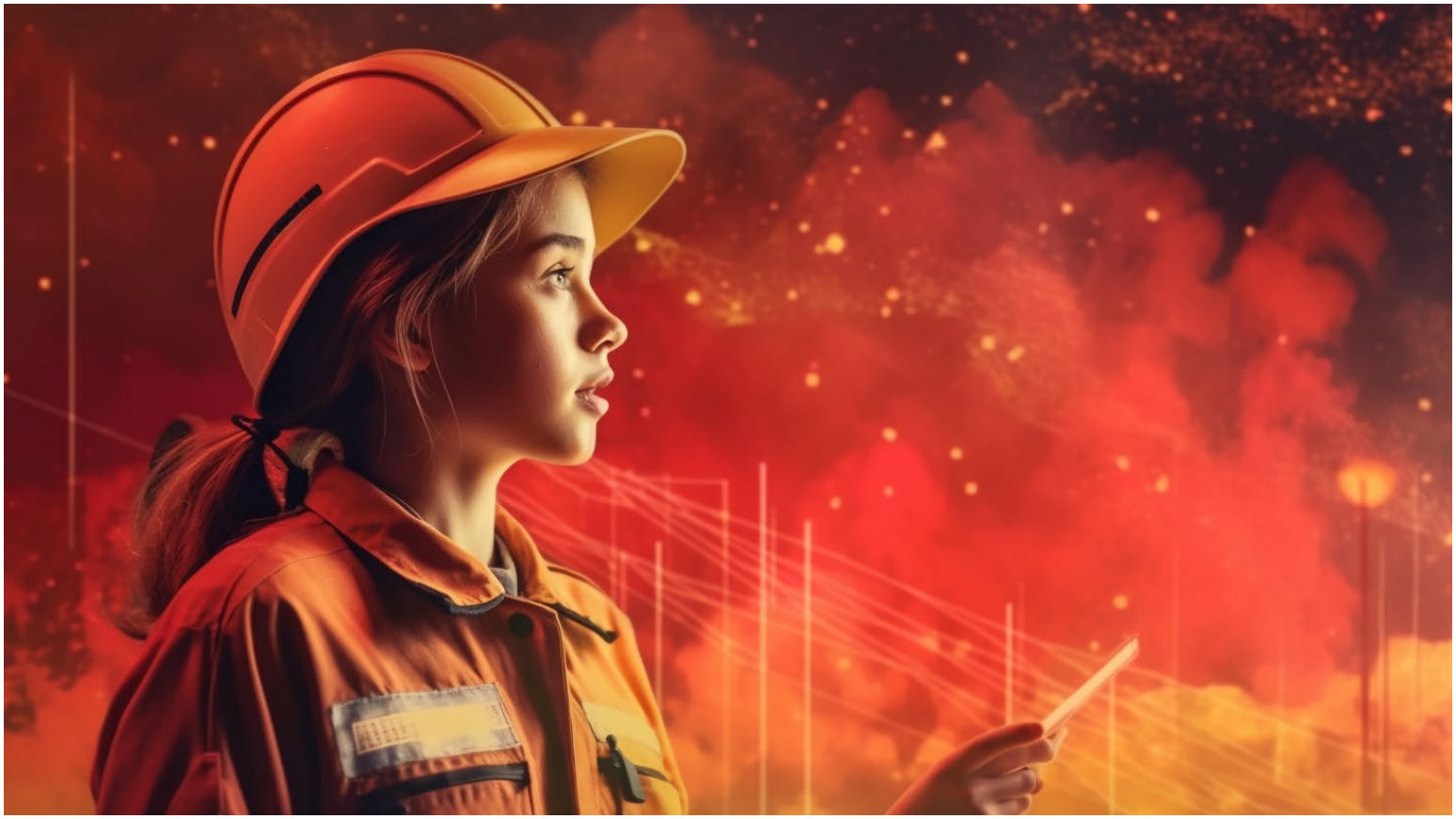
Stage 4 Technology mandatory digital technologies

Fire-Ed Up – Learning Sequence



NSW GOVERNMENT Office of the Chief Scientist & Engineer

Contents

The Digital Technologies context encourages students to develop an empowered attitude towards digital technologies, use abstractions to represent and decompose real-world problems, and implement and evaluate digital solutions. Students have the opportunity to become innovative creators of digital technologies in addition to effective users of digital systems and critical consumers of the information they convey. Students are provided with opportunities to develop fluency in a general-purpose programming language and use these skills to solve information problems and to automate repetitive tasks.

Fire-Ed Up

Welcome to Fire-Ed Up, a unit designed to empower young Australians in bushfire resilience. In response to the devastating Black Summer fires and the findings of the Royal Commission, the Office of the Chief Scientist and Engineer has introduced the Bushfire STEM in Schools Initiative, known as Fire-Ed Up. This unit, aimed at Year 7 and 8 students, equips them with practical skills and knowledge to reduce bushfire risks and contribute to their communities' safety.

