TAHI RUA TORU TECH

NZ'S DIGITAL CHALLENGE

TEACHER'S GUIDE

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Introducing the Challenge

123Tech is New Zealand's exciting digital challenge for school students built around the successful TechHub Challenge.

Through 123Tech, students solve problems in their local school or community using digital technologies – and have fun along the way!

TAHI RUA TORU TECH
NZ'S DIGITAL CHALLENGE

What is it?

Partnering with the Ministry of Education, the IT industry is supporting the introduction of the new Digital Technologies & Hangarau Matihiko curriculum into schools and kura with the 123Tech Challenge. The Challenge is a great way to get started with DT&HM in the classroom.

In the challenge, small teams of 3-4 students complete a project-based challenge either in-class in schools, or through a local Code Club. Most will complete it as a classroom activity but the model caters to both.

The 123Tech Challenge is for everyone, not just tech geniuses (although they're welcome too!). We partner you with an industry mentor and provide all the guidance and support you need to make a real difference – and maybe even win fame and fortune along the way!

- **What:** Digital challenge, where students use Digital Technologies & Hangarau Matihiko to solve a problem in their local school or community
- **Target Age Group:** Age-appropriate versions from Years 0-13
- **Method:** In-class (primarily) or in Code Clubs, led by a teacher and an industry mentor
- **Components:**
  - In-class **Challenge** for all students
  - Regional then National **Championship** for top students

The Challenge Framework

123Tech Challenge

Based on the previous
TechHub Challenge

Operated by IT Professionals NZ

delivered by

Teachers

In partnership, and supported by industry, tertiary and each other (via **DTTA** regional hubs)

Mentors

Provided by **ITP NZ**, **Code Clubs**, tertiary providers (e.g via **CITRENZ**) and others

in

Classrooms

Most common model, delivered in partnership with teachers and supported by industry

Code Clubs

Via hundreds of existing Code Clubs across NZ, and expanding Code Club into more schools

Other Groups

Any other suitable groups or other organisations can deliver the Challenge

leading to

Regional Championship

Teams enter the Regional Championship by completing a video and blog, judged by regional judging panels. Winners go on to the annual National Championship.

Regional winners get an **expenses-paid trip** to compete in the National Championship.

National Championship

A significant national gala event with judging and announcement of the national winners at each level of the Challenge, in front of a national audience including media.

National winners win a **cash prize** for both their team and their school.

Challenge Levels

The 123Tech Challenge is available across the following school levels:

- **Discovery Challenge (Years 1-6)**
- **First Challenge (Years 5-8)**
- **Secondary Challenge (Years 9-10)**
- **Senior Secondary Challenge (Years 11-13)**

These year levels are a guide, you as the pedagogical expert will know whether your students are capable of extending themselves or will need to start at perhaps a lower level than indicated above.

Discovery Level

Discovery Challenge (Years 1-6)

Primary school students undertake a series of heavily guided activities in small groups and build up a portfolio of completed activities.

Activities are undertaken in small teams, and students who complete 8 or more activities receive a 123Tech Discovery Certificate and will then be eligible to participate in the Regional and then National 123tech championship.

Discovery Challenge themes

The 123Tech Discovery Challenge uses a series of activities based on the excellent CSUnplugged activities, streamlined and customised for the challenge.

These activities help introduce students to Digital Technologies through engaging games and puzzles led by the classroom teacher. Each activity includes a list of common classroom items required to run the challenge and downloadable resources to enhance the learning and fun.

First Level | Secondary Level | Senior Secondary Level

First, Secondary, and Senior Secondary Challenges (Years 5-13)

Target levels:

- **First: Years 5-8** (Senior Primary and Intermediate)
- **Secondary: Years 9-10** (Junior Secondary)
- **Senior Secondary: Years 11-13** (NCEA / Senior Secondary)

First, Secondary, and Senior Secondary levels, delivered as part of the 123Tech Challenge, are team-based digital technology project challenges with comprehensive age and learning-level appropriate support and guidance.

At all levels, the students are learning skills in teamwork, research and technological practice.

Small teams of 3-4 students identify a problem in their school or local community and with the guidance of an industry mentor, use Digital Technologies to solve it.

The challenge can be undertaken as a term-long in-class challenge (the most common situation) or through the school's Code Club.

Each level builds on the previous in terms of the depth and complexity of both the process and the outcome. Each has a Challenge question – a variation of identifying a problem in their own school or community and devising a digital technologies-based solution to solve it.

Themes of the Challenge Projects (First, Secondary, and Senior Secondary)

The process becomes more comprehensive at higher levels, but the general theme includes:

- Sharing the learning journey via a blog (safe platform provided for teams).
- Deciding on an interesting problem to solve that meets the Challenge Question (student groups are supported to develop a Project Plan – more structured at later levels)
- Sharing and discussing the idea with an industry Mentor (provided as part of the Challenge), and getting advice on how to progress
- Exploring ideas with some trial and error, and deciding on an aim, need and opportunity.
- Carrying out the plan – with the support of the Mentor and Teacher, and using all resources at their disposal, try to solve the challenge and problem with a digital technologies solution.
- Pivoting is encouraged! Changing if necessary and revising as they go along.
- Reporting interesting aspects of the project to others and on the blog.
- Self-assessing using the assessment criteria provided and discussing with the teacher and mentor.
- Completing a short report on how it went and reflecting on learning.

