DTiF
Digital Technologies in focus
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acara AUSTRALIAN CURRICULUM, ASSESSMENT AND REPORTING AUTHORITY

CLASSROOM IDEAS: YEARS 3–6

Exploring Digital Technologies through shopping

Figure 1: Why might supermarket shelf labels include barcodes? Source: pixabay.com/photos/cheese-refrigerator-processed-dairy-2725235/

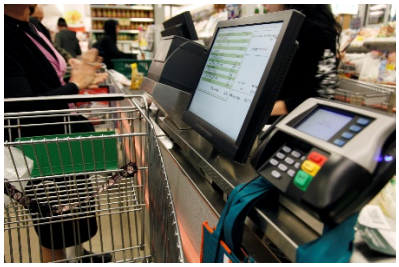

Figure 2: A supermarket checkout

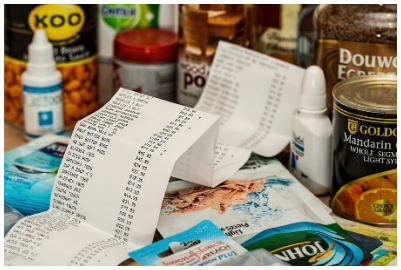

Figure 3: Receipt for groceries. Source: https://pixabay.com/photos/shopping-spending-till-slip-879498/

Students and their families use digital systems and Digital Technologies concepts in everyday shopping tasks. Through activities related to the shopping experience, students can participate in guided investigations to explore digital systems, data, algorithms and digital technologies.

Digital systems are made up of hardware and software components that receive data input, process and store data, and output data in some way. They are all around us in the form of computers, smart phones, smart TVs and digital ticket readers. In a supermarket there are many digital systems in use every day (e.g. Figures 1 and 2). Consider the following activities to help students identify these digital systems.

Students could:

- brainstorm: What is a digital system?
- visit a store with a caregiver or teacher to identify and record any digital displays they notice. Then consider: Do all digital systems have a digital display? What data are these displays telling the viewer? Students could collect their data (with appropriate store permission) using checklists, drawings, photographs or audio recordings.
  - identify and clarify information and ideas (CCTLC*)
- create a class picture glossary of the digital system (see sample, page 6). The language associated with digital systems may be new to some students. This activity will help all students:
  - navigate, read and view learning area texts (LLC#)
  - interpret and analyse learning area texts (LLC#)
  - understand learning area vocabulary (LLC#)
  - identify and clarify information and ideas (CCTLC*)
  - organise and process information components (CCTLC*) they may find in the local supermarket or at home. (Students could bring in cut off parts of packaging.)

*CCTLC – Australian Curriculum: Critical and creative thinking learning continuum https://v9.australiancurriculum.edu.au/downloads/general-capabilities -critical-and-creative-thinking (V8.4) #LLC – Australian Curriculum: Literacy learning continuum www.australiancurriculum.edu.au/f-10-curriculum/general-capabilities/literacy/ (V8.4)

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- use a choice of medium (drawing, writing, modelling, audio) to demonstrate how they think a digital checkout (Figure 2) works
- find a receipt from when someone last did their groceries (Figure 3) and from the receipt identify what data the digital system has provided to the consumer
- complete a PMI chart on the impact store-based digital systems could have on peoples' lives. The collection of this information could be used as a linking activity to the next concept of 'data'. Students may also realise that what some shoppers see as a plus, others see as a minus. The PMI chart could include:
  - time spent in lines or waiting for sales assistants
  - comparing spending patterns
  - accessing extra information about products
  - not needing to carry money
  - ordering food on interactive windows (kiosk)
  - virtual showrooms
  - decrease in customer service/less interaction with people
  - predictive analytics
  - facial recognition – to battle crime
  - in-store wi-fi
  - digital systems in store connecting with social media online, as seen in this example: mashable.com/2012/05/08/hangers-update-facebook-likes/ - FX4u4iMxvOqm

Data is the information collected by digital technologies. Data may include characters (letters, numbers, symbols), images or sounds. These types of data can be stored and communicated by digital systems.

