Digital Technologies – 9 and 10_ Data

	STRAND	Knowledge and understanding		Processes and production skills																	
		Digital Systems		Representation of data		Collecting, managing and analysing data				*Creating Digital Solutions by:*											
										Investigating and defining		Generating and designing				Producing and implementing		Evaluating		Collaborating and managing	
	Content Description	Investigate the role of hardware and software in managing, controlling and securing the movement of and access to data in networked digital systems (ACTDIK034)		Analyse simple compression of data and how content data are separated from presentation (ACTDIK035)		Develop techniques for acquiring, storing and validating quantitative and qualitative data from a range of sources, considering privacy and security requirements (ACTDIP036)		Analyse and visualise data to create information and address complex problems, and model processes, entities and their relationships using structured data (ACTDIP037)		Define and decompose real-world problems precisely, taking into account functional and non-functional requirements and including interviewing stakeholders to identify needs (ACTDIP038)		Design the user experience of a digital system by evaluating alternative designs against criteria including functionality, accessibility, usability, and aesthetics (ACTDIP039)		Design algorithms represented diagrammatically and in structured English and validate algorithms and programs through tracing and test cases (ACTDIP040)		Implement modular programs, applying selected algorithms and data structures including using an object-oriented programming language (ACTDIP041)		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 (ACTDIP042)		Create interactive solutions for sharing ideas and information online, taking into account social contexts and legal responsibilities (ACTDIP043)		Plan and manage projects using an iterative and collaborative approach, identifying risks and considering safety and sustainability (ACTDIP044)	
Sequence of Lessons / Unit	**Approx. time rq'd**	**Year**	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #
Data-driven innovation	10	9	☐		☐		☑	4	☑	4	☐		☐		☐		☐		☑	9	☐		☐	
Organise, visualise and analyse	10	10	☐		☐		☑	4	☑	4	☑	7	☐		☐		☐		☐		☐		☐	

Years 7 and 8 Achievement Standard	**Years 9 and 10 Achievement Standard**	
By the end of Year 8 • Students distinguish between different types of networks and defined purposes. (1) • They explain how text, image and audio data can be represented, secured and presented in digital systems. (2) • Students plan and manage digital projects to create interactive information. (3) • They define and decompose problems in terms of functional requirements and constraints. (4) • Students design user experiences and algorithms incorporating branching and iterations, and test, modify and implement digital solutions. (5) • They evaluate information systems and their solutions in terms of meeting needs, innovation and sustainability. (6) • They analyse and evaluate data from a range of sources to model and create solutions. (7) They use appropriate protocols when communicating and collaborating online. (8)	By the end of Year 10 • Students explain the control and management of networked digital systems and the security implications of the interaction between hardware, software and users. (1) • They explain simple data compression, and why content data are separated from presentation. (2) • Students plan and manage digital projects using an iterative approach. (3) • They define and decompose complex problems in terms of functional and non-functional requirements. (4) • Students design and evaluate user experiences and algorithms. (5) • They design and implement modular programs, including an object-oriented program, using algorithms and data structures involving modular functions that reflect the relationships of real-world data and data entities. (6) • They take account of privacy and security requirements when selecting and validating data. (7) • Students test and predict results and implement digital solutions. (8) • They evaluate information systems and their solutions in terms of risk, sustainability and potential for innovation and enterprise. (9) • They share and collaborate online, establishing protocols for the use, transmission and maintenance of data and projects. (10)	

Topic: Data
Units

Year 9	**Year 10**
Data-driven innovation 10 hours Examine the way 'big data' is being used on a large scale to inform decision-making.	**Organise, visualise and analyse 10 hours** Use tools to organise data and make sense of complex data to identify patterns and trends.

Organise, visualise and analyse

Data visualisation is the presentation of numerical data pictorially or graphically so that users can more easily make sense of complex data to identify patterns and trends. Usually, data visualisations allows input of new sets of data (or circumstances) so that the solution can model the effects of that changed data. When working with large amounts of data, tools are needed (for example, a spreadsheet or programming language such as Python) to manage the volume of information and get the most value from it. Databases enable data to be stored so it can be efficiently and reliably retrieved using relevant queries. When students are asked to respond to meaningful questions that they want to answer, they will be engaged when applying their understandings and developing their skills of data analysis and visualisation.