Time commitment for students

The time commitment for the Challenge varies significantly, depending on the nature of the school and experience of the team, the Challenge level, and the support available.

The Challenge has been designed to be flexible - it can either be undertaken as a standalone activity or fully integrated into classroom activities, so the time commitment for students can vary significantly depending on the approach taken.

Most levels of the Challenge can be taught in a single lesson per week over a term, assuming students undertake additional work outside class. Silver may require additional time. However it is far more effective when integrated with other classroom activities over the term.

123 Tech Certificate and Regional Championships

Those who complete the First, Secondary, and Senior Secondary Challenge to a suitable standard will have the option of downloading a 123Tech Challenge Certificate. Teachers and Code Club coordinators can also select the best projects to go forward to the Regional Championship. Winners of the Regional Championship can go on to enter the National Championship.

Students participating in the Discovery Challenge who can complete 8 or more of the 123Tech activities are also eligible for a certificate and entry to the Championship. For them, the Championship will involve teams competing in time-based challenges based on the 123Tech activities.

Each Challenge level is closely linked to the Digital Technologies and Hangarau Matihiko Progress Outcomes in the new curriculum content (see Page 10 of this Guide).

The 123Tech Process

The Challenge provides full documentation and resources to run the Challenge in your school or Code Club.

The overall 123Tech Challenge takes the form of two components:

- A **term-long challenge** completed in-class at school (or in a Code Club)
- The best teams them go onto a **Regional and National Championship**

Discovery Level

Discovery (for Years 0-6) involves completing a range of fun digital activities.

Students take part in practical, hands-on digital tech activities, working in pairs or small groups to solve a defined problem set.

Teachers present 1 problem set a week over 8-10 weeks. No industry mentor is necessary.

First Level

First, Secondary, and Senior Secondary (for Years 5-8, 9-10 and 11-13 respectively) take the form of a **term-long project**.

It is completed in **teams of 3-4 students**.

The complexity and depth increases at each level, teaching good project management skills alongside Digital Technologies.

First, Secondary, and Senior Secondary Process

While each level varies, the general process involves:

- **Weeks 1-2:** Preparing and planning, Determining a problem to solve
- **Weeks 3-4:** Conception and Design, creating an Action Plan and experimenting
- **Weeks 5-8:** Developing and testing a solution
- **Weeks 9-10:** Evaluating and writing a short report

Teams (and teachers) have access to an **industry mentor** to give advice and guidance.

Teams can determine their own project, identifying a problem in their school or local community and using Digital Technologies to solve it. The Challenge is ideal to run alongside other DT&HM work in class and ties in cleanly with the new curriculum Progress Outcomes.

The best teams can then go on to represent their school in the **Regional Championship!**

Resources provided

Teachers and students at First, Secondary, and Senior Secondary levels get access to a full set of resources and documents including process documentation, project plan and report templates, information sheets on each step of the process, posters that can be printed and so much more – everything you need to run the Challenge in your class or Code Club.

Essentially the 123Tech Challenge provides the process and guidance for running a team-based project Challenge, as well as an industry mentor to help. The best teams can then go on to compete in Regional and National Championships on behalf of their school.

Resources provided to teams and teachers

The following resources are provided as part of the 123Tech Challenge:

Resource	*First Level*	*Secondary Level*	*Senior Secondary Level*
Target year levels (this is a guide only)	*Yrs 5-8*	*Yrs 9-10*	*Yrs 11-13*
Programme of Work guide	✓	✓	✓
Working as a Team infosheet	✓	✓	✓
Help with choosing a topic	✓	✓	✓
Action Plan Template	✓	✓	✓
Mid-point Progress Checklist	✓	✓	✓
Detailed project requirements sheet	✓	✓	✓
Background research guide		✓	✓
Ethical Practice Planning Template		✓	✓
Project Proposal Form			✓
Collating and Analysing Results guide			✓
Executive Summary / Abstract guide			✓
Final Report Template and Guide	2-page template (fillable PDF)	3-page template (fillable PDF)	Guide for detailed report
Industry mentor to support team	✓	✓	✓

At **First** level (years 5-8), the process requirements are light - it's all about experimenting and getting hands-on as quickly as possible.