- ***Data collection*** – students gather different types of data in different ways; for example, by observing, counting and measuring (V8.4). Note in Version 9 this is called data acquisition and content is taught through Mathematics)
- ***Data representation*** – students start to notice patterns in the data, make predictions and explain how they can be represented in different ways; for example, five vs 5 vs IIIII vs 𝍸
- ***Data interpretation*** – students answer simple questions by grouping, classifying and revealing patterns. During this time they often make predictions about what they are observing. (V8.4) Note in Version 9 this content is taught through Mathematics)

Students could:

- brainstorm: What is data? (For some students this could also be used as a classification activity.)
- investigate:
  - what data are collected in a retail setting. How are data stored in a retail setting?
  - why the shopkeeper might be interested in the data collected by the digital systems in their store. The data might include: retail data, supplier data, market data, shopper data.
  - who might be interested in the data collected by the digital systems in a store, and what data might they collect?
  - if different data are collected if the product is purchased online rather than from a store
  - what data can tell us about the way we and other people shop.
- investigate in what ways data collected through digital systems in stores could be represented. Provide students with samples of data collected by digital systems in stores and have them identify how these data may be used by different groups of people; for example, shoppers, retailers, customers, suppliers, advertisers.
- consider data interpretation: What do the data tell us?
- investigate what kind of data can be found on a shopping docket, and consider: How do these data help the shop? How do these data help us as consumers?

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Suggested activity: Give students a collection of dockets from a variety of stores and tell them that they are from a mystery shopper. Have the class try to profile the mystery shopper based on their shopping patterns. Consider including some receipts that may cause cognitive conflict; for example, a receipt for 12 Hot Wheels cars may indicate the purchaser is a child or an adult collector.

Algorithms are a key concept in Digital Technologies and fundamental in computational thinking. They help us follow, describe and represent a sequence of steps and decisions needed to solve simple problems. We can use algorithms to describe ordinary activities in everyday life. For example, we can consider a recipe as an algorithm for cooking a particular food.

Students could:

- brainstorm: What is an algorithm?
- identify what kind of algorithms they see when they shop
  - For example, recipes on the sides of products, instructions on in-store coffee
- describe an algorithm they follow when they shop. For example, do you have to follow certain steps at the self-service checkout or a scoop-and-weigh area?
- consider these questions:
  - Could the spaced 'stand here' stickers used on the floor in stores as a result off COVID-19 be an algorithm?
  - 'When Mr Jones goes to the grocery store he follows the same path through the store every time.' Is this an algorithm? Why?
  - Why are algorithms useful when we shop?
- develop a flow chart with prompts to purchase bananas etc.
  - To support some learners this activity could be replaced by taking photographs of the steps involved in purchasing bananas and then used as a sequencing activity

Suggested activities

- Explore how digital systems work by role-playing information processes; for example, a customer buys some groceries and pays for them at the counter; for example, role-play transfer of data to a stock list or a bank or from a scanner to a register.
- Draw a diagram or flow chart to show how a digital retail system functions (see Figute 4).
  - To make this task more accessible, use manipulatives such as arrows to show data pathways and blocks to show different aspects of a digital system.
- Discuss how digital systems meet the needs of those who use them.
- Collect data, pose and respond to questions, develop design ideas and manipulate materials and equipment to evaluate the development of students' knowledge of retail processes/systems.

Assessment suggestions

- Design their own supermarket and transform the classroom. Using boxes, packaging, devices and QR codes they could role-play using digital systems.
- Design an algorithm for a programmable device such as a Sphero. The device could be coded with specific instructions/tasks to navigate through a classroom version of supermarket aisles, collect items from a list and successfully complete shopping.
  - Changing situations/obstacles could be given to students to challenge them to redesign their algorithm. For example, moving around aisles avoiding fellow shoppers or spills. This is a good way to simulate a similar approach to debugging a computer program.
- Collect data on the space five products (multiple brands) take up on the store shelf.
- Generate a list of recommendations which could be sent to leading supermarket chains showing how digital systems could be used to support the independence of shoppers with disability.

