DairyNZ

GROWING NZ

INNOVATION CHALLENGE

student guidebook

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INTRODUCTION

This programme is for year 9-11 students with an interest in technology, science or business.

The challenge uses a team project approach and can be delivered through an inter-school challenge day or a classroom project.

INTER-SCHOOL CHALLENGE DAY (IN SELECTED REGIONS)

This day presents teams with an industry challenge. It requires you to use investigative research and practical knowledge of science, technology and business to design and prototype a solution to the challenge. You will interview and collect feedback from industry representatives. Each day has $250 worth of prizes up for grabs.

Communication

Inquiry

Teamwork

Presentation

Feedback

CLASSROOM PROJECT

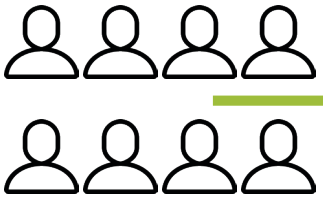
This project mirrors the facilitated inter-school challenge day however it is completed over a series classroom based lessons.

You will:

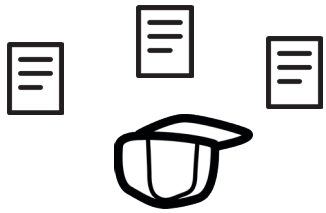
1. Start with a challenge affecting the primary sectors
2. Research and investigate the challenge
3. Choose two technology or science related 'enablers'
4. Develop a 'big idea' as a solution to the challenge
5. Design a rough prototype
6. Present your 'big idea' and prototype to others
7. Submit an entry into the national competition and be in to win.

PROJECT JOURNEY

Divide into teams of four



Draw challenge from hat



Research

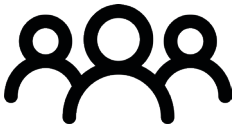
Choose two enablers

AI ✓ **GPS** ✓ **L** **VR**

Build prototype/s

Brainstorm ideas

Presentation



Enter and win

YOUR CHALLENGE

To start your adventure, your team will randomly select one challenge which relates to the primary sectors.

What challenge is your team trying to solve?

Before jumping to a quick solution, it's a good idea to find out more about the challenge and what is currently being used to address it. Some questions (among others) worth exploring:

- Who is being affected by this challenge?
- What are they doing now to work around the challenge?
- What are the immediate and long term effects of reducing this challenge?
- What would be considered 'a gain'?

From your research, record any new information which you have found out about this problem:

CHOOSE YOUR ENABLERS

These enablers consist of a range of existing and emerging technologies and sciences. You can choose a maximum of two which you will research in more depth and incorporate into your final solution.

Information sheets on each of these 'enablers' can be found in your workbook.

AI Artificial Intelligence	**NS** Networks and Sensors	**3D** 3D Printing	**BOT** Robots	**NANO** Nano-technology
VR Virtual Reality	**MS** Micro Satellites	**BD** Big Data	**SCS** Stem Cell Science	**BIF** Biofuels
GEN Genomes	**ST** Smart Things	**GPS** Global Positioning	**L** Lasers	**M** Smart Machines
HHP High Hydrostatic Pressure	**AG** Augmented Reality	**RFID** Radio Frequency Identification	**ADD YOUR OWN...**	

ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) is the ability of a computer program or a machine to think and learn. It is also a field of study which tries to make computers 'smart'.

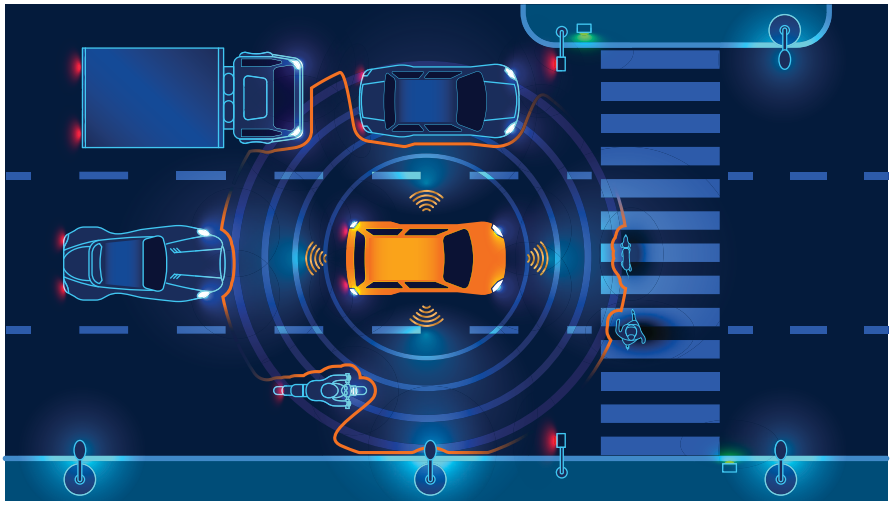
In general use, the term 'artificial intelligence' means a machine which mimics human cognition. At least some of the things we associate with our minds, such as learning and problem solving can be done by computers, though not in the same way as we do.

