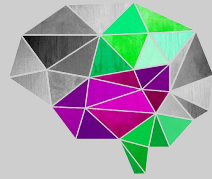


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Computational Thinking, Digital Fluency and the New Zealand Curriculum

Dr David Parsons

The New Curriculum

- ★ Under current proposals, digital technology is to be formally made a part of the New Zealand Curriculum in 2018
- ★ According to a ministerial announcement made in July 2016, instead of digital technologies being taught as optional subject areas, they will become a formal requirement for all students as a strand of Technology



Motivation For This Presentation

- Much is still to be decided
- The ministry currently have no specific answers to many questions raised by third parties
- None of the current staffing / student concerns have been addressed
- There may be future opportunities to engage with the process
- Researchers with an understanding of teaching and learning in a digital age should contribute to the debate



The New Digital Curriculum

Six areas of learning

- Algorithms
- Data representation
- Digital applications
- Digital devices and infrastructure
- Humans and digital technology
- Programming



Current Achievement Standards

Digital Technologies

- Information management
- Digital media
- Programming
- Electronics
- Data management
- Digital/network infrastructure

Computing

- Project management
- More specific tool related tasks
- Web development
- The use of computer systems in organisations
- + overlap with Digital Technologies



Skills As Topics or Fluency?

- In a subject-based education system, change is slow (White, 2013)
- What about the stages of digital proficiency, digital literacy and digital fluency?
- Are siloed ICT topics likely to make 21st century learners digitally fluent?
- How do Ministry references to digital competencies and fluency link to the curriculum?



Computational Thinking

"The method that is applied to create solutions that can be implemented using digital technologies. It involves integrating strategies, such as organising data logically, breaking down problems into parts, interpreting patterns and models and designing and implementing algorithms."

(ACARA, n.d.)



Not a 'trade'...

"just like how not everyone who learns to write will go on to become a professional writer - nor everyone who learns arithmetic will go on to become a professional mathematician - not everyone who learns to code will go on to become a software developer. But all people who learn these things will be immensely better off as a result of their efforts."

Quincy Larson - "Please do learn to code" (blog post)



... but a fundamental skill...

"Computational thinking is a fundamental skill for everyone, not just for computer scientists. To reading, writing, and arithmetic, we should add computational thinking to every child's analytical ability."

Jeanette Wing



... that everyone needs

"The impact of computing extends far beyond science, however, affecting all aspects of our lives. To flourish in today's world, everyone needs computational thinking."

Carnegie Mellon Center for Computational Thinking



Computational Thinking Means...

- ★ Solving problems
- ★ Applying abstraction and decomposition
- ★ Thinking algorithmically - what's the process?
- ★ Thinking conceptually - what's the model?
- ★ Understanding how things repeat and scale
- ★ Dealing with errors

...among other things (depends who you read)



What It Is and Is Not

- ★ Computational thinking is not
 - Thinking like a computer
- ★ Nor even (always)
 - Thinking about computation
- ★ But
 - Thinking with the same clarity and strategy that is required to command machines
 - ...even if you are not commanding a machine



This Week's Fad?

1960s - Theory of computation (Perlis)

1970s - Computing as a medium (Kay and Goldberg)

1980s - Constructionism (Papert), procedural literacy (Shiel)

2000 - Computational literacy (diSessa)

2006 - Computational thinking (Wing)



In the Curriculum

- ★ **Australia:** Computational thinking to define, design and implement digital solutions (ACARA, 2013).
- ★ **UK:** Fundamental computer science principles, such as abstraction, logic, algorithms and data representation, and write computer code to solve problems (DfE, 2013).
- ★ **USA:** The design and development of software products in the context of demonstrating and communicating curriculum concepts (CSTA Standards Task Force, 2011).



Open Letter to Hekia Parata

"Digital Technology has to be separated from...vocational subjects and become a standalone subject of significance, on a par with maths and science. Our secondary school students should be presented with an academic option developing their ability to understand computer logic, code and design."

Ian McCrae (Orion Health)

Frances Valentine (The Mind Lab)

