Computing in the Australian Curriculum

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Director, National Computer Science School
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Questions?

@drjamescurran #STEMeduau
Computing is everywhere in the Australian Curriculum

- ICT general capability
- Digital Technologies
- in all other learning areas
If not, you’re doing it wrong
1 ICT General Capability
General Capabilities

- *capabilities* encompass:
  - knowledge
  - skills
  - behaviours
  - dispositions

- GCs are taught across the curriculum
- one learning area may take primary responsibility for a GC
General Capabilities

- Literacy
- Numeracy
- ICT General Capability

- Critical and Creative Thinking
- Personal and Social Capability
- Ethical Understanding
- Intercultural Understanding
ICT General Capability

- Investigating with ICT
- Creating with ICT
- Communicating with ICT
- Applying social and ethical protocols and practices when using ICT
- Managing and operating ICT
Do you and your school teach the ICT General Capability?
(ICT) GC has a learning continuum
● Key idea: Investigating with ICT

○ define and plan information searches
○ locate, generate and access data and information
○ select and evaluate data and information
Key idea: Creating with ICT

- generate ideas, plans and processes
- generate solutions to challenges and learning area tasks
Key idea: Communicating with ICT

- collaborate, share and exchange
- understand computer-mediated communications
Key idea: Applying social and ethical protocols and practices when using ICT

- recognise intellectual property
- apply digital information security practices
- apply personal security protocols
- identify the impacts of ICT in society
Key idea: Managing and operating ICT

- select and use hardware and software
- understand ICT systems
- manage digital data
Select and evaluate data and information

1. to locate or generate required information
2. locate information from a given set of digital sources
4. locate, retrieve or generate information from a range of digital sources
6. locate, retrieve or generate information using search engines ... and classify information in meaningful ways
Select and evaluate data and information

8 locate, retrieve or generate information using search facilities and organise information in meaningful ways

10 use advanced search tools and techniques or simulations and digital models to locate or generate precise data and information that supports the development of new understandings
2 Digital Technologies
V8 endorsed by ministers on September 18, 2015. Implementation starts 2016 (and NSW eventually)
Technologies structure

- in two subjects:
  - Digital Technologies
  - Design and Technology

- and in two strands:
  - knowledge and understanding
  - processes and production skills
    - investigating and defining
    - generating and designing
    - producing and implementing
    - evaluating
    - collaborating and managing
Key concepts

- abstraction
- data: collection, representation, interpretation
- specification, algorithms, implementation
- digital systems
- interaction
- impact
Key concepts split by strand

- **knowledge and understanding:**
  - digital systems
  - representation

- **process and production skills**
  - investigating and defining: collection, interpretation, specification
  - generating and designing: algorithms
  - producing and implementing: implementation
  - evaluating/collaborating and managing: interaction and impact
## Digital Technologies Foundation to Year 10 scope and sequence