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Links to the Australian Curriculum

Tables 1 and 2 outline Australian Curriculum links version 9 which may be addressed depending on the task. Tables 3 and 4 outline Australian Curriculum links version 8.4 which may be addressed depending on the task.

Table 1: Links to the Australian Curriculum: Digital Technologies Years 3–4 (V9)

Digital Technologies ***Achievement standard***	By the end of Year 4 students create simple digital solutions and use provided design criteria to check if solutions meet user needs. Students process and represent data for different purposes. They follow and describe simple algorithms involving branching and iteration and implement them as visual programs. Students securely access and use digital systems and their peripherals for a range of purposes, including transmitting data. They use the core features of common digital tools to plan, create, locate and share content, and to collaborate, following agreed behaviours. Students identify their personal data stored online and recognise the risks.
Strand ***Sub-strand***	Digital Technologies knowledge and understanding • Digital systems • Data representation Processes and production skills • Investigating and defining • Generating and designing • Producing and implementing • Evaluating
Content descriptions	• explore and describe a range of digital systems and their peripherals for a variety of purposes AC9TDI4K01 • recognise different types of data and explore how the same data can be represented differently depending on the purpose AC9TDI4K03 • define problems with given design criteria and by co-creating user stories AC9TDI4P01 • follow and describe algorithms involving sequencing, comparison operators (branching) and iteration AC9TDI4P02 • generate, communicate and compare designs AC9TDI4P03 • implement simple algorithms as visual programs involving control structures and input AC9TDI4P04 • discuss how existing and student solutions satisfy the design criteria and user stories AC9TDI4P05 • use the core features of common digital tools to create, locate and communicate content, following agreed conventions AC9TDI4P06
Year 3 Mathematics ***Achievement standard***	By the end of Year 3, students order and represent natural numbers beyond 10 000. They partition, rearrange and regroup two- and three-digit numbers in different ways to assist in calculations. Students extend and use single-digit addition and related subtraction facts and apply additive strategies to model and solve problems involving two- and three-digit numbers. They use mathematical modelling to solve practical problems involving single-digit multiplication and division, recalling multiplication facts for twos, threes, fours, fives and tens, and using a range of strategies. Students represent unit fractions and their multiples in different ways. They make estimates and determine the reasonableness of financial and other calculations. Students find unknown values in number sentences involving addition and subtraction. They create algorithms to investigate numbers and explore simple patterns.

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	Students use familiar metric units when estimating, comparing and measuring the attributes of objects and events. They identify angles as measures of turn and compare them to right angles. Students estimate and compare measures of duration using formal units of time. They represent money values in different ways. Students make, compare and classify objects using key features. They interpret and create two-dimensional representations of familiar environments. Students conduct guided statistical investigations involving categorical and discrete numerical data and interpret their results in terms of the context. They record, represent and compare data they have collected. Students use practical activities, observation or experiment to identify and describe outcomes and the likelihood of everyday events explaining reasoning. They conduct repeated chance experiments and discuss variation in results.
Strand	• Statistics
Year 3 ***Content descriptions***	• acquire data for categorical and discrete numerical variables to address a question of interest or purpose by observing, collecting and accessing data sets; record the data using appropriate methods including frequency tables and spreadsheets AC9M3ST01 • create and compare different graphical representations of data sets including using software where appropriate; interpret the data in terms of the context AC9M3ST02 • conduct guided statistical investigations involving the collection, representation and interpretation of data for categorical and discrete numerical variables with respect to questions of interest AC9M3ST03
Year 4 Mathematics ***Achievement standard***	By the end of Year 4, students use their understanding of place value to represent tenths and hundredths in decimal form and to multiply natural numbers by multiples of 10. They use mathematical modelling to solve financial and other practical problems , formulating the problem using number sentences, solving the problem choosing efficient strategies and interpreting the results in terms of the situation. Students use their proficiency with addition and multiplication facts to add and subtract, multiply and divide numbers efficiently. They choose rounding and estimation strategies to determine whether results of calculations are reasonable. Students use the properties of odd and even numbers. They recognise equivalent fractions and make connections between fraction and decimal notations. Students count and represent fractions on a number line. They find unknown values in numerical equations involving addition and subtraction. Students follow and create algorithms that generate sets of numbers and identify emerging patterns. They use scaled instruments and appropriate units to measure length, mass, capacity and temperature. Students measure and approximate perimeters and areas. They convert between units of time when solving problems involving duration. Students compare angles relative to a right angle using angle names. They represent and approximate shapes and objects in the environment. Students create and interpret grid references. They identify line and rotational symmetry in plane shapes and create symmetrical patterns. Students create many-to-one data displays, assess the suitability of displays for representing data and discuss the shape of distributions and variation in data. They use surveys and digital tools to generate categorical or discrete numerical data in statistical investigations and communicate their findings in context. Students order events or the outcomes of chance experiments in terms of likelihood and identify whether events are independent or dependent. They conduct repeated chance experiments and describe the variation in results.
Strand	• Statistics

