



# Digital Sciences Learning Area

A possible model for the future of  
Digital Technologies education in New Zealand schools



The Institute of IT Professionals NZ is the independent professional body of the IT industry and New Zealand's largest IT representative group

# Introduction: Technology is transforming our world

Computing and Digital Technology has redefined almost every facet of the modern world and become ubiquitous at work, home and in the community. This transformation has empowered people and changed the way we do business.

At work, the relatively young IT industry employs more people than ever before, is frequently found to be amongst the highest paid professions in New Zealand, has the potential to redefine the economic development of New Zealand and has created thousands of amazing and challenging roles here and abroad, more than all other areas of science combined.

Whether in the IT industry, in other fields, or just in life, strong computing and digital skills are essential and those without are significantly disadvantaged. In today's world, every learner in school without access to comprehensive digital technologies education will not have the same opportunities as those who do – it has become an equity issue.

However the current NZ Curriculum structure sees Digital Technologies as just one component of a generally non-academic Learning Area that is not well positioned to lead the transformational change necessary, despite amazing work by some individual teachers and schools. In our view it is not possible for Digital Technologies to reach the scale, prominence or focus needed in NZ under the current structure.

The challenge is thus to transform how Digital Technologies is structured within the New Zealand Curriculum to ensure it is positioned to deliver on the potential for every learner in New Zealand schools.

## A massive opportunity for New Zealand

New Zealand was world-leading in the introduction of the Digital Technologies Achievement Standards in 2011, following three years of work. Since then, other countries such as the UK and Australia have made similar or more comprehensive changes, many creating the equivalent of a Digital Sciences Learning Area.

On Tuesday 29<sup>th</sup> July 2014 the NZ Government released *A Nation of Curious Minds: A National Strategy Plan for Science in Society*. Amongst other initiatives, this plan committed to working alongside sector partners to review the positioning and content of Digital Technologies within the NZ Curriculum.

This strategy plan is our collective opportunity to truly transform IT education in schools – to finish the job started with the new Digital Technologies Achievement Standards, to establish a structure that better resources teachers, and to position Digital Technologies to deliver on the needs and promise of all of today's learners.

The Institute is open to any model or structure that achieves this objective. This document simply outlines in brief the starting point for one such approach – the creation of a *Digital Sciences Learning Area*.

*Science is the study of the structure and behaviour of the physical and natural world.*

*Digital Science is the study of the structure and behaviour of the digital world through observation and experiment.*

## Who is IITP?

The Institute of IT Professionals NZ is the professional body for those working in the Information Technology industry. With thousands of members nationwide, the Institute is the voice of the IT Profession and the largest IT representative body in New Zealand.

IITP has been heavily involved in most ICT/computing educational advances in recent years, including participating in the Digital Technologies Expert Panel, assisting with the creation of the new DT Achievement Standards, co-leading the review of ICT Qualifications at tertiary level, & overseeing Degree Accreditation.

The Institute works closely with Industry, Government and Academia however is a fully independent non-profit body; funded, operated & governed by IT Professionals. The Institute has been the voice of the IT Profession for 54 years.

More information at [www.iitp.org.nz](http://www.iitp.org.nz)



# Digital Technologies: The Current State

As outlined in the introduction, Digital Technology has the potential to both truly transform the education sector in New Zealand, and permanently change the structure, dynamic and outcomes of New Zealand's schooling system. As well as opening up new opportunities for pedagogy, learning to use and create with digital technologies is essential to ensure young kiwis have the best opportunity to succeed in today's digital world.

**However there is currently no “top level” learning or subject area that focuses on computing or ICT – either usage of computers and technology, or creation in an ICT context.**

Students leaving school now, let alone those just starting out or part way through their primary and secondary schooling, need to succeed in an increasingly digital world. It is the responsibility of New Zealand's education system to give them the best opportunity for success in whatever field they choose, and this means a comprehensive focus on both using and creating with computers and other technology.