We use the term AI for successfully understanding human speech, competing at a high level in strategic game systems, self-driving cars, and interpreting complex data.

An extreme goal of AI research is to create computer programs that can learn, solve problems, and think logically.

EXAMPLES

- Voice powered personal assistants i.e. 'OK Google' and 'Siri'
- iRobot vacuum cleaning device
- Self driving cars



NETWORKS AND SENSORS

Wireless sensor networks (WSN), are made up of a network of sensors which can monitor physical or environmental conditions, such as temperature, sound, pressure, etc. Together, they pass their data through the network to a main location.

Modern networks enable control of sensor activity.

EXAMPLES

- Wearable devices
- Forest fire detection—a network of sensor nodes can be installed in a forest to detect when a fire has started
- Air quality monitoring

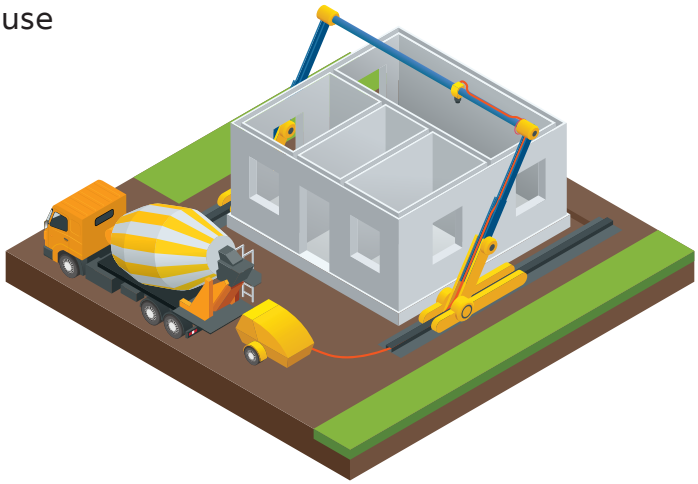
3D PRINTING

3D printing is a process used to create a three-dimensional object in which multiple layers of material are formed under computer control to create an object.

Objects can be of almost any shape or geometry and are produced using data from a 3D model.

EXAMPLES

- Machine parts
- Prosthetic body parts
- 3D printed house



3D PRINTING

ROBOTS

A robot is a machine capable of carrying out a complex series of actions automatically. Robots may be constructed to take on human form but most robots are machines designed to perform a task with no regard to how they look.

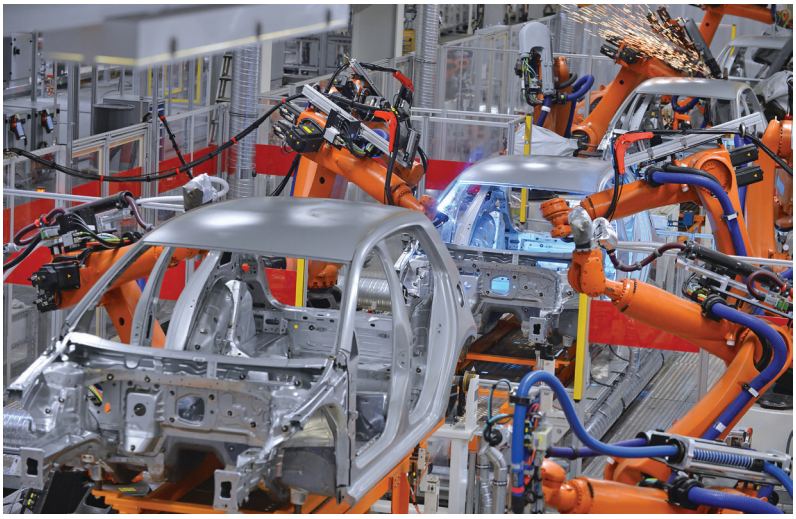
Robotics is the branch of technology that deals with the design, construction, operation, and application of robots, as well as computer systems for their control, sensory feedback and information processing.