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Year 4 ***Content descriptions***	• acquire data for categorical and discrete numerical variables to address a question of interest or purpose using digital tools; represent data using many-to-one pictographs, column graphs and other displays or visualisations; interpret and discuss the information that has been created AC9M4ST01 • analyse the effectiveness of different displays or visualisations in illustrating and comparing data distributions, then discuss the shape of distributions and the variation in the data AC9M4ST02 • conduct statistical investigations, collecting data through survey responses and other methods; record and display data using digital tools; interpret the data and communicate the results AC9M4ST03		
Technologies Core concepts	• Systems • Data • Interactions and impact • Systems thinking • Computational thinking	***Digital Technologies Core concepts***	• Digital systems • Data representation • Data acquisition (through Mathematics content) • Data interpretation (through Mathematics content) • Algorithms • Implementation
		General capabilities	• Digital Literacy • Literacy • Numeracy
Cross-curriculum priorities		***Learning area or subject connections***	

Table 2: Links to the Australian Curriculum: Digital Technologies 5–6 (V9)

Digital Technologies ***Achievement standard***	By the end of Year 6 students develop and modify digital solutions, and define problems and evaluate solutions using user stories and design criteria. They process data and show how digital systems represent data. Students design algorithms involving complex branching and iteration and implement them as visual programs including variables. They securely access and use multiple digital systems and describe their components and how they interact to process and transmit data. Students select and use appropriate digital tools effectively to plan, create, locate and share content, and to collaborate, applying agreed conventions and behaviours. They identify their digital footprint and recognise its permanence.
Strand ***Sub-strand***	Digital Technologies knowledge and understanding • Digital systems • Data representation Digital Technologies processes and production skills • Investigating and defining • Generating and designing • Producing and implementing • Evaluating
Content descriptions	• investigate the main internal components of common digital systems and their function AC9TDI6K01 • explain how digital systems represent all data using numbers AC9TDI6K03