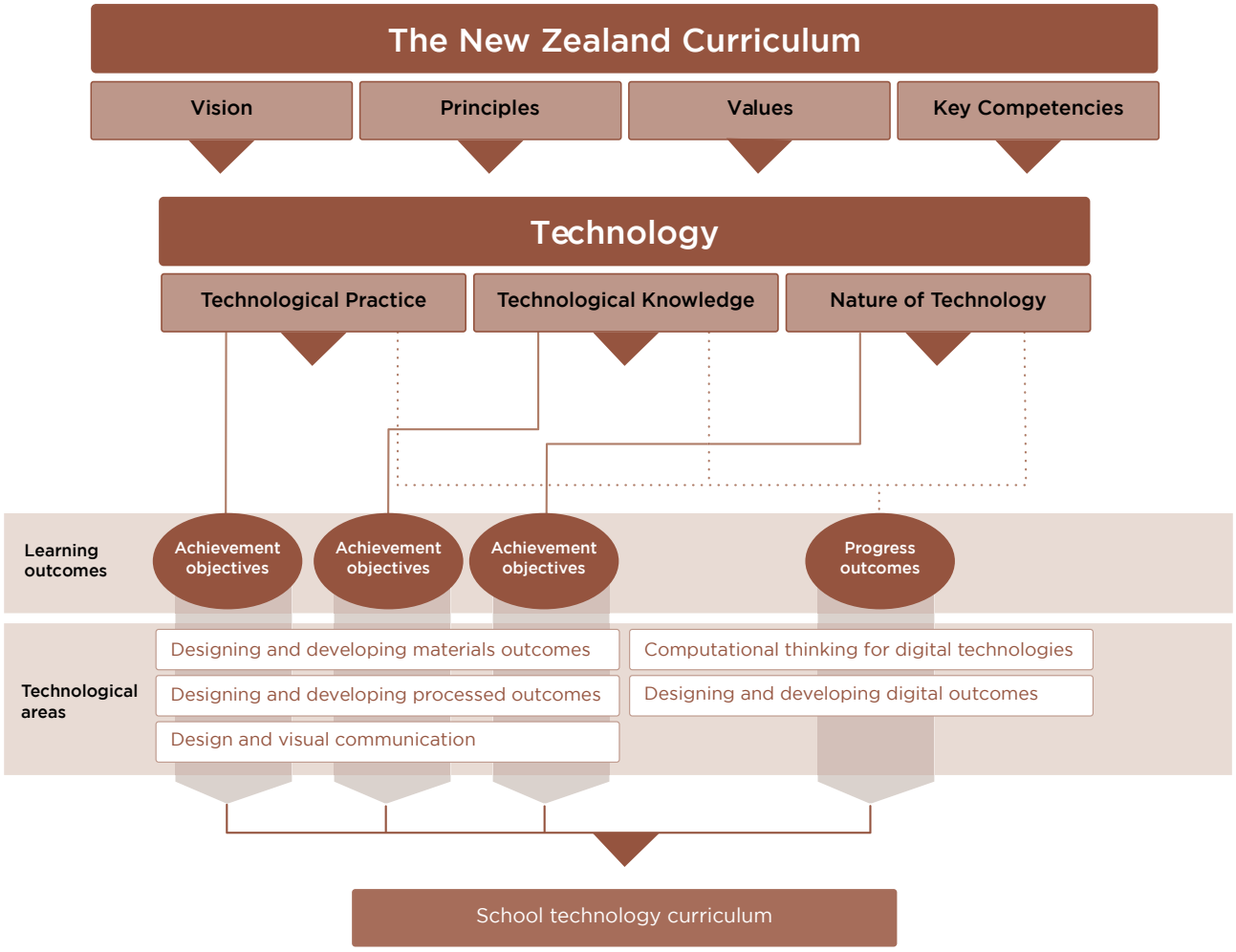
At **Secondary** level (years 9-10) the challenge includes more research and reflection.

At **Senior Secondary** level (years 11-13) the challenge includes broader process requirements and support, including a formal project proposal, deeper analysis and reflection on outcome and a more detailed Final Report.

Alignment with Curriculum

In December 2017 the new Digital Technologies and Hangarau Matihiko curriculum changes were officially launched, becoming a requirement for all schools to teach from years 1 to 10.

The changes include new Progress Outcomes in **Computational thinking for digital technologies** and **Designing and developing digital outcomes:**



Computational thinking is about:

Understanding the computer science principles that underlie all digital technologies

and learning how to develop instructions, such as programming, to control these technologies.