These technologies deal with automated machines that can take the place of humans in dangerous environments or manufacturing processes, or resemble humans in appearance, behaviour, and/or cognition.

Many of today's robots are inspired by nature contributing to the field of bio-inspired robotics.

EXAMPLES

- Autonomous robots e.g. iRobot
- Apple picking robot
- Car painting and assembling



NANOTECHNOLOGY

Imagine if you climbed out of the shower only to discover you'd shrunk in the wash by about 1500 million times!

If you stepped into your living room, what you'd see around you would not be chairs, tables, computers and your family, but atoms, molecules, proteins and cells. Shrunk down to the 'nanoscale', you'd not only see the atoms that everything is made from, you'd actually be able to move them around!

Now suppose you started sticking those atoms together in interesting new ways, like tiny LEGO® bricks of nature. You could build all kinds of fantastic materials, everything from brand new medicines to ultra-fast computer chips. Making new things on this incredibly small scale is called nanotechnology and it's one of the most exciting and fast-moving areas of science and technology today.

EXAMPLES

- Super small computer chips
- Water filters for cleaning polluted water
- Creating materials that are stronger, more flexible, lighter, smoother, waterproof, antibacterial

VIRTUAL REALITY

Everything that we know about our reality comes by way of our senses. In other words, our entire experience of reality is simply a combination of sensory information and our brains sense-making mechanisms for that information.

If you can present your senses with made-up information, your perception of reality would also change in response to it. You would be presented with a version of reality that isn't really there, but from your perspective it would be perceived as real.

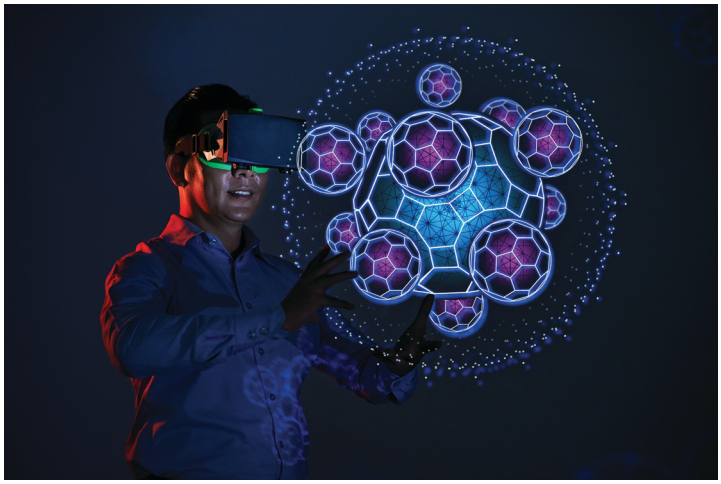
Something we would refer to as a virtual reality.

Virtual reality presents our senses with a computer generated virtual environment that we can explore.

Virtual reality is the term used to describe a three-dimensional, computer generated environment which can be explored and interacted with by a person. That person becomes part of this virtual world or is immersed within this environment and whilst there, is able to manipulate objects or perform a series of actions.