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	• define problems with given or co-developed design criteria and by creating user stories AC9TDI6P01 • design algorithms involving multiple alternatives (branching) and iteration AC9TDI6P02 • design a user interface for a digital system AC9TDI6P03 • generate, modify, communicate and evaluate designs AC9TDI6P04 • implement algorithms as visual programs involving control structures, variables and input AC9TDI6P05 • evaluate existing and student solutions against the design criteria and user stories and their broader community impact AC9TDI6P06 • select and use appropriate digital tools effectively to create, locate and communicate content, applying common conventions AC9TDI6P07
Year 5 Mathematics ***Achievement standard***	By the end of Year 5, students use place value to write and order decimals including decimals greater than one. They express natural numbers as products of factors and identify multiples. Students order and represent add and subtract fractions with the same or related denominators. They represent common percentages and connect them to their fraction and decimal equivalents. Students use their proficiency with multiplication facts and efficient calculation strategies to multiply large numbers by one- and two-digit numbers and divide by single-digit numbers. They check the reasonableness of their calculations using estimation. Students use mathematical modelling to solve financial and other practical problems, formulating and solving problems, choosing arithmetic operations and interpreting results in terms of the situation. They apply properties of numbers and operations to find unknown values in numerical equations involving multiplication and division. Students create and use algorithms to identify and explain patterns in the factors and multiples of numbers. They choose and use appropriate metric units to measure the attributes of length, mass and capacity, and to solve problems involving perimeter and area. Students convert between 12- and 24-hour time. They estimate, construct and measure angles in degrees. Students use grid coordinates to locate and move positions. They connect objects to their two-dimensional nets. Students perform and describe the results of transformations and identify any symmetries. They plan and conduct statistical investigations that collect nominal and ordinal categorical and discrete numerical data using digital tools. Students identify the mode and interpret the shape of distributions of data in context. They interpret and compare data represented in line graphs. Students conduct repeated chance experiments, list the possible outcomes, estimate likelihoods and make comparisons between those with and without equally likely outcomes.
Strand	• Statistics
Year 5 ***Content descriptions***	• acquire, validate and represent data for nominal and ordinal categorical and discrete numerical variables to address a question of interest or purpose using software including spreadsheets; discuss and report on data distributions in terms of highest frequency (mode) and shape, in the context of the data AC9M5ST01 • interpret line graphs representing change over time; discuss the relationships that are represented and conclusions that can be made AC9M5ST02 • plan and conduct statistical investigations by posing questions or identifying a problem and collecting relevant data; choose appropriate displays and interpret the data; communicate findings within the context of the investigation AC9M5ST03

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Year 6 Mathematics ***Achievement standard***	By the end of Year 6, students use integers to represent points on a number line and in the Cartesian plane. They solve problems using the properties of prime, composite and square numbers. Students order common fractions, giving reasons, and add and subtract fractions with related denominators. They use all 4 operations with decimals and connect decimal representations of measurements to the metric system. Students solve problems involving finding a fraction, decimal or percentage of a quantity and use estimation to find approximate solutions to problems involving rational numbers and percentages. They use mathematical modelling to solve financial and other practical problems involving percentages and rational numbers, formulating and solving the problem, and justifying choices. Students find unknown values in numerical equations involving combinations of arithmetic operations. They identify and explain rules used to create growing patterns. Students create and use algorithms to generate sets of numbers, using a rule. They interpret and use timetables. Students convert between common units of length, mass and capacity. They use the formula for the area of a rectangle and angle properties to solve problems. Students identify the parallel cross-section for right prisms. They create tessellating patterns using combinations of transformations. Students locate an ordered pair in any one of the 4 quadrants on the Cartesian plane. They compare distributions of discrete and continuous numerical and ordinal categorical data sets as part of their statistical investigations, using digital tools. Students critique arguments presented in the media based on statistics. They assign probabilities using common fractions, decimal and percentages. Students conduct simulations using digital tools, to generate and record the outcomes from many trials of a chance experiment. They compare observed frequencies to the expected frequencies of the outcomes of chance experiments.		
Strand	• Statistics		
Year 6 ***Content descriptions***	• interpret and compare data sets for ordinal and nominal categorical, discrete and continuous numerical variables using comparative displays or visualisations and digital tools; compare distributions in terms of mode, range and shape AC9M6ST01 • plan and conduct statistical investigations by posing and refining questions or identifying a problem and collecting relevant data; analyse and interpret the data and communicate findings within the context of the investigation AC9M6ST03		
Technologies Core concepts	• Systems • Systems thinking • Computational thinking • Data • Interactions and impact	***Digital Technologies Core concepts***	• Digital systems • Data representation • Data acquisiton (though Mathematics content) • Data interpretation (through Mathematics content) • Abstraction • Algorithms • Implementation
		General capabilities	• Digital Literacy • Literacy • Numeracy

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Cross-curriculum priorities		***Learning area or subject connections***	

Table 3: Links to the Australian Curriculum: Digital Technologies Years 3–4 (V8.4) (depending on the task)