<table>
<thead>
<tr>
<th>Strand</th>
<th>Foundation to Year 2</th>
<th>Years 3 and 4</th>
<th>Years 5 and 6</th>
<th>Years 7 and 8</th>
<th>Years 9 and 10 (Elective subject)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Digital systems</strong></td>
<td>2.1 Identify and use digital systems (hardware and software components) for a purpose</td>
<td>4.1 Explore and use a range of digital systems with peripheral devices for different purposes, and transmit different types of data</td>
<td>6.1 Investigate the main components of common digital systems, their basic functions and interactions and how such digital systems may connect together to form networks to transmit data</td>
<td>8.1 Investigate how data are transmitted and secured in wired, wireless and mobile networks, and how the specifications of hardware components impact on network activities</td>
<td>10.1 Investigate the role of hardware and software in managing, controlling and securing the movement of and access to data in networked digital systems</td>
</tr>
<tr>
<td><strong>Representation of data</strong></td>
<td>2.2 Recognise and explore patterns in data and represent data as pictures, symbols and diagrams</td>
<td>4.2 Recognise different types of data and explore how the same data can be represented in different ways</td>
<td>6.2 Investigate how digital systems use whole numbers as a basis for representing all types of data</td>
<td>8.2 Investigate how digital systems represent text, image and audio data in binary</td>
<td>10.2 Analyse simple compression of data and how content data are separated from presentation</td>
</tr>
<tr>
<td><strong>Collecting, managing and analysing data</strong></td>
<td>2.3 Collect, explore and sort data, and use digital systems to present the data creatively</td>
<td>4.3 Collect, access and present different types of data using simple software to create information and solve problems</td>
<td>6.3 Acquire, store and validate different types of data, and use a range of commonly available software to interpret and visualise data in context to create information</td>
<td>8.3 Acquire data from a range of digital sources and evaluate its authenticity, accuracy and timeliness</td>
<td>10.3 Develop techniques for acquiring, storing and validating quantitative and qualitative data from a range of sources, considering privacy and security requirements</td>
</tr>
<tr>
<td><strong>Creating digital solutions by:</strong></td>
<td><strong>Defining</strong></td>
<td>2.4 Follow, describe and represent a sequence of steps and decisions (algorithms) needed to solve simple problems</td>
<td>4.4 Define simple problems, and describe and follow a sequence of steps and decisions (algorithms) needed to solve them</td>
<td>6.4 Define problems in terms of data and functional requirements, and identify features similar to previously solved problems</td>
<td>8.5 Define and decompose real-world problems taking into account functional requirements and economic, environmental, social, technical and usability constraints</td>
</tr>
<tr>
<td><strong>Designing</strong></td>
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<td>10.5 Precisely define and decompose real-world problems, taking into account functional and non-functional requirements and including interviewing stakeholders to identify needs</td>
</tr>
<tr>
<td>Designing</td>
<td>Implementing</td>
<td>Evaluating</td>
<td>Collaborating and managing</td>
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<tr>
<td>6.5 Design a user interface for a digital system, generating and considering alternative designs</td>
<td>6.6 Design, modify and follow simple algorithms represented diagrammatically and in English involving sequences of steps, branching, and iteration (repetition)</td>
<td>6.6 Design, modify and follow simple algorithms represented diagrammatically and in English involving sequences of steps, branching, and iteration (repetition)</td>
<td>2.6 Work with others to create and organise ideas and information using information systems, and share these in safe online environments</td>
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<tr>
<td>8.6 Design the user experience of a digital system, generating, evaluating and communicating alternative designs</td>
<td>8.7 Design algorithms represented diagrammatically and in English; and trace algorithms to predict output for a given input and to identify errors</td>
<td>8.8 Implement and modify programs with user interfaces involving branching, iteration (repetition), and user input</td>
<td>4.6 Explain how developed solutions and existing information systems meet common personal, school or community needs; and envisage new ways of using them</td>
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<tr>
<td>10.6 Design the user experience of a digital system, evaluating alternative designs against criteria including functionality, accessibility, usability, and aesthetics</td>
<td>10.7 Design algorithms represented diagrammatically and in structured English and validate algorithms and programs through tracing and test cases</td>
<td>10.8 Implement modular programs, applying selected algorithms and data structures including using an object-oriented programming language</td>
<td>6.8 Explain how developed solutions and existing information systems are sustainable and meet local community needs, considering opportunities and consequences for future applications</td>
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<tr>
<td>4.5 Implement digital solutions as simple visual programs with algorithms involving branching (decisions), and user input</td>
<td>6.7 Implement digital solutions as simple visual programs involving branching, iteration (repetition), and user input</td>
<td>8.9 Evaluate how well developed solutions and existing information systems meet needs, are innovative, and take account of future risks and sustainability</td>
<td>4.7 Work with others to plan the creation and communication of ideas and information safely, applying agreed ethical and social protocols</td>
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<tr>
<td>10.9 Critically evaluate how well developed solutions and existing information systems and policies, take account of future risks and sustainability and provide opportunities for innovation and enterprise</td>
<td>10.10 Create and communicate interactive ideas and information collaboratively online, taking into account social contexts and legal responsibilities</td>
<td>10.11 Plan and manage projects using an iterative and collaborative approach, identifying risks and considering safety and sustainability</td>
<td>6.9 Manage the creation and communication of ideas and information including online collaborative projects, applying agreed ethical, social and technical protocols</td>
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</tbody>
</table>
Writing a curriculum involves packing everything up.
Teaching a curriculum involves **unpacking** everything.
Digital Systems

2. Recognise and **explore digital systems** (hardware and software components) for a **purpose**

4. Identify and **explore a range of digital systems** with peripheral devices for **different purposes**, and **transmit different types of data**

6. Examine the **main components of common digital systems** and how they may **connect together to form networks** to transmit data
Digital Systems

8. Investigate how data is transmitted and secured in wired, wireless and mobile networks, and how the specifications affect performance.

10. Investigate the role of hardware and software in managing, controlling and securing the movement of and access to data in networked digital systems.
# Digital Systems

<table>
<thead>
<tr>
<th>Systems</th>
<th>Networks</th>
<th>Security</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explore systems with purpose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explore range of systems + peripherals with purposes</td>
<td>Transmit data</td>
<td></td>
</tr>
<tr>
<td>Explore components</td>
<td>How to form networks to transmit data</td>
<td></td>
</tr>
<tr>
<td>How specifications affect performance</td>
<td>How data is transmitted</td>
<td>How data is secured</td>
</tr>
<tr>
<td>How data is managed</td>
<td>Movement of data in networks</td>
<td>How data is controlled and secured</td>
</tr>
</tbody>
</table>
**Representation**