EXAMPLES

- Surgery simulations
- Scientific visualisation



MICRO AND NANO SATELLITES

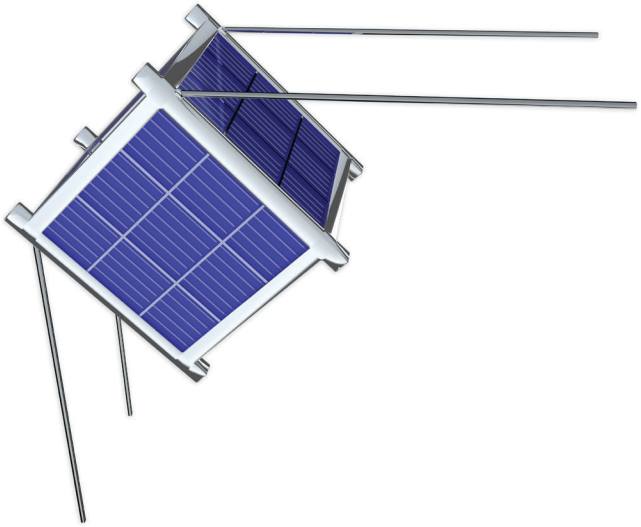
When it comes to laptop computers and cell phones, bigger isn't better. The same logic applies to satellites: the bulkier the satellite, the more time it takes to design and build, and the more expensive it is to put into orbit.

Researchers are now taking advantage of the electronics technologies that have made personal gizmos compact and affordable to make satellites that weigh and cost a fraction of their predecessors.

These tiny satellites can 'piggy back' off larger rocket launches. Multiple satellites can create a network in space to provide environmental sensing and develop new networks in which to exchange data.

EXAMPLES

- Weather research and monitoring
- Monitoring atmospheric pollution from aerosols or organic substances etc.



BIG DATA

Everything we do is increasingly leaving a digital trace (or data), which we (and others) can use and analyse. Big Data refers to that data being collected and our ability to make use of it.

Now data analysts can also look at 'unstructured' data like photos, tweets, emails, voice recordings and sensor data to find patterns.

Using big data, retailers can predict what products will sell, telecom companies can predict if and when a customer might switch carriers, and car insurance companies understand how well their customers actually drive.

Big data analytics enable us to find new cures and better understand and predict the spread of diseases. Big data tools are also used to optimize energy grids using data from smart meters.

EXAMPLES

- Optimising machine perfomance
- Detect and prevent cyber attacks
- Wearable devices, comparing your performance with communities from arround the world

Machine-generated data will increase to

42%

of all data by 2020 up from 11% in 2005

STEM CELL SCIENCE

Despite their name, adult stem cells are found inside people of all ages, even newborns. Their job is to replace cells that wear out. Although adult stem cells can develop into many different types of cells, they cannot become every type.

Using stem cells scientists can repair and reproduce human organs. Stem cell science can also be used for plant health too.

Stem cell research has great potential to reduce the reliance scientists have for using animals for laboratory experiments.

EXAMPLES

- Repairing and reproducing human organs and muscle tissue
- Livestock improvement—using stem cells to reproduce high quality sperm for livestock improvement
- Producing higher yields from plants

BIO FUELS

Bioenergy is energy derived from biofuels. Biofuels are fuels produced from organic material including plant materials and animal waste.

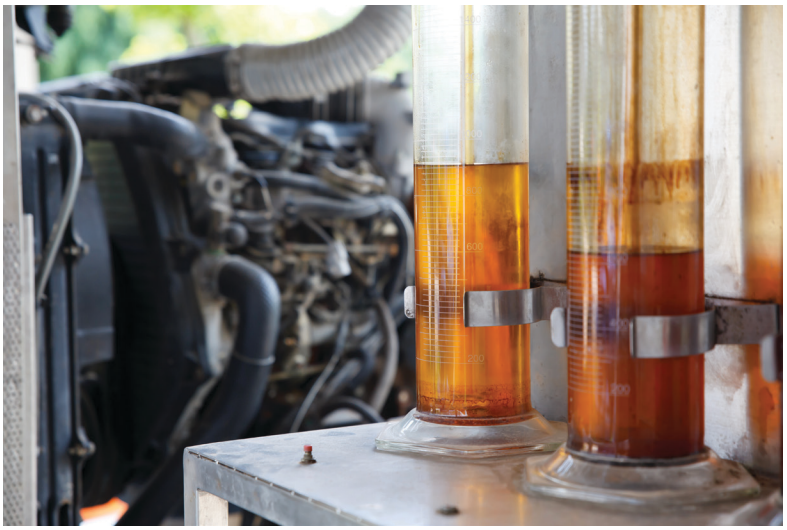
More advanced and efficient conversion technologies now allow the extraction of biofuels from materials such as wood, crops and waste material. Biofuels can be solid, gaseous or liquid.

