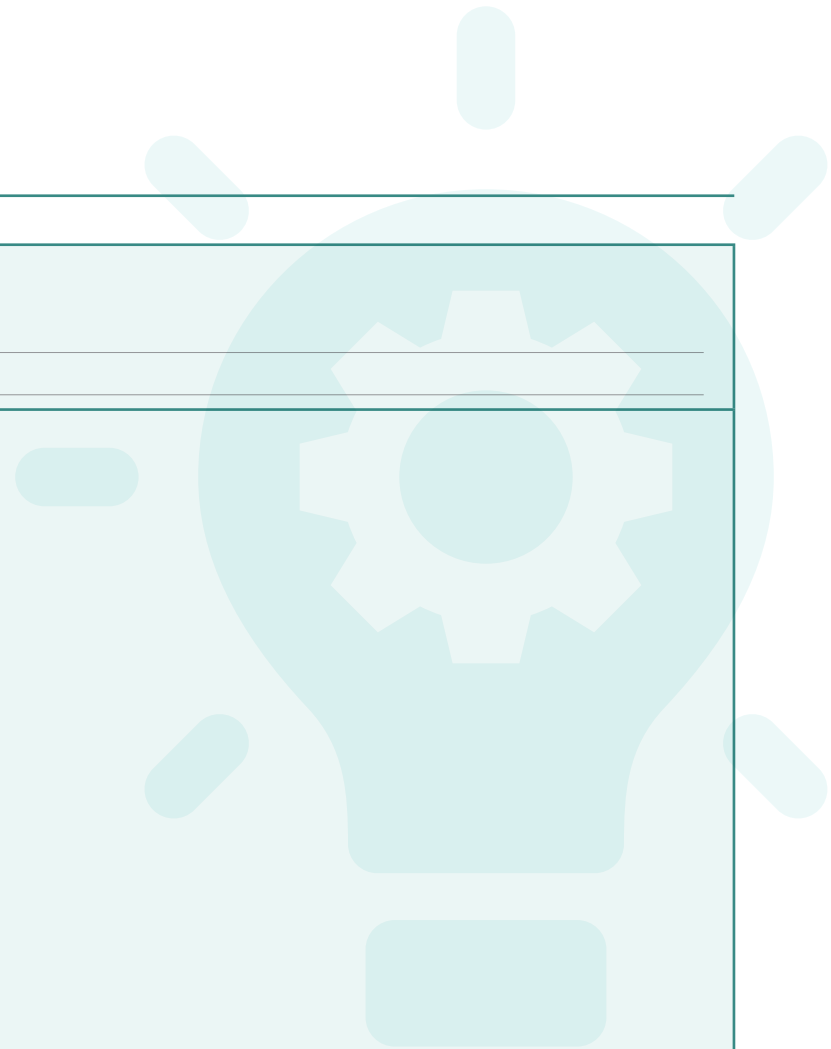
Brainstorming ideas

Activity tips:

Encourage students to write all ideas, even “silly” ones. We don’t want to see blocking language or behaviour, as every idea has potential and this is not the evaluation stage yet.

Problem:

Mind-map:





Prototype

Make and break solutions



Prototyping and ideation go hand in hand as you start to **manifest your ideas** in a more **tangible** way.

Prototypes don't have to be polished models – and they usually shouldn't be. They can be sketches, role plays, cardboard cut-outs, wireframes – anything that helps you **communicate concepts** and **receive feedback**. The more prototyping you do, especially low-fidelity prototyping, the less sunken cost you will find further down the track – be it time, resources, or money. Prototyping reveals early issues and tweaks that simply brainstorming ideas cannot.

In an ideal project, prototyping would be a **co-creative process** (i.e. done alongside users) – this may not always be possible, but ideally you will have such a **rich understanding of your users** from the empathise phase that you will still be well equipped to prototype.

Most importantly, a prototype is **not a product**. You will create many prototypes for multiple different ideas before you start to consider the final solution.

PROTOTYPE

Sketching

Activity tips:

Consider inviting the students to sketch more than just their prototype – how is it used? Where is it placed?