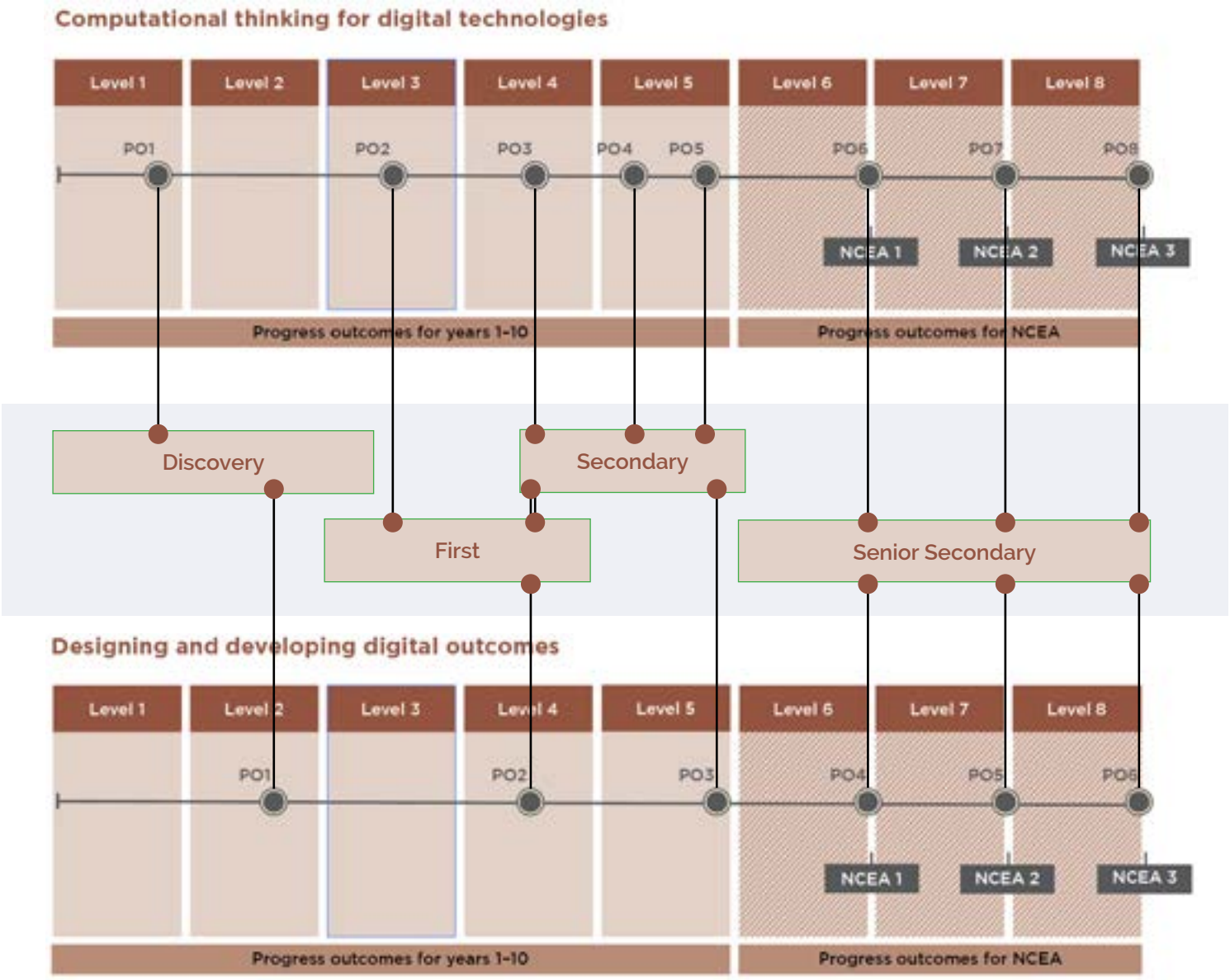
Designing and developing digital outcomes is about:

Understanding that digital systems and applications are created for humans by humans,

and developing knowledge and skills in using different digital technologies to create digital content across a range of digital media and electronics.

The 123Tech Challenge weaves across both of these technological areas and also has relevance to other areas of the Technology learning area. The Challenge relates and integrates directly with the DT&HM Progress Outcomes.

The Progress Outcomes for each of these align roughly with the curriculum levels as follows:



This means that:

- **Discovery** can be used towards:
  - Computational Thinking Progress outcome 1
  - Digital Outcomes Progress outcome 1
- **First** can be used towards:
  - Computational Thinking Progress outcomes 2 or 3
  - Digital Outcomes Progress outcome 2
- **Secondary** can be used towards:
  - Computational Thinking Progress outcomes 3, 4 or 5
  - Digital Outcomes Progress outcomes 2 or 3
- **Senior Secondary** can be used towards:
  - Computational Thinking Progress outcomes 6, 7 or 8
  - Digital Outcomes Progress outcomes 4, 5 or 6

Note that detailed Progress Outcome links for each level of the Challenge can be found in Appendix A at the end of this document

Getting Started

The Challenge is fun and **completely free** for schools and students. Here's a quick guide to how to get started with the Challenge:

1. **Sign up as a teacher** (or CodeClub coordinator) at 123tech.nz
2. Download the **Challenge resources** and documentation
3. Join DTTA and get on their mailing list to get support from other teachers
4. **Integrate** the Challenge into classroom learning where possible
5. **Create your class teams** (3-4 students) and load them on the 123Tech site
6. **Plan out the term** using the Programme of Work for your level
7. Identify or request your **mentor(s)**, and meet with them ***(First, secondary and Senior Secondary only)***
8. Introduce your class to the Challenge with **posters** and other material
9. **Start the Challenge!** (Just follow the Programme of Work for your level)

Teacher checklist *(First, Secondary, and Senior Secondary levels)*

Once the teams have been assembled, follow the Programme of Work and ensure they have:

- brainstormed their idea and come to a consensus on their project idea
- carried out research on their idea
- formulated the need and aim of their project
- created a plan with deadlines
- updated their blogs with details of decisions and pivots (if any)
- met regularly to discuss and review their project
- allocated tasks fairly amongst themselves
- performed a self-assessment during the development of their product

As their supervisor you should also:

- Encourage students to evaluate and modify regularly
- Watch group dynamics and troubleshoot where necessary
- Ensure that contact with the mentor is not abused
- Encourage students to have a go

Teacher checklist *(Discovery level)*

Once the teams have been assembled, follow the Programme of Work and ensure they have:

- Plan the order in which you want to run the activities over the term (we recommend sticking to the original order, but this can be changed if necessary).
- Gather the common resources required for each activity.
- Print the printable resources listed for each activity.
- Encourage students to continue to do the activities throughout the week and outside of school.
- Identify a team of students to represent your school at the Regional Championship.