2. Recognise and explore patterns in data and represent data as pictures, symbols and diagrams.

4. Recognise different types of data and explore how the same data can be represented in different ways.

6. Examine how whole numbers are used to represent all data in digital systems.

8. Investigate how digital systems represent text, image and audio data in binary.

10. Analyse simple compression of data and how content data are separated from presentation.
## Representation

<table>
<thead>
<tr>
<th>Representation</th>
<th>Types of data</th>
<th>Compression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Represent data as pictures, symbols and diagrams</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The same data can be represented in different ways</td>
<td>Different types of data</td>
<td></td>
</tr>
<tr>
<td>How whole numbers are used to represent all data</td>
<td>All (simple) data: <em>types should be more complex</em></td>
<td></td>
</tr>
<tr>
<td>Represent data in binary</td>
<td>Text, image and audio</td>
<td></td>
</tr>
<tr>
<td>Content vs. presentation: <em>documents are represented</em></td>
<td>All data: <em>structured data</em></td>
<td>Simple compression of data</td>
</tr>
</tbody>
</table>
Collection and interpretation

2. Collect, explore and sort data, and use digital systems to present the data creatively.

4. Collect, access and present different types of data using simple software to create information and solve problems.

6. Acquire, store and validate different types of data, and use a range of software to interpret and visualise data to create information.
Collection and interpretation

8 Acquire data from a range of sources and evaluate authenticity, accuracy and timeliness

8 Analyse and visualise data using a range of software to create information, and use structured data to model objects or events

10 Develop techniques for acquiring, storing and validating quantitative/qualitative data from a range of sources, considering privacy and security requirements

10 Analyse and visualise data to create information and address complex problems, and model processes, entities and their relationships using structured data
## Collection and interpretation

<table>
<thead>
<tr>
<th>Collect</th>
<th>Organise / create</th>
<th>Visualise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collect and explore data</td>
<td>Sort data</td>
<td>Present the data</td>
</tr>
<tr>
<td>Collect and access different types of data</td>
<td>Create information and solve problems</td>
<td></td>
</tr>
<tr>
<td>Acquire, store and validate different types of data</td>
<td>Interpret data to create information</td>
<td>Visualise data to create information</td>
</tr>
<tr>
<td>Evaluate authenticity, accuracy and timeliness</td>
<td>Use structured data to model objects or events</td>
<td>Visualise data using a range of software</td>
</tr>
<tr>
<td>Validating quantitative and qualitative data; considering privacy and security</td>
<td>Model processes, entities and their relationships using structured data</td>
<td>Visualise data to create information and address complex problems</td>
</tr>
</tbody>
</table>
Specification and Algorithms

2. Follow, describe and represent a **sequence of steps and decisions** (algorithms) needed to solve simple problems.

4. Define simple problems, and describe and follow a **sequence of steps and decisions** (algorithms) needed to solve them.

6. Define problems in terms of **data and functional requirements** drawing on previously solved problems.

6. Design a **user interface** for a digital system.

6. Design, modify and follow simple algorithms involving **sequences of steps, branching, and iteration**.
Specification and Algorithms

Define and decompose real-world problems taking into account functional requirements and economic, environmental, social, technical and usability constraints.

Design the user experience of a digital system, generating, evaluating and communicating alternative designs.

Design algorithms represented diagrammatically and in English, and trace algorithms to predict output for a given input and to identify errors.
Define and decompose real-world problems precisely, taking into account functional and non-functional requirements and including interviewing stakeholders to identify needs.

Design the user experience of a digital system by evaluating alternative designs against criteria including functionality, accessibility, usability, and aesthetics.

Design algorithms represented diagrammatically and in structured English and validate algorithms and programs through tracing and test cases.
## Specification and Algorithms

<table>
<thead>
<tr>
<th>Describe problems</th>
<th>Follow/design algorithms</th>
<th>Design user interfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fig. 2</td>
<td>1. Follow, describe and represent a sequence of steps and decisions</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2. Define simple problems</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>3. Define problems using data and functional requirements</td>
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</tr>
<tr>
<td>8</td>
<td>4. Decompose real-world problems; Consider economic, environmental, social, technical and usability constraints</td>
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<tr>
<td>10</td>
<td>5. Interviewing stakeholders to identify needs</td>
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<td></td>
<td>6. Validating algorithms and programs through tracing and test cases</td>
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<tr>
<td></td>
<td>7. Generate and evaluate alternative designs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8. Evaluate designs against criteria: functionality, accessibility, usability, and aesthetics</td>
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</tr>
</tbody>
</table>
Implement digital solutions as simple visual programs involving **branching** (decisions) and **user input**

Implement digital solutions as simple visual programs involving **branching**, **iteration (repetition)**, and **user input**
Implementation

8. Implement and modify programs with user interfaces involving branching, iteration and functions in a general-purpose programming language.

