Questacon MAKER PROJECT

WORKSHOP TEACHER RESOURCE

Teacher Resources – Intro to 3D Design

Welcome to the Questacon Maker Project Intro to 3D Design. This resource provides information and activities designed to complement your workshop experience. This includes pre- and post-visit activities, questions to keep your class thinking about the project, tips on running this workshop on a smaller scale and general information on the innovation process.

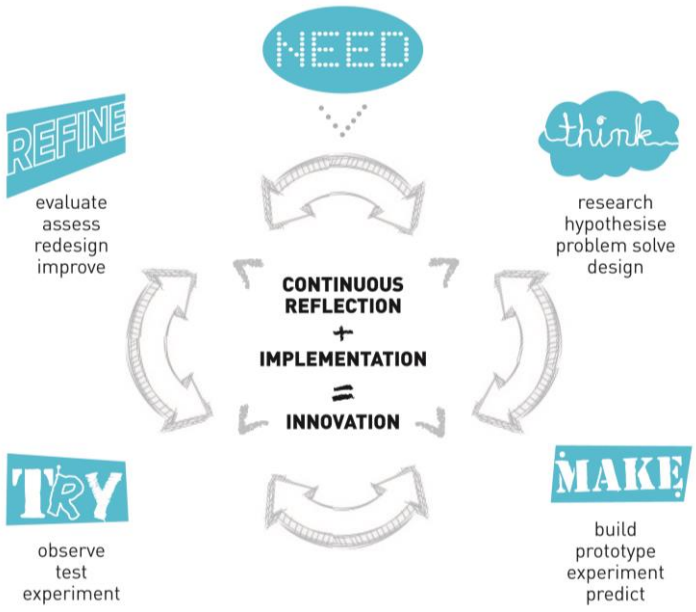
Innovation

Contrary to popular belief, Thomas Edison didn't "invent" the light bulb. He is known for this life changing invention because he improved upon a 50-year-old idea and made it accessible for everyone to use. This process of building on ideas to create something new is called innovation.

We all have the tools we need to be innovative; problem solving, creativity, maths, science and technology, but it's how we use these tools that can make the difference between having an idea and doing something with it.

The process of need, think, make, try, refine is at the heart of any design or engineering feat. These stages don't follow a set pattern or order, but arise naturally from the exploration of new ideas. It can be useful to think about each of these stages as you work on your own designs.

- Does your idea address your **need**?
- Can you **think** of a new or better approach to solve your problem?
- Can you **make** a prototype?
- **Try** out your prototype – does it do what it's supposed to?
- How can you **refine** your design to make it better?



Before your visit

Pre-visit Activities

The innovation process is simply about taking an idea and making something new. So an innovator is someone who wants to create change by coming up with new ways of doing things. Sometimes, making this change in society comes from changing your perspective.

Activity 1

Obtain two random objects (anything from a plastic spoon, a party hat to a test tube). For each object ask the class to brainstorm other ways the object could be used.

1. Imagine the object at any scale, or in any context. It might be helpful to ask your students what they could use the object for if they were abandoned on a desert island – this can get the creative juices flowing. Also encourage students to deconstruct it and form a concept design of the new purpose of the object.

2. How would you improve the original object to better address the new purpose? Does this new object perform the function better than existing products?

Activity 2

This activity is designed to show your students some of the real world challenges that relate to using computers in the design process. The activity explores inputs and outputs, and the need for clear, step by step instructions. It is a paper-based exercise, we recommend having your class work in pairs for this activity.

Before you start

On the final pages of this document are a set of images; please copy and cut out the images so that you have one image per student. The students will need blank paper to draw on and a pencil to draw with.

The task

1. Break the class into pairs and have each pair sit back to back. Neither person is allowed to turn around. One of the pair is the sketcher and the other student is an instructor.
2. Give each sketcher a sheet of blank paper and item to draw with. Give each instructor one of the images.
3. The instructor must then describe the image, *without using shape names*, whilst the sketcher follows these instructions to draw the image on their paper. If students are stuck at the beginning it can help them to break the page up into units and directions to give them a frame of reference. Once this has been accomplished each pair reverses roles with a different image.

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During your visit

What to expect at the workshop

Designing objects on a computer is a very different process to simply building an object with your hands. There are many different approaches and programs written to do this. One thing which they all have in common is the need for users to be able to visualise the objects in 3D space so that they can imagine how the object would look in the real world.

In this workshop students will experiment with Computer Aided Design (CAD) to start to understand how computers take their instructions and build them into an object. Thanks to the technology of 3D printing students will be able to see how a computer model can be turned into a real world object.