Flow of activities				
Short text	Meaningful questions Apply understandings about, and develop skills of, data analysis and data visualisation.	Working with data Use tools to enable the students to manage large amounts of data to get the most value from it.	Channels of information Explore how data can be encoded and represented visually as channels of information.	Presenting information Consider both the appearance and functionality of information when presenting information.
Questions to guide exploration	*How can a data set be used to answer my question?*	What *are some ways to organise, analyse and visualise data in a spreadsheet?*	*How does data visualisation help us identify patterns in a data set?*	*How can I present data effectively as information?*
Australian Curriculum alignment	*Collecting, managing and analysing data (ACTDIP036) (ACTDIP037)*	*Collecting, managing and analysing data (ACTDIP036) (ACTDIP037)*	*Collecting, managing and analysing data (ACTDIP037)*	*Collecting, managing and analysing data (ACTDIP036) (ACTDIP037) Investigating and defining (ACTDIP038)*
What's this about?	Students consider meaningful questions that they want to answer. They use these questions to apply their understandings about, and develop their skills of, data analysis and data visualisation. When acquiring data, students consider whether the data set is representative of the entire audience. Some data sets may be biased as they are from a sample that does not fully represent all views. Data acquired from a range of resources may include both quantitative and qualitative data. To effectively use qualitative data, techniques may need to be applied. To undertake useful data analysis, students need to start with quality data. There are plenty of things that can go wrong with data; for example, data may be inappropriately structured or organised, may have formatting issues such as empty cells or apostrophes, may have spelling errors or may be numeric data imported in an incorrect format such as date or currency. In acquiring data from a database, students should develop an understanding that data is stored in a way that allows it to be efficiently and reliably retrieved, and this is different to how it is presented.	When working with large amounts of data, tools enable the user to manage the bulk of information to get the most value from it. Spreadsheets enable you to sort and filter data insert subtotals into sorted lists, use simple formula and visualise data. More complex data sets may require the use of pivot tables to make it easier to analyse all of the information in your worksheet. Pivot tables help make your worksheets more manageable by summarising your data and allowing you to manipulate it in different ways. When using large data sets, it is possible to use a programming language such as Python to read and write the data enabling analysis. To do this, data should be in CSV format, which is like Excel standard spreadsheet format, presented in plain text.	Data can be encoded and represented visually as channels of information. These visual channels include spatial position, colour, size, shape, orientation and direction of motion. Multiple visual channels can be used to simultaneously represent data. Heat maps are a way of visualising numerical data represented as colour. Interactive data visualisations help further to model processes and examine relationships.	Both the appearance and functionality of information contribute to its quality. Appearance relates to the aesthetics of information and it usually draws on design principles, such as alignment, repetition, contrast, space and balance. Alignment connects elements visually through an invisible line. Contrast shows differences between elements. Repetition involves re-using the same or similar elements for consistency. Space relates to the distance between elements. Balance relates to the weighting given to different elements. Functionality also contributes to the effectiveness of information. Characteristics of functionality include the useability of a solution such as its flexibility and ease of use, and accessibility such as its ease of navigation. The quality of information is also enhanced if conventions (or normally accepted procedures) are applied such as a chart having a legend, heading and labelled axes. Similarly, the use of colour should promote contrast but also consider users who are colour blind.
The focus of the learning (in simple terms)	Discuss some broad areas for inquiry that are of interest to students and that would require data to make evidence-based claims. These may be able to be integrated into a classroom context for example in English, science or geography. Some areas of interest: • Social conscience (eg homelessness): Who is affected? Do we have people in our area who are homeless? What can be done to help? • Entertainment (eg books, music or movies): What genre of music creates the most money annually and has this changed over time? Choose a favourite novel and determine which characters within the story interact the most. In the 'Star Wars' series of movies, who are the villains and who are the heroes; who is related and who isn't?	Revise various ways students can use a spreadsheet to make sense of data sets. Model, or use students with expertise in this skill or provide online tutorials so that all students explore how to create a pivot table. Once you've created a pivot table, you can use it to answer different questions by rearranging, or pivoting, the data. Model ways to use a pivot table or provide suitable video tutorials (some are available on YouTube). Creating a dashboard as part of your workbook can be used to summarise the data and present related data visually.	After a brief discussion about data visualisations and what they are, provide students with a set time to use the internet to locate a visualisation that appeals to them. Share as a class and ask generic questions such as: • What information does the visualisation convey? • What is done well; what is misleading? • What channels of information are used; for example, size, colour, position etc? Examine a numeric data set shown in a table compared with an analysis based on colour; for example, numerical data such as temperatures, moisture levels and ocean depth. Many other types of numerical data can be effectively used; for example, retail data and population data – in fact, any data that is within a range where colour can be used to represent the values in that range. Let students	After analysing the data students can create their own infographic to present their ideas visually. Students create a structured database of something of interest; for example, games, sporting teams, digital photographs, music, etc. Students implement methods of validating data as it is entered, using data types, range and constraints, codes and cross-referencing. Students implement various checks from the wide range available and compare their effectiveness in reducing data errors.