The Black Summer fires of 2019-2020 had a profound impact, emphasising the need for education and preparedness. The Royal Commission highlighted community engagement and a skilled workforce as crucial in mitigating bushfire risks. Fire-Ed Up directly addresses these needs.

Using microcontroller technology, students are required to work in teams to design, produce and evaluate a digital solution that will make the Australian Fire Danger Rating System (AFDRS) more accurate. Students will use coding software (Micro Python) and relevant hardware to develop an understanding of how the AFDRS works. Throughout the unit, students will learn programming concepts and commands and how to modify code. Students will also learn how to use microcontroller technologies to assist in the production of their final design solution.

Duration of learning

Indicative time – 10 weeks 25 hours.

Inquiry question

Can we make the Australian Fire Danger Rating System more accurate?

Outcomes

A student:

- designs, communicates and evaluates innovative ideas and creative solutions to authentic problems or opportunities **TE4-1DP**
- plans and manages the production of designed solutions **TE4-2DP**
- designs algorithms for digital solutions and implements them in a general-purpose programming language **TE4-4DP**
- explains how data is represented in digital systems and transmitted in networks **TE4-7DI**
- explains how people in technology related professions contribute to society now and into the future **TE4-10TS**

All outcomes referred to in this unit come from Technology Mandatory Syllabus Year 7-8 Syllabus

Aim

The aim of this unit is to provide students with opportunities to develop fluency in a general-purpose programming language and use these skills to solve problems related to bushfire and to automate repetitive tasks.

Purpose and audience

This teaching resource is for teachers delivering or planning to deliver the course. The learning sequence demonstrates how a combination of outcomes can be used to develop teaching and learning activities. It also suggests a range of resources to support teachers when planning and/or teaching the course.

When and how to use this document

Use this resource when designing learning activities that align with the course outcomes and content. The activities and resources can be used directly or may be adapted based on teacher judgment and knowledge of their students. The column for adjustments and registrations is intentionally left empty so that each class teacher can fill it in, considering the specific adjustments needed for their class based on the unique needs of their students. Teachers should complete the registrations, including any notes, on a weekly basis.

Weeks 1 and 2

Table 1 – Fire-Ed Up weeks 1 and 2 learning sequence

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
Week 1 – Identifying and defining TE4-1DP, TE4-2DP Students: • define and decompose real-world problems, taking into account functional requirements and a range of constraints, eg economic, environmental, social, technical and usability (ACTDIP027)	**Overview of Fire-Ed Up** Introduce the unit of work and the tasks to be completed – **Group work** - prototype design **Individual** – portfolio. **Teacher** • distribute Fire-Ed Up – Student resource folio to students • distribute Fire-Ed Up – Student design folio to students • distribute Fire-Ed Up assessment task **Australian fire danger rating system** **Teacher** • introduce AFDRS page 2 Student Resource Folio (SRF)	• Students can describe the types of tasks that they are expected to complete as part of the Fire-Ed Up unit of work. • Student completion of assigned activities in the Student Resource Folio (SRF) and the Student Design Folio (SDF). • Students can define a problem effectively.	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	• show video 'Unpacking the fire danger rating system – NSW RFS' (15 minutes) • introduce the focus question 'Can we make the Australian Fire Danger Rating System more accurate?' **Students** • class discussion on topic 'The previous fire rating system was considered to be accurate about 40% of the time, while the updated system has an accuracy rate of 60%.' • **Question:** Why isn't the system fully accurate, achieving a 100% accuracy rate?'	• Students can describe the purpose of the Australian Fire Rating System? • Students can describe the major limitations of the previous fire danger rating system. • Students can provide reasoned arguments as to why it is difficult for the AFDRS information system to be 100% accurate.	

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
Identifying and defining TE4-1DP, TE4-2DP Students: • define and decompose real-world problems, taking into account functional requirements and a range of constraints, eg economic, environmental, social, technical and usability (ACTDIP027) • evaluate how existing information systems meet needs, are innovative, and take account of future risks and sustainability (ACTDEK029, ACTDIP031)	**Design situation** Introduce the design situation page 2 Student Design Folio (SDF). **Teacher** • introduce the design situation – page 2 SDF • introduce the design brief, links to digital technologies (Raspberry Pi, Micro Python) and the deliverables - page 3 SDF • coordinate the formation of teams **Students** • students form into teams **iSTEM Engineering Design Process**	• Students can explain the design situation in the context of the Australian Fire Danger Rating System (AFDRS). • Students produce a design brief statement and produce a prototype design and folio for the Fire-Ed Up unit. • Students can define a problem effectively. • Students can work effectively in teams to produce solutions to design problems. • Students evaluate existing information systems.	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	Teacher • introduce the iSTEM engineering design process, provide a copy of the A4 poster to each student and describe the basic components. The iSTEM process guide is available to support teachers. **AFDRS as an information system** Introduce the fire behaviour models, fuel types and Fire Behaviour Index (FBI) page 2-4 Student Resource Folio (SRF). **Teacher and students** • class discussion how the AFDRS is an information system?	• Students can recall the different 'cogs' that make up the iSTEM Process. • Students can plan and manage the production of designed solutions using the iSTEM process. • Students can define the AFDRS as an information system. • Students can suggest at least two improvements of the new AFDRS over the old system. • Students can recall what are the 'What are fire behaviour	