All tools and resources will be supplied; a teacher will need to be present at the workshop.
Running time: 120 minutes

Introduction	Introduction to IPTLC Introduce the challenge. Provide guidance on how to interact with the 3D design software.
Introduction to 123Design	Students are broken up into pairs and given a laptop. They will be given a tutorial on drawing simple 3D shapes using the CAD software package 123Design. They learn to break down and replicate 3D objects in 123D Design. Students are encouraged to use trial-and-error approaches in order to maximise their understanding of how computers construct and display 3D content on a 2D screen.
Main Activities	Students are introduced to 3D scanning technology and its merits in creating a 3D object without timely manipulation in a CAD program. Students are given a 3D printed legless insect and instructed to create legs using craft materials located in the Maker Space. Based on the legs students attach to their plastic 3D printed bug, they are instructed to replicate their design digitally in 123D design. Students are able to import a 3D scanned model of the bug and manipulate with 3D shapes to create a finished product that can move or travel.
Wrap-up	Groups discuss the challenges faced during the design phase. They are shown a video of 3D printed leg prosthetics for a dog. This allows students to understand the real-life applications for 3D designers and their need to test and refine using a digital platform. Facilitate questions and discussion on workshop, including: • What was your favourite aspect of the workshop? • Approach to the challenge(s) • What would you do differently next time?
Resources	Resources provided: Laptop with 123Design software, tools and construction materials.

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After your visit

Follow up Activities

Activity 3

Students can complete a real-life challenge at school and work on their own product designs. Digital prototyping gives manufacturers the ability to virtually explore a complete product before it is built—so they can design, visualize, and simulate products from the conceptual design phase through manufacturing process. Below is a list of challenges that students can undertake in pairs or individually. These challenges may require some initial planning and design on paper or by using simple craft supplies to model. Students should also be encouraged to consider material properties and research other existing products that can be used as a basis for justifying or improving their design.

- Design a car that can be used for multiple purposes.
- Design a house using passive design principles to reduce energy usage.
- Design a space container that astronauts can use on Mars to grow plants or use for research.
- Design a new piece of furniture that helps a person with a disability.

Below is a list of fantastic free educational programs that can be downloaded and used for 3D modelling in the classroom.

- 123Design (http://www.123dapp.com/design) is a free 3D design program that includes tutorials, an app for handheld digital devices and a gallery of other people's design projects. It is just one of eight 3D modelling programs included in the AUTODESK 123D suite of downloadable software.
- Thingiverse (http://www.thingiverse.com) is an open-source website for 3D designs that you can download and print instantly with a 3D printer or customise the designs to suit your needs.
- 123DCatch (http://www.123dapp.com/catch) is part of the AUTODESK 123D suite of programs. Students can use the app on a smartphones or handheld devices to take a series of photos of an existing object. The app will stitch the photos together to create a 3D model that can be manipulated in most CAD programs.
- Sketchup (http://www.sketchup.com/) is an easy program to get started when drawing layouts or designing buildings in 3D form. There is also a large gallery of pre-designed products and furniture that you can import into your own 3D model.

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Explore and Expand: Science and Innovation

Many new inventions that have made our lives easier, or just more enjoyable, wouldn't have happened without innovative thinking. However, you need tools to innovate, and scientific knowledge is one of those tools. Other tools that you may need (or already have access to) include maths, drawing, design, language and computer science. Science and innovation have a close relationship—they go hand in hand. Many scientific and technological advancements and developments are due to innovative thinking; using something that already exists but applying it to something new—being creative, thinking laterally.

Australian Innovation

Did you know? WiFi is an Australian innovation!

WiFi was originally developed by Dr. John O'Sullivan while he was trying to solve a radio astronomy problem—finding exploding black holes. After some time, other researchers from CSIRO modified his idea; using mathematics and physics to solve another problem—wireless communication. This didn't happen overnight, but the various applications of WiFi have made this innovation one of the most crucial technologies in our networked society. Check out the full story at http://www.abc.net.au/catalyst/stories/2708730.htm

Activity 4

Research and discuss: Ask students to discover some of Australia's coolest inventions and innovations and discuss the process behind their creation!
Questions might include:

1. What are some of Australia's most creative inventions and innovations?
2. Who came up with them? Was it a team effort or an individual effort?
3. How did the creator(s) come up with their invention? What Ideas did they build on? What inspired them?
4. Can you identify the need?
5. Were there any prototypes? What did they look like?

Questions are based around the innovation process to help unpack it and provide real world examples of the process in action.

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Curriculum Links

Science: Science Inquiry Skills Strand

This workshop's activities relates to Science Inquiry Skills across all years by encouraging:

- Questioning and predicting
- Planning and conducting
- Processing and analysing data and information
- Evaluating
- Communicating

Science: Science as a Human Endeavour Strand

This activity can be linked to the Science as a Human Endeavour Strand if it is extended to research, design, and manufacturing. Applications of 3D printing useful to a vast range of scientists, from astronauts to town planning architects.

Digital Technologies: Knowledge and Understanding Strand

Year 5/6

Investigate the main components of common digital systems, their basic functions and interactions, and how such digital systems may connect together to form networks to transmit data (ACTDIK014)

Digital Technologies: Processes and Production Skills

Year 5/6

Define problems in terms of data and functional requirements, and identify features similar to previously solved problems (ACTDIP017)

Year 7/8

Analyse and visualise data using a range of software to create information, and use structured data to model objects or events (ACTDIP026)

Design and Technology: Knowledge and understanding

- Technologies and society: the use, development and impact of technologies in people's lives
- Technologies contexts: technologies and design across a range of technologies contexts

Design and Technology: Processes and production skills

Creating designed solutions by:

- investigating
- generating
- producing
- evaluating
- collaborating and managing

Australian National Curriculum Online: http://www.australiancurriculum.edu.au/

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