	• Health: What are the top ten health risks for Australians? Do certain environmental conditions trigger asthma? What factors affect life expectancy? • Environment: What data supports climate change theory? How has the climate changed over time? What habitat is most vulnerable and which species are likely to be impacted? • Sports: How fit does an athlete need to be to play a particular sport? Are athletes who warm up before physical activity less likely to be injured? Locate data sets that can be used to answer questions of interest. Data sets can be found on the internet or data can be collated from an online survey; for example, using an online survey tool such as Survey Monkey or Google Forms. Although not a requirement at this level, students could use a structured query language to retrieve specific data from a structured database, and compare this to ad hoc queries and search engine queries. Students could identify the advantages of different forms of queries. Often data needs to be cleaned up to make it useful for analysis and visualisation. Provide guidance to students on how to make sure data is in a useable form; for example, in a spreadsheet such as XLS and CSV.	Remind students that correlation does not necessarily equal causation. Spend time looking at charts where data correlates but does not have a causal link. Provide online tutorials or model as a lesson how to use spreadsheet software such as Excel to create a heat map by assigning a colour to numerical data and using conditional formatting. As a further challenge, students may incorporate data within programming; for example, using Python programming language to run a series of commands to interrogate a data set imported as a CSV.	explore a data set of interest and report back their findings. Provide access to relevant tools that enable users to visualise data on a map; the data set will need to contain location data such as latitude and longitude, countries/regions, states, counties or postal codes. Analyse population data made up of structured data categorised as, for example, income ($), life expectancy (years), population (millions of people), country (name), age (years) etc. Examine the relationships using visualisation tools such as those provided by Gap Minder.	
Supporting resources and tools and purpose/context for use	Top ten ways to clean your data This website offers ten ways to clean your data (for example, by correcting misspellings). GovHack 2017 data This website features a comprehensive list of the official data sets available for GovHack. How does income relate to life expectancy? In this short video Professor Hans Rosling shows that people live longer in countries with a high GDP per capita. Choose your own statistic This interactive website provides information about important issues by exploring different statistics about Australian society. Students can download data sets to organise and analyse data.	A spreadsheet's secret weapon This lesson helps students learn to use pivot tables, which have been described as the most powerful tool within spreadsheets. Seeing the wood for the trees In this lesson sequence students summarise data using advanced filtering and grouping techniques; for example, pivot tables in spreadsheets and aggregation functions in databases. Data analysis Learn how to use the following functions in Excel: sort, filter, conditional formatting, charts, pivot tables, tables and what-if analysis. Also learn about the Analysis ToolPak add-in. Tips and tricks for working with data in Excel This video will help you learn about creating a chart, importing a data set from a website, sorting and filtering, conditional formatting and pivot tables. Correlation and causality This is a Khan Academy lesson about correlation and causality. Python for beginners: Reading and manipulating CSV files This blog post provides a useful, easy-to-understand tutorial on how to use Python to read and write data from an Excel data file. Python library: CSV file reading and writing This support is provided by Python and provides guidance on how to use Python to read and write data from an Excel data file. Import data and analyse with Python This tutorial is a basic step-by-step introduction on how to import a text file (CSV), perform simple data analysis, export the results as a text file, and generate a trend.	Tableau Desktop Public Edition Create graphs, charts, maps and more. Tableau Public is a popular, free data visualisation tool. Gap Minder tools Gap Minder's visualisations tools can be used to interrogate population data. Census 2016: This is Australia as 100 people This data visualisation shows what Australia's data would look like if Australia were 100 people. How to create a cool heat map in Excel This video tutorial goes through the process of how to use conditional formatting to turn a data set into a heat map. Turn your data into a heat map This short article provides tips about how to use conditional formatting to turn a data set into a heat map. Creating heat maps with Excel While this video draws on a Chicago data set, it provides a useful tutorial clearly explained about how to use location data and use the map function in Excel. Create a map chart You can use a map chart to compare values and show categories across geographical regions. Use it when you have geographical regions in your data, such as countries, states or postal codes. Create a map in power view Create a 3D map of your data in Excel.	Canva Create infographics with Canva's free online infographic maker. Intro to SQL: Querying and managing data Use this Khan Academy tutorial to learn how to use Structured Query Language (SQL) to store, query and manipulate data. Design your own database: Concept to implementation This PDF describes how to design a database without touching a computer. Zoho Build applications to collect and organise your data online with an easy-to-use database management software. Sodadb (Simple Online Database) Simple Online Database offers templates to assist students with databases. SQLZoo This is a series of SQL tutorials and activities.

Assessment	**Suggested approaches:** • Identification of sources of data • List of validation techniques to enhance the reasonableness of the data to be manipulated • Examples of a coding system for qualitative data **Achievement standard** **Take account** of privacy and security requirements when selecting and validating data.	**Suggested approaches:** Presentation or demonstration **Achievement standard** **Take account** of privacy and security requirements when selecting and validating data.	**Suggested approaches:** Artefact analysis **Achievement standard** **Take account** of privacy and security requirements when selecting and validating data. **Evaluate** information risk, sustainability and potential for innovation and enterprise.	**Suggested approaches:** • Presentation or demonstration • Artefact analysis **Achievement standard** **Define** and **decompose** complex problems in terms of functional and non-functional requirements. **Take account** of privacy and security requirements when selecting and validating data.