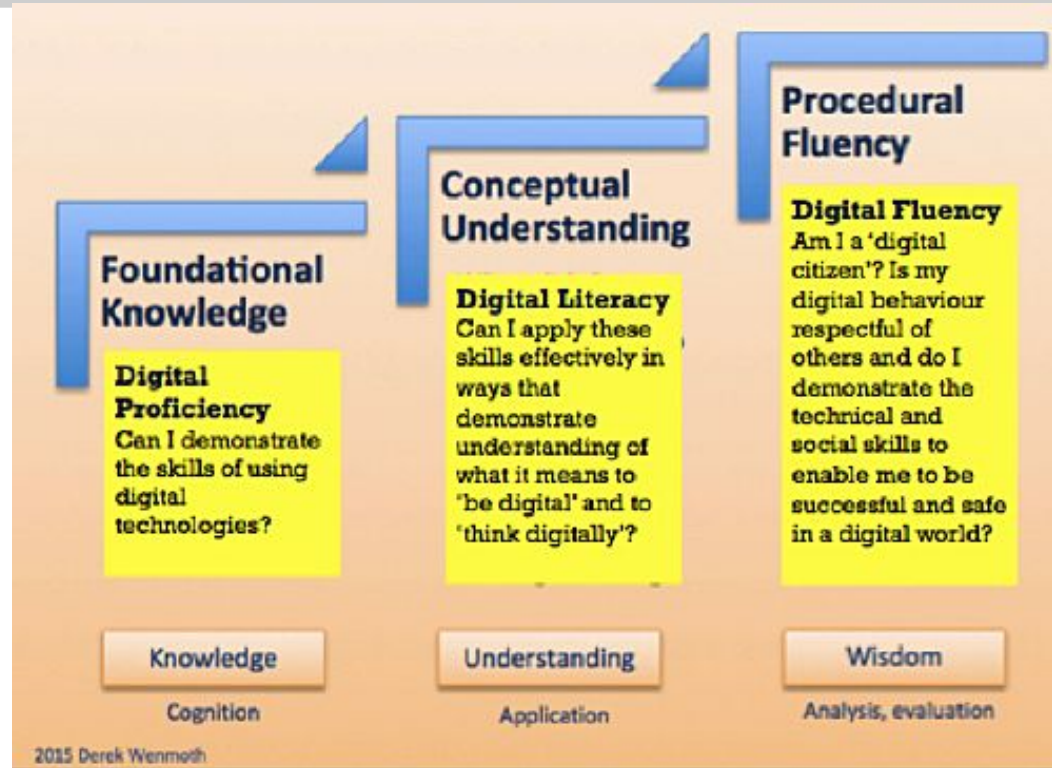
Ian Taylor (Animation Research)

July 2016



Digital Fluency

- Derek Wenmouth's 3 step model towards digital fluency
- Where is this in the proposed curriculum?



Digital Literacy

- ★ The ability to understand and use information in multiple formats from a wide variety of sources (Bawden, 2008)
- ★ Learners being able to express themselves and develop their ideas through ICT both for work readiness and as digital citizens (UK Department for Education, 2013)
- ★ Competency in computational thinking (Park, 2016)



Digital Fluency

- Learning anywhere, anytime, and digital learning for every learner regardless of location (NZ MoE, n.d.)
- Digitally fluent learners can self-select from a range of tools to achieve outcomes, and navigate collaborative spaces effectively and confidently (Spencer, 2015).
- The set of social, emotional and cognitive abilities that enable individuals to face the challenges and adapt to the demands of digital life (Park, 2016)



A Proposal

- ★ A digital curriculum should not be a set of siloed skill sets
- ★ It should not be a technology ghetto
- ★ It should integrate computational thinking across whatever layer of development is appropriate
- ★ It should integrate a journey towards digital fluency



Types of Curriculum

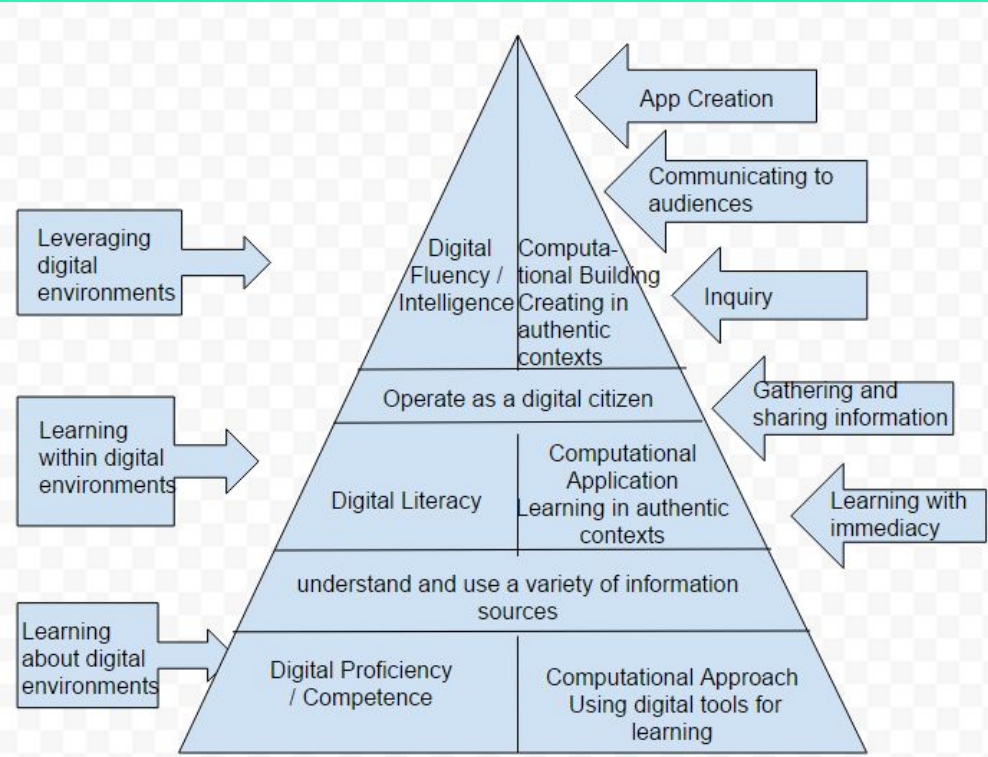
- “Lehrplan-type” curricula provide specific details of what should be taught and how it should be taught,
- “Standards-type” curricula specify the goals that should be met, but do not specify the detail

(Rasinen, 2003)

We have begun sketching out a standards-type curriculum around digital fluency and computational thinking



A Digital Curriculum Framework



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