Biofuels may be derived from agricultural crops. Biofuels may also be derived from forestry and fishery products as well as from food service by-products and wastes.

Straight vegetable oil (SVO) is a potential fuel for diesel engines that can be produced from a variety of sources, including oilseed crops such as rapeseed, sunflower, soybean and palm. Used cooking oil from restaurants and animal fat from meat-processing industries can also be used as fuel for diesel vehicles.

EXAMPLES

- Bio diesel
- Power generation



GENOMES

The whole piece of DNA within the chromosomes of an organism is called the genome.

Genomics allow researchers to decipher DNA sequences of whole genomes from virtually any organism, including humans. Single experiments can test genes and compare genomes of different species.

Genomics uses genome sequence data to identify genes, to predict the structure of gene products, to study the evolution of individual genes, or to examine the genetic relationships among species.

The use of genomics in agriculture is called agrigenomics and it is being used to help plant and animal breeders identify desirable traits, leading to healthier and more productive crops and livestock.

EXAMPLES

- To produce enhanced plant resistance to drought, frost, pests and floods—increase yield, reduce costs
- Screening tools to choose the best traits for breeding decisions

SMART THINGS

A smart device is an electronic device, generally connected to other devices or networks via different wireless protocols such as Bluetooth, NFC, Wi-Fi, 3G, etc.

EXAMPLES

- Smart phones
- Wearables
- Drones

GPS TECHOLOGY

GPS is a network of satellites that orbit the earth at fixed points above the planet and beam down signals to anyone on earth with a GPS receiver. These signals carry a time code and geographical data point that allows the user to pinpoint their exact position, speed and time anywhere on the planet.

EXAMPLES

- Mapping
- Emergency locator beacon
- Vehicle navigation

LASERS

Lasers are amazing light beams powerful enough to zoom miles into the sky or cut through lumps of metal.

We all have lasers in our homes (in CD and DVD players), in our offices (in laser printers), and in the stores where we shop (in barcode scanners). Our clothes are cut with lasers, we fix our eyesight with them, and we send and receive emails over the Internet with signals that lasers fire down fiber-optic cables. Whether we realize it or not, all of us use lasers all day long.

EXAMPLES

- Medical lasers can be used as a scalpel—since the laser can be controlled and can have such a small contact area it is ideal for fine cutting and depth control
- Precision agriculture machinery—this is used to ensure land can be made level
- Fiber optics—since lasers travel very fast they make an ideal way to communicate

SMART MACHINES

In general, a smart machine is an intelligent device that uses machine-to-machine (M2M) technology.

Smart machines include robots, self-driving cars and other cognitive computing systems that are able to make decisions and solve problems without human intervention.

Smart machine technologies learn on their own and can produce unanticipated results. They must:

- Adapt their behavior based on experience (learning)
- Not be totally dependent on instructions from people (learn on their own)
- Be able to come up with unanticipated results.

EXAMPLES

- Robot writers—these auto-produce blogs and articles using AI and machine learning
- Virtual assistants for call centres i.e. DRU from Dominos
- Harvesters and forwarders are technology-laden vehicles that automate timber harvesting processes—these powerful vehicles harvest, stack, move and generally process logs in difficult to access locations

HIGH HYDROSTATIC PRESSURE

High hydrostatic pressure (HHP) processing is a method of preserving and sterilizing food, in which a product is processed under very high pressure, leading to the inactivation of certain microorganisms and enzymes in the food.

This process stops chemical activity caused by microorganisms that play a role in the deterioration of foods. The technique is now used to preserve foods such as fish and meats, salad dressing, rice cakes, and yoghurts. Unlike many other treatments HHP can be done while foods are in soft packaging and can ensure foods are kept safe for human consumption.

HPP treatment does not greatly affect the nutritional value, taste, texture, or appearance of foods. As a result, high pressure treatment of foods is regarded as a 'natural' preservation method, as it does not use chemical preservatives. Food has a longer shelf-life and can be transported to more distant locations.

EXAMPLES

- Meat, fish and shellfish
- Fresh juice

AUGMENTED REALITY

The basic idea of augmented reality is to superimpose graphics, audio and other sensory enhancements over a real-world environment in real time.