Helpful Tips

- Students can take part in the Challenge with absolutely no programming experience. Many previous Regional and National winners of the 123Tech Challenge taught themselves to code as part of the Challenge.
- DON'T make it optional, set the challenge as a class based activity, with teams updating the class regularly on their progress to keep momentum, motivation and innovation alive.
- Where appropriate, use Senior Secondary project work for NCEA and other assessments.
- Make use of your mentor (First, Secondary and Senior Secondary only), they are there to support you as well as the students.
- Talk to ITP about having an Inspirational speaker talk to your students.
- TKI has a large range of exemplars and project ideas, use it!
- Consider other uses for the students work:
    - **Science and Technology Fairs**
      http://www.realisethedream.org.nz/regional-events.php
    - **Bright sparks**
      http://www.brightsparks.org.nz/
    - **Eureka! Awards**
      https://www.eureka.org.nz/
    - **Young Designers**
      http://technology.tki.org.nz/Resources/Teaching-snapshots/Middle-Years-7-10/Young-Designer-Awards

But most of all, have fun!

Regional Championship

All participating schools, kura and code clubs throughout New Zealand can nominate teams for the Regional Championship. Each school can nominate one team per Challenge level to represent their school.

Participating in the Regional Championship is entirely optional, but we strongly recommend entering a team to represent your school.

The teachers at each school nominate which team will go on to represent the school in the Regional Championship. You can do this however you like - some teachers select a team (if there is one that has had a great outcome), others run an in-school finals event, with industry reps reviewing and selecting the school winner. 123Tech can assist with the process.

Note that if you have a large number of students participating in the Challenge, you may be able to nominate more than one team to represent your school. Please contact us if you have more than 10 teams participating in one level.

Finalists in each level will be selected in each of the following Ministry of Education areas:

- Tai Tokerau (Northland)
- Auckland
- Waikato
- Bay of Plenty / Rotorua / Taupo
- Hawkes Bay / Gisborne
- Taranaki / Whanganui / Manawatu
- Wellington
- Nelson / Marlborough / West Coast
- Canterbury
- Otago / Southland

All Regional Winners are automatically entered into the National Championship, with a comprehensive judging process - then national winners announced live during a live broadcast in December.

One team at each level will be crowned the **National Winners** for the year in front of a national audience!

Industry mentors

Mentors are vital to 123Tech projects. They provide access to information and experiences often not found inside the classroom and help to support the students and teacher to introduce the best practice ideals in their project.

Mentors are available at the First, Secondary and Senior Secondary levels and are there to support you in the Challenge, **but are not teachers**. Mentors are advisors, motivators, role models and supporters of the students undertaking the projects, and for you as teacher.

It is important to remember that the mentor is the subject expert, however the teacher is the pedagogical expert.

The most successful projects come from students' own ideas, though a project does need to be manageable and realistic. Mentors will support the student's initiatives but will avoid doing the project for them.

The role of the Mentor

Specifically The Mentor's role in the 123Tech challenge is to:

- **Support and encourage** the students with their ideas and keep them interested and excited in technology
- Provide the students with **advice** that is appropriate to the students level and compliments the student's own ideas
- Help students to find a **good direction** to take and offer them some help with ideas around how to go about creating their solution
- **Be a sounding board** and challenge the student's ideas to help them think critically about their project
- Explain how "something is usually done" or provide information about a project
- **Suggest other questions** or avenues that would be interesting and manageable to explore
- Help students towards setting and achieving **realistic goals**
- Help the students complete their projects with a sense of satisfaction and enjoyment.

Mentor activities

Mentors will come to your school to initially meet with you and the students. They will discuss the students ideas with them and offer some age appropriate advice.

Mentors will then also help review the project proposal and action plan and provide positive advice (either to you as teacher, or to the students if you prefer).

They will assist you by being available to help answer questions that the students may have that you need support with, and to support you with facilitating the challenge. If necessary, you can arrange follow-up meetings with the mentor partway through the Challenge and to provide comments at the end.

They will be as positive and as encouraging as possible to both you and the students.

Finding your industry mentor

If students are participating through the school's CodeClub, or they are participating in-class and the school runs a separate CodeClub, we recommend the school's CodeClub coordinators act as mentors for the Challenge as they are already involved in the school.

Otherwise, either the school can find an industry mentor from their community, or we can help identify and introduce a mentor (we have hundreds of mentors available throughout NZ).

We provide full guidance for mentors and support them throughout the Challenge. Please let us know as soon as possible if you need us to identify and introduce you to a mentor in your area and we will come back to you promptly.