Sketches can also be a great visual element to their final pitches.



PROTOTYPE

Planning for prototyping

Use this space to brainstorm what you will need for successful prototyping before making it happen.

<p>What are the key features of your idea?</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<p>How does your idea solve/address the problem?</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
<p>What shift in the user journey do you want your solution to create?</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<p>How will you make your idea tangible? What types of prototyping will you use? E.g. 3D models, collage, sketches, role-playing, paper/craft prototypes</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>

Test

Bring it to users for feedback



The test phase is all about **end-user feedback**. This is how we understand if our technology has truly solved the problem and met the end-user's needs.

Structured methods for gaining rich feedback are important, as most **users will not always directly communicate** their needs.

This is where you will see the importance of “**fail fast, fail often**” – if you iterate well throughout the design process, you will get early feedback from this stage, and that will allow you to go back and **refine your product**.

Again, in the absence of continual user input, you will have to **keep your “empathise” hat on** and think from the user's perspective. There are also other methods for testing that allow you to **critically evaluate your designs** without necessarily gaining direct external feedback.

TEST

Test Option 1: “The Mini-Pitch”

Three-minute time limit

<p>Who is your user(s)?</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<p>What problem are they experiencing?</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
<p>What is your solution?</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>

TEST

Test Option 2: “Pitch Outline”

Activity tips:

Short and sweet – four minutes is plenty of time for an effective design pitch. Encourage the students to remove unnecessary detail and focus on the value brought to the end-user, showcasing the prototype, and the overall design journey.

Encourage the students to be creative with their pitch – does it have to be a speech? Can it be a role play? Can they ask questions to the audience? Can they show how their prototype works?

<p>Team name:</p> <hr/> <p>Members:</p> <hr/> <p>School:</p> <hr/>	<p>Big picture:</p> <p>What is the problem context? What is the main idea? What problem statement did you address?</p> <hr/> <hr/> <hr/>
<p>Your end user:</p> <p>Who is your end user? How do they experience the problem?</p> <hr/> <hr/> <hr/>	<p>Your solution:</p> <p>What is your technology/product/service/solution? How are you prototyping/demonstrating this?</p> <hr/> <hr/> <hr/>
<p>Design journey:</p> <p>How did you reach your solution? Did you have any pivots? How did you prototype and test your idea? What did you learn along the way? You are encouraged to refer to the five stages of the design thinking process.</p> <hr/> <hr/> <hr/> <hr/>	<p>Future directions/call to action:</p> <p>What are the future directions for your solution? How is your solution sustainable?</p> <hr/> <hr/> <hr/> <hr/>

Case studies and reference material

Design+ Book: an eBook from the Aalto Design Factory that nicely unpacks the fundamentals of design

<https://designfactory.aalto.fi/design-plus/>

IDEO Design Kit Case Studies: more design examples as well as a good set of (advanced) design methods

<https://www.designkit.org/case-studies>

Board of Innovation: resources on design thinking templates and tools

<https://www.boardofinnovation.com/tools/>

Design Thinking: helpful summary/intro article

<https://www.interaction-design.org/literature/article/what-is-design-thinking-and-why-is-it-so-popular>

Design thinking case studies: a collection of 40 examples across various sectors

<https://theaccidentaldesignthinker.com/2017/09/16/40-design-thinking-success-stories/>

“VAD”: Case study on the design process for artificial heart patients

https://www.researchgate.net/publication/332448918_Exploring_the_role_of_Design_in_the_context_of_Medical_Device_Innovation

“What’s Next”: case study on design in airports

<http://www.samuel-medvedowsky.com/work/whats-next/>

“Embrace Baby Carrier” Case Study: more information

<https://www.invisionapp.com/inside-design/reimagine-products-empathy/>

Miro: great online tool for collaboration, especially design tools (has a lot of templates)

<https://miro.com/>

Notes

Please consult the Student Edition of the Design Mini-Challenge Toolkit
for printable, blank versions of the templates in this document



www.ansto.gov.au/hackathon