On the spectrum between virtual reality, which creates immersive, computer-generated environments, and the real world, augmented reality is closer to the real world. Augmented reality adds graphics, sounds, haptic feedback and smell to the natural world as it exists.

Picture yourself walking or driving down the street. With augmented-reality displays, which will eventually look much like a normal pair of glasses, informative graphics will appear in your field of view, and audio will coincide with whatever you see. These enhancements will be refreshed continually to reflect the movements of your head.

EXAMPLES

- Retail make-up mirror
- Tag and find your car

RADIO FREQUENCY IDENTIFICATION

Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects.

RFID tags are used in many industries, for example, an RFID tag attached to an automobile during production can be used to track its progress through the assembly line.

RFID tags can be attached to cash, clothing, and possessions, or implanted in animals and people.

Fixed readers are set up to create a specific interrogation zone which can be tightly controlled. This allows a highly defined reading area for when tags go in and out of the interrogation zone. Mobile readers may be hand-held or mounted on carts or vehicles.

RFIDs are easy to conceal or incorporate in other items. In 2009, researchers glued RFID micro-transponders to live ants in order to study their behavior.

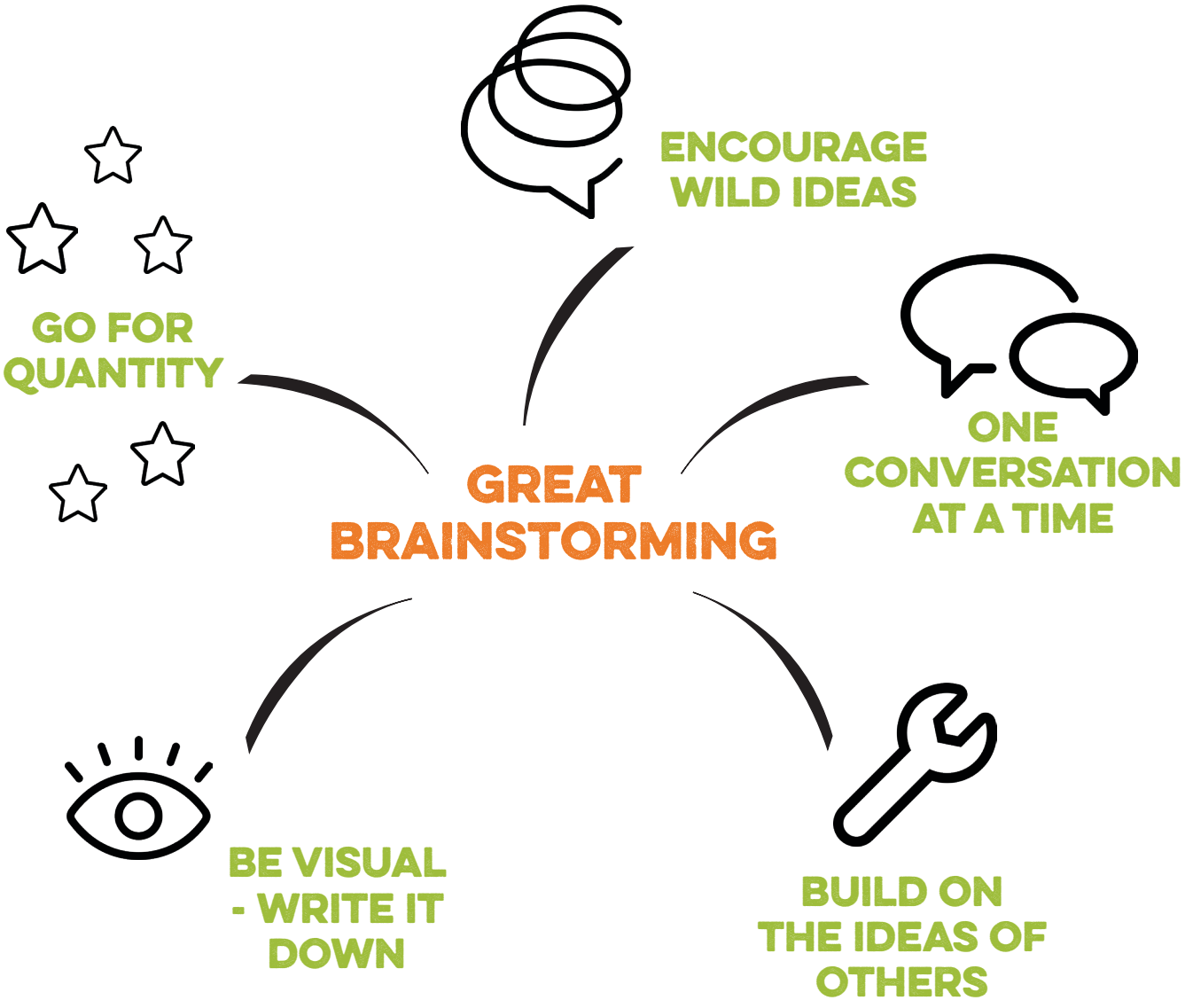
EXAMPLES

- Tracking equipment and packages—RFID technology has been used to track equipment i.e. tools, machinery, freight etc.