Many individual schools and teachers are doing an extremely good job of teaching digital technologies in their communities and the teacher subject association (NZ Association of Computing, Digital and Information Technology Teachers – NZACDITT) is very active and successful in supporting this. However whether in a use, programming, digital design or other context, digital technologies skills are essential for every learner in New Zealand and we believe the structure of the NZ Curriculum needs to change before this scale can be achieved.

## Digital Technologies in the NZ Curriculum

The New Zealand Curriculum is currently divided into eight *Learning Areas*, each resourced separately. The Learning Areas are effectively the focused subject areas taught in schools, and each are then divided into strands (such as Algebra, Geometry and Measurement, and Statistics in the case of *Maths*).

These learning areas are currently:

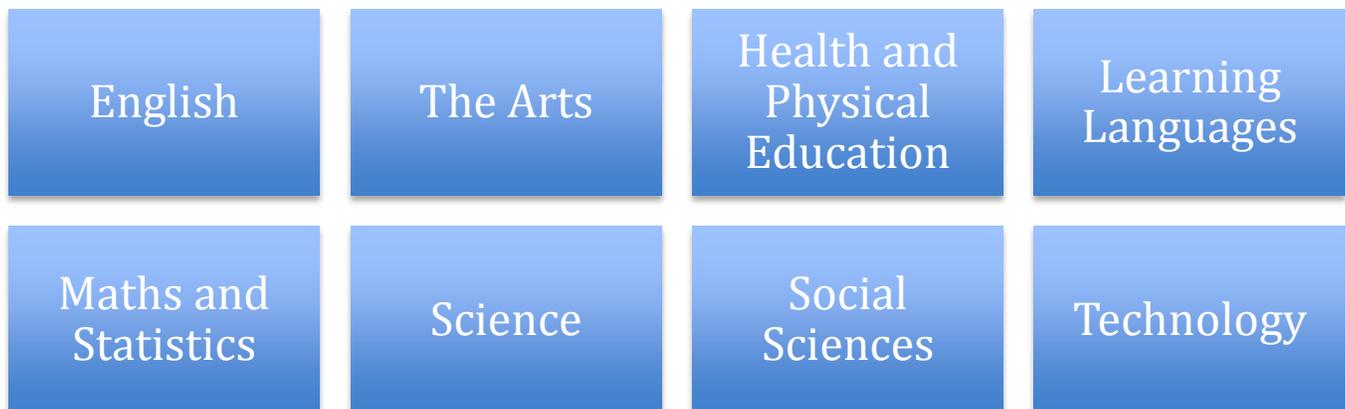


Figure 1: Current essential Learning Areas of the NZ Curriculum

**Digital Technologies** sits within the *Technology* Learning Area. The Technology Learning Area has three strands (technology practice, technology knowledge and nature of technology) but in practice the subject areas taught within the Technology Learning Area, alongside DT, include Hard Materials, Food Technology, Textile Design and Graphics<sup>1</sup>. These subjects have their roots in what used to be called Woodwork, Metalwork, Cooking, Sewing and Technical Drawing.

<sup>1</sup> It should be noted that the names for the Technology subject areas have changed in many places to Construction and Mechanical Technologies, Manufacturing, Processing Technologies and Design and Visual Communication. Most schools still appear to use the old structure and naming however.

Digital Technologies itself has 5 streams, including Digital Information, Digital Media, Programming and Computer Science, Electronics, and Infrastructure (which includes Networking).