You are the gatekeeper between students and mentors

Our mentors have agreed to our Vulnerable Children Policy which includes provisions stating that under no circumstances should mentors ever:

- Be in contact with any student or team directly, without the teacher being involved (e.g. if there is any email communication, the teacher should be CC'd on everything)
- Be left alone with any child. When a mentor is visiting, a teacher or CodeClub coordinator must be physically present at all times
- Arrange to meet with students or teams outside the meeting times agreed with and by the teacher (or CodeClub coordinator)

We treat student safety very seriously and ask that you help us strictly enforce these requirements and let 123Tech know immediately if you become aware of any breach of this policy, even if it is minor or appears inconsequential.

NOTE that mentors are not available at the Discovery Challenge level - these activities are designed to run in the classroom. We are happy to help in any other way however - please don't hesitate to contact us.

Example projects

Example entries from prior year

Here are some example entries at the Secondary level.

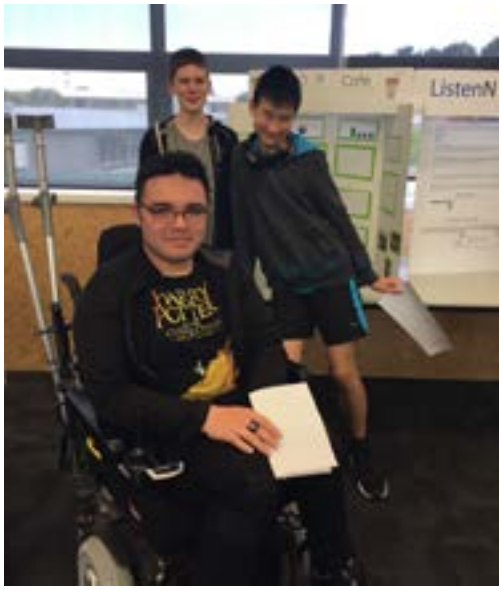
Students were encouraged to think outside the square, with teachers and mentors supporting their creativity and innovation while thinking about problems differently and how Digital Technologies could solve them.

Colour Café

Onslow College

Colour Café is an app that provides the ability for people with various forms of colour blindness to apply a filter to a picture on their mobile phone, to allow them to view it corrected for their type of colour blindness.

They can also apply a similar filter to demonstrate to other people what the person with colour blindess actually sees. The team intends to evolve their app to the inclusion of a live stream video that users can apply a filter to, allowing them to view a corrected version of what they are experiencing.



Food Fall
St Marys School

Food Fall is an interactive game using Augmented Reality, and requiring the player to catch good food and let the bad food fall to the ground.

Your game is over when you have caught too much bad food. The idea behind the development of the game was to find a way to engage players in a fun and physical way in which they learn about different types of food and their nutritional values, which are displayed at the end of the game.

By recognising the foods that give them more points (ie the foods that have better nutritional values) this team hoped that people playing the game would recognise those same values in every day foods that they choose to eat.

#Spirit
Samuel Marsden Karori School

In an effort to encourage a sense of community, #spirit tracks attendance at school hosted events and allocates points to the students "house".

At the end of the year the house with the most points earned by students is awarded a prize or recognition within the school.

Alzheimers
Hornby School

This team set about producing an app for tablets that could help someone caring for an Alzheimers patient.

It contained customised alarms that could be set to remind the patient to get dressed, go to the kitchen for dinner etc. They also integrated skype for easy calling of family and friends and also provided a customised activity centre where the caregiver could upload photos of families, pets, important memories or items that were then presented in formats such as memory recall games, photos with names and descriptions etc.

They wanted to further develop their product to work with a tracking device that would sound an alarm or send an alert if a patient wandered too far away from their tablet.

Other example projects

- Interactive game supporting the victims of bullying
- Student-focused fun website about nutrition and exercising
- Homework scheduling app
- Motivational game to encourage studying
- App to store and sort research reference and bibliography details
- Homework task assignment and notifications to parents
- School virtual tour app
- Kids recipe collection app
- School canteen ordering App
- App with lyrics to school songs hyms and prayers
- Survival skills App
- Interactive app and games for sufferers of autism

How to get Support

In the first instance, all support enquiries should be sent to:

kiaora@123tech.nz

or visit:

www.123tech.nz

Curriculum/teaching support should be directed to Digital Technologies Teachers Aotearoa:

admin@nzacditt.org.nz or visit www.dtta.org.nz

Appendix A:

Detailed Curriculum links

The following pages outline the detailed links between each Challenge level and the Progress Outcomes from the new Digital Technologies curriculum.

Progress Outcome Key:

CT = Computational Thinking

DO = Designing and developing digital outcomes

123Tech Discovery links to DT & HM Progress Outcomes

The following table outlines the core Progress Outcomes that relate to this level:

PO	Progress Outcome Description	123Tech Notes
CT 1	In authentic contexts and taking account of end-users, students use their decomposition skills to break down simple non-computerised tasks into precise, unambiguous, step-by-step instructions (algorithmic thinking). They give these instructions, identify any errors in them as they are followed, and correct them (simple debugging).	The activities in Discovery are designed to break down simple non-computerised tasks into precise, unambiguous, step-by-step instructions (algorithmic thinking). Each activity that relates to this Progress outcome is identified.
DO 1	In authentic contexts and taking account of end-users, students participate in teacher-led activities to develop, manipulate, store, retrieve, and share digital content in order to meet technological challenges. In doing so, they identify digital devices and their purposes and understand that humans make them. They know how to use some applications, they can identify the inputs and outputs of a system, and they understand that digital devices store content, which can be retrieved later.	The activities in Discovery meet this Progress Outcome description perfectly. Each activity that relates to this Progress outcome is identified.