- Sports race timing
- Security doors

BRAINSTORMING

You probably already know the value of brainstorming to help you develop your ideas. In teams, brainstorming can be really effective at collecting everyone's ideas and visually seeing the teams' 'thinking'.

Unfortunately, poor habits can really shut ideas down. Try using these brainstorming rules and get the most out of your teams' creative thinking.



CREATING AND DESCRIBING VALUE

If you can provide a solution to a pain or help someone benefit in some way from your offer then you are providing value for that person.

It's best to design your idea AFTER you have taken the time to observe the potential customer and understand:

1. What jobs they are trying to get done?

2. What pains they are experiencing?

3. What would THEY consider to be 'a gain'—a fix, an improvement?

When you understand the pains you can design your 'big idea' based on these needs. What you design should provide benefits and features that directly tackle the pains the user is experiencing.

Describe how your product or services 'kill pain' or 'create gain' for the user.

Value could be time, speed, weight, strength, physical well-being, reducing risk or improving safety, cultural, emotional, learning, reliability etc.

PROTOTYPING

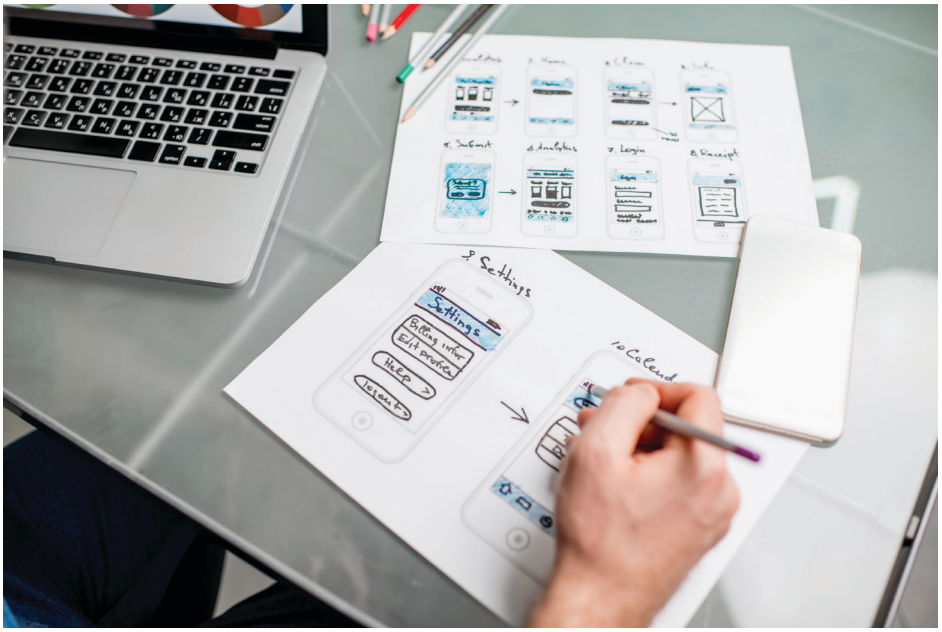
Making a rough physical prototype out of recycled materials or everyday items in the classroom can make it much easier to explain your idea to others. Multiple prototypes can help you test and refine what elements of your idea people most like.