Thus the structure of the relevant parts of the Technology Learning Area looks like this:

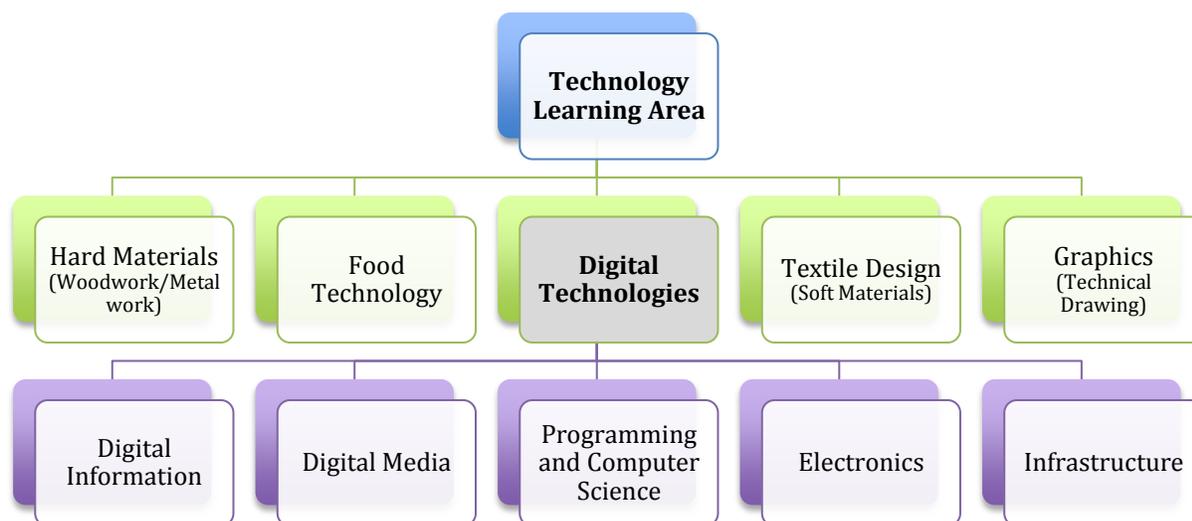


Figure 2: The Digital Technologies component of the Technology Learning Area

So to be clear, the current home for all of ICT and technology-related subjects (including usage of technology within the context of digital literacy as well as all ICT-related topics such as software, digital design, electronics, networking etc under Digital Technologies) is currently within one single *strand* of one learning area.

**To put that within a comparative context, this means that the entire Digital Technologies field has the same overall curriculum focus of (for example) Biology, Calculus, Food Technology, or Drama. Each area of Digital Technologies (such as *Digital Information* or *Programming and Computer Science*) has the same curriculum focus of one module, or in this case one fifth of, a stream.**

In the Institute's view, it is simply not possible to provide sufficient grounding at scale under this model, to adequately prepare New Zealand learners for the current and future digital world.

It is also fair to say that all areas of the Technology Learning Area other than Digital Technologies are focused on vocational, non-academic outcomes. This was an appropriate place when Digital Technologies was simply spreadsheets and word processing, however that is no longer the case. *Technology* as a learning area has the unfortunate perception in most schools as the subject that the less academically inclined students undertake, and this has a dire and significant impact on the types of students that study in the field, and those that choose hi-tech pathways in tertiary and industry.

In 2009 the first recommendation from the *Digital Technologies Expert Panel*, a panel of experts from all stakeholders related to ICT and hi-tech areas, was:

***“Technology” is not a natural home for ICT and in the longer term the panel recommends that ICT become a Learning Area of the NZ Curriculum in its own right.***

The Institute believes that Digital Technologies needs to be a greater focus within the NZ Curriculum. While things have improved with the new Digital Technologies Achievement Standards, we believe it cannot achieve the scale, reputation, resources, focus or attention needed as a small component of a large Learning Area.

On Tuesday 29<sup>th</sup> July 2014 the NZ Government released *A Nation of Curious Minds: A National Strategy Plan for Science in Society*. Amongst other initiatives, this plan committed to working alongside sector partners to review the positioning and content of Digital Technologies within the NZ Curriculum. This is our collective opportunity to truly transform IT education in schools – to finish the job started with the new Digital Technologies Achievement Standards and better position Digital Technologies to be delivering on the needs and promise of today's learners.