123Tech First links to DT & HM Progress Outcomes

The following table outlines the core Progress Outcomes that relate to this level:

PO	Progress Outcome Description	123Tech Notes
CT 2	In authentic contexts and taking account of end-users, students give, follow, and debug simple algorithms in computerised and non-computerised contexts. They use these algorithms to create simple programs involving outputs and sequencing (putting instructions one after the other) in age-appropriate programming environments.	The First can be undertaken in a basic programming context, with students guided through the process of developing a solution to a local problem using technology.
CT 3	In authentic contexts and taking account of end-users, students decompose problems into step-by-step instructions to create algorithms for computer programs. They use logical thinking to predict the behaviour of the programs, and they understand that there can be more than one algorithm for the same problem. They develop and debug simple programs that use inputs, outputs, sequence, and iteration (repeating part of the algorithm with a loop). They understand that digital devices store data using just two states represented by binary digits (bits).	The First process guides students to look at a problem, then break it down into "Action Steps" before applying a solution via digital technologies. The Challenge also encourages students to predict and analyse outcomes.
DO 2	In authentic contexts and taking account of end-users, students make decisions about creating, manipulating, storing, retrieving, sharing, and testing digital content for a specific purpose, given particular parameters, tools, and techniques. They understand that digital devices impact on humans and society and that both the devices and their impact change over time. Students identify the specific role of components in a simple input-process-output system and how they work together, and they recognise the "control role" that humans have in the system. They can select from an increasing range of applications and file types to develop outcomes for particular purposes.	Through the First challenge process, students are encouraged to make decisions about technology having considered a problem and its possible solution. Teachers can use the Challenge to provide a practical example of components of an input-process-output system and help students begin to make decisions on applications and approaches for their specific challenge context.

123Tech Secondary links to DT & HM Progress Outcomes

The following table outlines the core Progress Outcomes that relate to this level:

PO	Progress Outcome Description	123Tech Notes
CT 3	In authentic contexts and taking account of end-users, students decompose problems into step-by-step instructions to create algorithms for computer programs. They use logical thinking to predict the behaviour of the programs, and they understand that there can be more than one algorithm for the same problem. They develop and debug simple programs that use inputs, outputs, sequence, and iteration (repeating part of the algorithm with a loop). They understand that digital devices store data using just two states represented by binary digits (bits).	The Secondary process guides students to look at a problem, then break it down into "Action Steps" before applying a solution via digital technologies. The Challenge also encourages students to predict and analyse outcomes.
CT 4	In authentic contexts and taking account of end-users, students decompose problems to create simple algorithms using the three building blocks of programming: sequence, selection, and iteration. They implement these algorithms by creating programs that use inputs, outputs, sequence, basic selection using comparative operators, and iteration. They debug simple algorithms and programs by identifying when things go wrong with their instructions and correcting them, and they are able to explain why things went wrong and how they fixed them. Students understand that digital devices represent data with binary digits and have ways of detecting errors in data storage and transmission. They evaluate the efficiency of algorithms, recognising that computers need to search and sort large amounts of data. They also evaluate user interfaces in relation to their efficiency and usability.	While undertaking the 123Tech Challenge at the Secondary level, students can choose to solve their problem using programming specifically. A Secondary level programming solution would be expected to create simple algorithms and debug these as part of their project. A core part of the Challenge is reflection in the final report - including identifying when things went wrong and what they did to fix it. While not all projects will relate to data management, user interface is increasingly focused on at this level.

PO	Progress Outcome Description	123Tech Notes
CT 5	In authentic contexts and taking account of end-users, students independently decompose problems into algorithms. They use these algorithms to create programs with inputs, outputs, sequence, selection using comparative and logical operators and variables of different data types, and iteration. They determine when to use different types of control structures. Students document their programs, using an organised approach for testing and debugging. They understand how computers store more complex types of data using binary digits, and they develop programs considering human-computer interaction (HCI) heuristics.	In more advanced Secondary -level projects, student teams will begin to work independently to decompose problems into Action Steps then algorithms. The Challenge provides a good vehicle for reinforcing "programming hygiene" in the form of documentation and structured testing as well as full HCI heuristics.
DO 2	In authentic contexts and taking account of end-users, students make decisions about creating, manipulating, storing, retrieving, sharing, and testing digital content for a specific purpose, given particular parameters, tools, and techniques. They understand that digital devices impact on humans and society and that both the devices and their impact change over time. Students identify the specific role of components in a simple input-process-output system and how they work together, and they recognise the "control role" that humans have in the system. They can select from an increasing range of applications and file types to develop outcomes for particular purposes.	The Challenge provides an ideal vehicle to support students making decisions on creating, manipulating, storing, retrieving, sharing and testing digital content for their specific purpose. Through the increased focus on human ethics, students also focus on the human factor of technology.
DO 3	In authentic contexts, students follow a defined process to design, develop, store, test, and evaluate digital content to address given contexts or issues, taking into account immediate social, ethical, and end-user considerations. They identify the key features of selected software and choose the most appropriate software and file types to develop and combine digital content. Students understand the role of operating systems in managing digital devices, security, and application software and are able to apply file management conventions using a range of storage devices. They understand that with storing data comes responsibility for ensuring security and privacy.	The Secondary challenge provides a clean and clear process for the design and development of digital content for a specific purpose. It's important to note that the Challenge has both significant practical and process steps, bringing to life the theory but in a solid and structured manner. If students are working towards Digital Outcomes Progress outcome 3, a project with a focus on digital devices and management of data might be preferable.