10. Implement modular programs, applying selected algorithms and data structures including using an object-oriented programming language.
## Implementation

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Programming</th>
<th>Test and debug</th>
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</thead>
<tbody>
<tr>
<td>Branching (decisions) and user input</td>
<td>Visual programming</td>
<td></td>
</tr>
<tr>
<td>Iteration (repetition)</td>
<td>Visual programming</td>
<td></td>
</tr>
<tr>
<td>User interfaces and functions</td>
<td>General purpose text programming</td>
<td>In algorithms content descriptor</td>
</tr>
<tr>
<td>Modularity, algorithms and data structures</td>
<td>Object-oriented programming</td>
<td>In algorithms content descriptor</td>
</tr>
</tbody>
</table>
Explore how people safely use common information systems to meet information, communication and recreation needs.

Explain how student solutions and existing information systems meet common personal, school or community needs.

Explain how student solutions and existing information systems are sustainable and meet current and future local community needs.
Impact (including evaluation)

8. Evaluate how student solutions and existing information systems meet needs, are innovative, and take account of future risks and sustainability.

10. Evaluate critically how student solutions and existing information systems and policies, take account of future risks and sustainability and provide opportunities for innovation and enterprise.
## Impact (including evaluation)

<table>
<thead>
<tr>
<th>Users</th>
<th>Solutions</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>“people”</td>
<td>Common information systems</td>
<td>Information, communication and recreation needs</td>
</tr>
<tr>
<td>Personal, school or community</td>
<td>Student solutions and existing information systems</td>
<td>Sustainability; Current and future needs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Innovation; Future risks and sustainability</td>
</tr>
<tr>
<td></td>
<td>Policies</td>
<td>Opportunities for innovation and enterprise</td>
</tr>
</tbody>
</table>
Interaction (including creativity)

2. Create/organise ideas and information using information systems independently and with others, and share these with known people in safe online environments.

4. Plan, create and communicate ideas and information independently and with others, applying agreed ethical and social protocols.

6. Plan, create and communicate ideas and information, including collaboratively online, applying agreed ethical, social and technical protocols.
Interaction (including creativity)

- Plan and **manage projects** that create and communicate ideas and information collaboratively online, taking **safety** and **social contexts** into account.
- Create **interactive solutions** for sharing ideas and information online, taking into account safety, social contexts and **legal responsibilities**.
- Plan and manage projects using an **iterative and collaborative approach**, identifying **risks** and considering safety and sustainability.
## Interaction (including creativity)

<table>
<thead>
<tr>
<th>Collaboration</th>
<th>Environment/Protocols</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create ideas/information with others; share with known people</td>
<td>Safe online environments</td>
<td></td>
</tr>
<tr>
<td>Plan, create and communicate ideas and information</td>
<td>Applying agreed ethical and social protocols</td>
<td></td>
</tr>
<tr>
<td>Plan, create and communicate collaboratively online</td>
<td>Applying technical protocols</td>
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</tr>
<tr>
<td>Create interactive solutions for sharing ideas and information online</td>
<td>Taking into account safety and social contexts</td>
<td>Plan and manage projects</td>
</tr>
<tr>
<td></td>
<td>Taking into account legal responsibilities</td>
<td>Use an iterative and collaborative management approach, identifying risks</td>
</tr>
</tbody>
</table>
Computing in other learning areas
Computing explicitly linked in all LAs

2. **Create/organise ideas and information using information systems independently and with others, and share these with known people in safe online environments.**

4. Plan, create and **communicate ideas** and information independently and with others, **applying agreed ethical and social protocols**.

6. Plan, create and communicate ideas and information, including **collaboratively online**, applying agreed ethical, social and **technical protocols**.
Computing explicitly linked in all LAs

- select using ICT GC filter
- all too often just involves: “with and without digital technologies” or “and appropriate digital technologies”
- Substantial/deep overlap with:
  - Mathematics
  - Science
Digital Technologies and Mathematics

- Fantastic opportunities across substrands
  - Number and place value
  - Data representation and interpretation
  - Chance
  - Geometric reasoning/trigonometry
  - Patterns and algebra

...
Digital Technologies and Science

Science inquiry skills

- Planning and conducting
- Processing and analysing data and information
- Evaluating
- Communicating
Where to next?
professional development and resources
Questions?

Find me at:
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james@groklearning.com
○ How should we onboard students who won't see the whole curriculum?
○ Does the curriculum mandate a particular coding platform?
○ In NSW primary schools, science and technology are one learning area. What will happen with that?
○ How much time is needed for these content descriptors?
○ What happens if nobody takes responsibility for the general capabilities, and what kind of depth is expected there?
○ Any recommendations for teacher professional development programs?