Digital Technologies ***Achievement standard***	By the end of Year 4, students describe how a range of digital systems (hardware and software) and their peripheral devices can be used for different purposes. They explain how the same data sets can be represented in different ways. Students define simple problems, design and implement digital solutions using algorithms that involve decision-making and user input. They explain how the solutions meet their purposes. They collect and manipulate different data when creating information and digital solutions. They safely use and manage information systems for identified needs using agreed protocols and describe how information systems are used.		
Strands	Digital Technologies knowledge and understanding • Representation of data Digital Technologies processes and production skills • Collecting, managing and analysing data • Creating designed solutions by: – investigating and defining – producing and implementing		
Content descriptions	• Recognise different types of data and explore how the same data can be represented in different ways (ACTDIK008) • Collect, access and present different types of data using simple software to create information and solve problems (ACTDIP009) • Define simple problems, and describe and follow a sequence of steps and decisions (algorithms) needed to solve them (ACTDIP010) • Implement simple digital solutions as visual programs with algorithms involving branching (decisions) and user input (ACTDIP011)		
Key concepts	• digital systems • data representation • data collection • algorithms • implementation	***Key ideas***	Thinking in Technologies • computational thinking • systems thinking
Cross-curriculum priorities		***General capabilities***	• Critical and creative thinking • Information and Communication Technology (ICT) Capability • Literacy • Numeracy

Table 4: Links to the Australian Curriculum: Digital Technologies Years 5–6 (V8.4)

Digital Technologies ***Achievement standard***	By the end of Year 6, students explain the fundamentals of digital system components (hardware, software and networks) and how digital systems are connected to form networks. They explain how digital systems use whole numbers as a basis for representing a variety of data types. Students define problems in terms of data and functional requirements and design solutions by developing algorithms to address the problems. They incorporate

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	decision-making, repetition and user interface design into their designs and implement their digital solutions, including a visual program. They explain how information systems and their solutions meet needs and consider sustainability. Students manage the creation and communication of ideas and information in collaborative digital projects using validated data and agreed protocols.		
Strands	Digital Technologies knowledge and understanding • Digital systems Digital Technologies processes and production skills • Evaluating		
Content descriptions	• Examine the main components of common digital systems and how they may connect together to form networks to transmit data (ACTDIK014) • Explain how student solutions and existing information systems are sustainable and meet current and future local community needs (ACTDIP021)		
Key concepts	• abstraction • digital systems • algorithms • interactions	***Key ideas***	Thinking in Technologies • computational thinking • systems thinking
Cross-curriculum priorities		***General capabilities***	• Critical and creative thinking Information and Communication Technology (ICT) Capability • Literacy • Numeracy

Useful links

- Australian Curriculum: Digital Technologies F–10 www.australiancurriculum.edu.au/f-10-curriculum/technologies/digital-technologies/ (V8.4)
- Australian Curriculum: Digital Technologies F–10 https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/digital-technologies (V9.0)
- Digital Technologies in focus project (DTiF) resources to assist in the implementation of the Australian Curriculum: Digital Technologies www.australiancurriculum.edu.au/resources/digital-technologies-in-focus/resources/
- Grok Academy – Unpack the curriculum, Years 3–4 (digital systems, algorithms, data representation, data collection, implementation) https://groklearning.com/a/curriculum/

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Sample picture glossary

Barcode A barcode is a method of representing data in a visual, machine-readable form. Barcodes usually consist of numbers and a pattern of parallel lines of different widths. Barcodes are typically used on product packaging.	 *Image source: pixabay.com/vectors/bar-code-information-data-business-24157/*
QR code A quick response or QR code is like a two-dimensional barcode that can be digitally scanned. QR codes can contain vast amounts of data, many times more than the type of barcode common on supermarket products. This makes QR codes perfect for encoding data from a wide variety of media. QR codes can appear on packaging and signs in a store.	 *Image source: pixabay.com/vectors/code-scan-qr-code-handy-phone-156629/*
SKU The stock keeping unit (SKU) is a unique code or number assigned to a product by a retail store to track stock (inventory). It sometimes looks like a barcode.	 RED-DRE-SML-CR01 colour (red) · type (dress) · size (small) · manufacturer code

Figure 4 – Example of retail digital systems