Computational Thinking: What's coding got to do with it?

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Digital Technologies

- Design Thinking
- Computational Thinking

Design Thinking

- When developing solutions in Digital Technologies, students explore, analyse and develop ideas based on data, inputs and human interactions. When students design a solution to a problem they consider how users will be presented with data, the degree of interaction with that data and the various types of computational processing.

(ACARA, 2015, p 7)

Computational Thinking

- Computational thinking is a problem-solving 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, 2015, p 8)

Computational Thinking

- A problem-solving method that involves various techniques and strategies in order to solve problems that can be implemented by digital systems, such as organising data logically, breaking down problems into components, and the design and use of algorithms, patterns and models.

(Victorian Curriculum, 2016)

Computational Thinking

- Representing a problem
- Systematic generation and implementation of solutions
- Examining multiple solutions
- Systematically approaching problems
- Productive attitude to ‘errors’
- A disposition to approaching open-ended and difficult problems
- Building generational skills that are applicable beyond robotics and computational thinking

(Bers, Flannery, Kazakoff & Sullivan, 2014)

Computational Thinking

- Involves a set of concepts and thought processes that help a person to formulate a problem and find a solution. What makes it computational is that it is usually thought to involve computer processing in some way.

(Mannila et al., 2014)

Computational Thinking

- Computational thinking is taking an approach to solving problems, designing systems and understanding human behaviour that draws on concepts fundamental to computing.

(Wing, 2008)

- Wing has suggested that the essence of computational thinking is *abstraction*

Computational Thinking

- a distinct need to switch from programming to the idea of problem solving

(Mannila et al., 2014)

Literature Review: Key Concepts

In a review of countries, computational thinking involves:

- Conceptualising problems in a way that allows computers to act as a tool to help solve the problem
- Organising data so that it can be analysed with the aid of computers
- Finding ways to automate solutions so that they are a series of ordered steps (algorithmic thinking)
- Identifying possible solutions and analyse them for efficiency
- Being able to apply problem-solving solutions to a range of problems

(Mannila et al., 2014)

Literature Review: Key Concepts

Second key concept about computational thinking:

- The relations between *abstraction* and *automation*

(Mannila et al., 2014)

How computational thinking is taught?

Cluster 1	Cluster 2	Cluster 3
- Collecting Data - Analysing Data - Representing Data	- Simulations - Automation - Parallelisation	- Problem Composition - Algorithms - Abstraction

(Mannila et al., 2014)

Key Concepts

What is the most effective way of organising concepts in a curriculum so that children's learning develops over time?

Key Concepts

How should we integrate the computer with teaching concepts of computational thinking?

- Computer shouldn’t get in the way
- Children should not just learn how to use a computer
- Important that children don’t think that because they can use a computer they have learned computational thinking

(Fleer, 2016)

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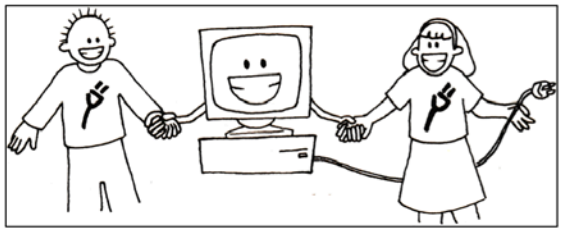

An enrichment and extension programme for primary-aged students

Created by

Tim Bell, Ian H. Witten and Mike Fellows

Adapted for classroom use by Robyn Adams and Jane McKenzie

Illustrations by Matt Powell

2015 Revision by Sam Jarman

Topics

- Data: Representing Information
- Putting Computers to work: Algorithms
- Telling Computers What To Do: Representing Procedures
- Really Hard Problems: Intractability
- Sharing Secrets and Fighting Crime: Cryptography
- The Human Face of Computing: Interacting with Computers

Activity 1: 20 Questions

- One person on the table thinks of a number:
  - Between 1-100
  - Between 1-1000
  - Between 1-1,000,000
- People on table can ask any question, provided that the answer is strictly ‘yes’ or ‘no’
- Tally the number of question to get to the answer.

Activity 1: Extension

- Think of a 4-6 word sentence.
  - Guess the letters one at a time. Left to right.
  - Tally up the number of guesses needed.

Activity 2: Graph Colouring

- Colour in the countries on these maps using as few colours as possible, make sure that no two bordering countries are the same colour.

Activity 3: Sorting Networks

Human Resource Machine

- App that finds a balance between abstract and physically enacting a program

- https://www.youtube.com/watch?v=_KDx9ldlPP4

References

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