A rough prototype can be made out of very ordinary materials.

This rough prototype was used by its inventor to explain her initial concept. The final product (right) is now used as a medical instrument in hospitals all over the world!

Image credit: Rupert Yen

Prototypes of services or involving computer screens can be sketched out showing the design of the idea.



PRESENTATION TIPS

You might have the smartest idea and have even made an awesome prototype but if you cannot present it well, it's unlikely to get others excited. Here are five tips to help you present like a team of pros.

EYE CONTACT

Make eye contact. Firm handshake. Show confidence.

TEAM

Look like a team. Everybody paying attention (avoid fidgeting in the background).

VALUE

Focus on the value your customer receives rather than the features.

START AND FINISH STRONG

Start strong (grab attention), finish with a memorable statement.

FEEDBACK

Leave time for questions and feedback. Use the feedback as a positive way to strengthen your idea. Say THANK YOU!

THE COMPETITION

Your entry must be digital, so that you can upload it to be viewed online by the judges.

The entry must be in one of these formats:

Infographic Poster

- piktochart.com
- canva.com

Explainer Video

- moovly.com
- biteable.com

HTML Slide Show

- emaze.com
- Google Slides: google.com/slides/about (turn sharing on)

Submit your entry online here:

HTTPS://WWW.SURVEYMONKEY.COM/R/GROWINGNZ_ENTRY

Representatives from GrowingNZ will judge entries based on:

- Demonstrated understanding of the challenge itself (quality of research undertaken)
- Application of 'enablers' incorporated into your 'big idea'
- Quality of your explanation on how you have created value.

Teachers will be notified by email if one or more of their student teams are selected as a prize winner.

DEADLINE DATES

Winners will be selected each term from the entries received during the term.

Submit your entry by 4pm on these dates:

- 6th July
- 28th September
- 3rd December

A CHALLENGE FOR EVERY TALENT

Imagine designing a biosecurity defence system to protect a farm from diseases and pests; keeping cows cool in hot weather conditions; or developing a system to track timber products from an overseas market back to the forest where it was grown. Those are just some of the real-life challenges you might have had a taste of when participating in GrowingNZ's Innovation Challenge.

The primary sectors include everything from growing quality food, wood and wool through to making those things into products like ice cream, pizza boxes and even clothing for fashion stores. It also involves taking those products to the world.

To achieve that, we need innovative and talented people like you. People who can help us think outside the box, do things differently and use their skills to make a real difference.

We need a city's worth of people with a lot of different talents. That's 50,000 more people by 2025!

Maybe you love programming robots, working with animals or protecting our environment. You might be an unstoppable problem solver, a budding entrepreneur or an aspiring business person. It doesn't matter if you've grown up in a city or the country, or where you'd like to spend your time in future. Step out your back door to work on a farm, be experimental in a high-tech lab, or manage a complex business in the middle of a big city…it's up to you. There's a place for you in all these areas.

With plenty of challenges to solve, no two days are likely to be the same. Once you've explored your talents in one role, there are amazing opportunities for you to grow into others. Or you can use your skills in another primary sector where you'll be just as welcome.

FIND OUT MORE

1. **Explore a Huge Range of Roles**
   Whatever your interest, you can explore a huge range of roles on our website and get the inside-story from people already working in our sector.
   www.growingnz.org.nz

2. **Drop by Our Stand at a Careers Expo**
   We'd love to meet you at the next Careers Expo. Once we know what you're interested in, we can let you know about all the amazing educational, training and other opportunities available in our sector. Keep an eye on our Facebook page for upcoming dates and details.
   www.facebook.com/growingnz/

3. **Search Our Database of Over 250 Scholarships**
   If you're planning to study, your first year could be 'fees-free'. But there are heaps of scholarships available—$3million worth in fact—that cover other costs like books, accommodation and fees **after** your first year. Some set you up with a mentor, give you the chance to get some work experience or to hang out with inspiring experts. There are scholarships for apprenticeships and cadetships too.
   www.growingnz.org.nz/scholarships

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NOTES

NOTES

SKETCHES

THE PRIMARY SECTORS NEED TALENTED YOUNG NEW ZEALANDERS LIKE YOU.

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