123TEch Senior Secondary links to DT & HM Progress Outcomes

The following table outlines the core Progress Outcomes that relate to this level:

PO	Progress Outcome Description	123Tech Notes
CT 6	In authentic contexts and taking account of end-users, students determine and compare the "cost" (computational complexity) of two iterative algorithms for the same problem size. They understand the concept of compression coding for different media types, its typical uses, and how it enables widely used technologies to function. Students use an iterative process to design, develop, document and test basic computer programs. They apply design principles and usability heuristics to their own designs and evaluate user interfaces in terms of them.	As part of the Challenge at Senior Secondary level, students should be encouraged to experiment with multiple methods of solving their problem. Senior Secondary-level programming projects would be expected to use an iterative process to design, develop, document and test programs and evidence of this is necessary to be successful.
CT 7	In authentic contexts and taking account of end-users, students analyse concepts in digital technologies (for example, information systems, encryption, error control, complexity and tractability, autonomous control) by explaining the relevant mechanisms that underpin them, how they are used in real world applications, and the key problems or issues related to them. Students discuss the purpose of a selection of data structures and evaluate their use in terms of trade-offs between performance and storage requirements and their suitability for different algorithms. They use an iterative process to design, develop, document and test advanced computer programs.	The Senior Secondary level challenge guides students through the concepts of initial research and investigation of digital technologies that could be used to solve their problem. The challenge provides a good opportunity to explore DT concepts in more depth as part of this exercise.
CT 8	In authentic contexts and taking account of end-users, students evaluate concepts in digital technologies (for example, formal languages, network communication protocols, artificial intelligence, graphics and visual computing, big data, social algorithms) in relation to how key mechanisms underpin them and how they are applied in different scenarios when developing real world applications. Students understand accepted software engineering methodologies and user experience design processes and apply their key concepts to design, develop, document and test complex computer programs.	The heavier focus on research and planning in the Senior Secondary challenge provides good opportunities to explore DT concepts in depth, especially for students who have undertaken a Secondary or Senior Secondary Challenge previously. Students are expected to report on methodologies and focus on user experience design.

PO	Progress Outcome Description	123Tech Notes
DO 4	In authentic contexts, students investigate and consider possible solutions for a given context or issue. With support, they use an iterative process to design, develop, store and test digital outcomes, identifying and evaluating relevant social, ethical and end-user considerations. They use information from testing and apply appropriate tools, techniques, procedures and protocols to improve the quality of the outcomes and to ensure they are fit-for-purpose and meet end-user requirements.	The Progress Outcome definition sums up the Senior Secondary-level challenge. Students are guided through the process of considering social, ethical and end-user considerations as they investigate and consider possible solutions to their problem.
DO 5	In authentic contexts and with support, students investigate a specialised digital technologies area (for example, digital media, digital information, electronic environments, user experience design, digital systems) and propose possible solutions to issues they identify. They independently apply an iterative process to design, develop, store and test digital outcomes that enable their solutions, identifying, evaluating, prioritising and responding to relevant social, ethical and end-user considerations. They use information from testing and, with increasing confidence, optimise tools, techniques, procedures and protocols to improve the quality of the outcomes. They apply evaluative processes to ensure the outcomes are fit-for-purpose and meet end-user requirements.	The Senior Secondary Challenge encourages and supports students as they investigate particular digital technologies areas while considering how to solve their problem. The Challenge process also supports their development of a technology solution, considering social, ethical and end-user considerations. They also reflect on their solution in-depth and consider whether it met end-user requirements.
DO 6	In authentic contexts, students independently investigate a specialised digital technologies area and propose possible solutions to issues they identify. They work independently or within collaborative, cross-functional teams to apply an iterative development process to plan, design, develop, test and create quality, fit-for-purpose digital outcomes that enable their solutions, synthesising relevant social, ethical and end-user considerations as they develop digital content. Students integrate in the outcomes they develop specialised knowledge of digital applications and systems from a range of areas, including: network architecture; complex electronics environments and embedded systems; interrelated computing devices, hardware and applications; digital information systems; user experience design; complex management of digital information; and creative digital media	More experienced students undertaking the Senior Secondary level challenge will work within collaborative, cross-functional teams to apply an iterative development process to develop their solution. It's unlikely any one Challenge project will meet all of the requirements for DO Progress outcome 6, however it does form a solid base on which additional class work can be built.

The Tahi Rua Toru Challenge is brought to you by:

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