# The Vision: A new “Digital Sciences” Learning Area

While these names may change, IITP proposes the creation of a new *Digital Sciences Learning Area*, incorporating Digital Literacy-related topics at primary and secondary school levels as well as digital practice, and Digital Technologies focused on Electronics and Infrastructure, Programming and Computer Science and Digital Media:



Digital Literacy



Digital Practice



Digital Technologies

- Electronics and Infrastructure
- Programming and Computer Science
- Digital Media

This new Learning Area would bridge the digital divide through a focus on 21<sup>st</sup> century learning across the primary and secondary education sector. All students in all schools would be exposed to digital learning and all students in New Zealand would be better prepared for today's digital world.

The *Digital Literacy* stream would include much of what is now Digital Information, but significantly expanded and available at all levels, not just NCEA. This would have greatest focus earlier in the school system.

*Digital Practice* would focus on the practice of technology, ensuring a rich platform of learning and assessment for a digital environment. In practice, much of this stream would be modification of generic technology standards giving them a digital context and focus to create new standards.

The *Digital Technologies* stream would include three key components:

- A combined Electronics and Infrastructure stream;
- An expanded Programming and Computer Science stream, including Databases (currently in Digital Information);
- Digital Media, as is currently provided.

In reality, courses in Digital Sciences would draw from all three streams (as is now the case).

## Impact on existing Achievement Standards

The Institute is **not** suggesting a wholesale rewrite or review of the existing Achievement Standards in Digital Technologies. While this recommendation would necessitate a transformation of how they are structured, we support the bulk of these standards and believe they are fit for purpose as one component of the new Learning Area.

However new standards would need to be created in some areas, and the generic Technology standards reviewed with some new standards derived with a digital science focus.

## Impact on Teachers

There is a major and structural undersupply of teachers able to competently and confidently teach digital technologies within schools. This will require a two-pronged approach: incentivising technologists into teaching, and a dedicated effort to up-skill existing teachers.

Recent research has found that only 56% of those currently teaching Digital Technologies subjects have any form of computing qualification and only 22% have a computing degree.<sup>2</sup> In addition, and while it has improved since introduction, teachers don't have an adequate level of confidence in teaching the new Digital Technologies Achievement Standards:

Survey:	2012	2013	change
1.44 Computer science	2.47	2.89	+0.42
1.45 Program planning	2.64	2.85	+0.21
1.46 Program implementation	2.92	3.10	+0.18

*Teacher confidence in Year 1 Computer Science subjects, scale of 1-4*

While these numbers are improving, a stronger focus on supporting the professional learning and development of Digital Technologies teachers is needed, with or without the structural change being proposed in this document. It is a testament to the professionalism and dedication of DT teachers that the new standards are in place and a success.

Put another way, the objectives, opportunities and outcomes that a new Digital Sciences Learning Area represents cannot be achieved without better resourcing and support for (and from) teachers of this subject. Any change will also necessitate a comprehensive review of professional learning and development in this area.

*A Nation of Curious Minds: A National Strategy Plan for Science in Society* commits to making changes to both initial teacher training, and professional learning in the science and technology areas. This is very welcome.

We see it as critical that Digital Technologies teachers, through NZACDITT and their other representatives, are involved in the governance and direction of the review and process throughout.

## Next steps

The Institute of IT Professionals looks forward to working collaboratively and productively with the Government, Ministry of Education, teachers and other stakeholders during the review of the content and position of Digital Technologies in the NZ Curriculum in coming months.

Having been heavily involved in most ICT curriculum developments at secondary and tertiary level in recent years, IITP is well positioned to contribute expertise on behalf of the IT Profession. While we have presented one model in this document, the Institute is open to alternatives that achieve the key objectives.

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<sup>2</sup> Thompson, D., & Bell, T. (2013). Adoption of new Computer Science high school standards by New Zealand teachers. In M. Knobelndorf, R. Romeike, & M. E. Caspersen (Eds.), *The 8th Workshop in Primary and Secondary Computing Education (WiPSCE 2013)*. Aarhus, Denmark: ACM.