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	Teacher • introduce fire behaviour models, fuel types and Fire Behaviour Index (FBI) – pages 2-4 SRF • Show video 'Why we needed to update the fire danger rating system' video (14 minutes). **Students** • Student led discussion on why we need a more accurate fire rating danger system and why is it important that it is accurate in your local community?	models?'. • Students can describe the difference between FBI and the fire danger rating categories. • Students can name fire behaviour characteristics that the FBI helps to predict. • Students will be able to effectively compare the AFDRS and FBI. • Students will be able to explain the AFDRS and FBI to someone in their community who is not familiar with them.	
Identifying and defining TE4-1DP, TE4-2DP Students: • define and decompose real-world problems, taking into account functional	**Teacher** • discuss vegetation types used to develop fire behaviour models pages 5-6 SRF • demonstrate where students can find the current Fire Danger Rating for their area.	• Students can recall the number of vegetation types that the previous fire behaviour model was based upon and describe how the new model is more accurate as it uses more vegetation types.	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
requirements and a range of constraints, eg economic, environmental, social, technical and usability (ACTDIP027)	http://www.bom.gov.au/nsw/forecasts/fire-danger-ratings.shtml **Students** • research the current fire rating for their district and complete activities on page 6 SRF • test their knowledge by answering the questions presented on page 7 of the SRF.	• Students can explain why it is important to have different fire behaviour models for different vegetation types. • Students can determine why fire district for which they live. • Students will be able to find the current fire danger rating and fire behaviour index for their district. • Students will be able to determine based on the fire danger rating and fire behaviour index what type of actions they should be taking.	
Week 2 **Identifying and defining** TE4-7DI Students: • evaluate how existing information systems meet	**NSW RFS Pocketbook** Get students to download the App or demonstrate it to students. **Teacher** • demonstrate how the NSW rural fire service use the	• Students are able to input various variables into the App and get outputs.	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
needs, are innovative and take account of future risks and sustainability (ACTDEK029, ACTDIP031)	pocketbook to determine the FBI and fire rating for their area • describe how the different variables would be used in an algorithm to produce a numeric index in the App **Extension** • Asks a representative of the NSW RFS to visit the classroom. **Students** • Explore the different calculators available on the App including; - The Superseded McArther MkV forest Fire danger - The superseded grassland fire danger and - Current fire behaviour calculators	• Students can explain how the different variables are added to the App to produce an index. • Students to be able to describe how the information system uses an algorithm to produce an index. • Students can evaluate existing information systems.	

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	Teacher and Students • evaluate the suitability of the pocketbook information system to get accurate fire ratings and fire behaviour index for their district. • Evaluate the Apps performance against the needs of different users **Fire-Ed Up – Raspberry-Pi Device** The Fire-Ed Up Raspberry-Pi kits to be distributed to the students. **Teacher** • demonstrates how the Fire-Ed Up unit works to produce a simulated Fire Behaviour Index and Fire Rating	• Students are able to determine the suitability of the use of the hardware (Phone) and software (App) to their local area. • Students are able to determine the suitability of the use of the hardware (Phone) and software (App) to meet the needs of different users. • Students are able to determine the suitability of the use of the Fire-Ed Up hardware and software to their local area.	

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	Students • experiment with the Fire-Ed Up units making adjustments to the environmental and fuel condition controls to determine outcomes.	• Students are able to determine the suitability of the use of the hardware to meet the needs of different users.	
Identifying and defining TE4-1DP, TE4-2DP Students: • develop criteria to evaluate design ideas, processes and solutions, the functionality, aesthetics and a range of constraints, e.g. accessibility, economic, resources, safety, social, sustainability, technical (ACTDEP038, ACTDIP027, ACTDIP031) DT ST	**Design brief** Discuss the design brief 'Utilising STEM technologies and local environmental insights to enhance your community's bush fire danger rating system.' **Teacher** • describe how students will utilise the Fire-Ed Up Raspberry Pi units and how this could be used to solve the problem described. • inform students that they can come up with prototype solutions using any digital	• Students produce a clearly defined design brief statement. • Students select a project in which they use the Raspberry-Pi unit or other digital technology of their choice.	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	technology. • describe how to produce a design brief statement page 4 SDF. **Students** Work in teams to: • review the design brief and situation to better understand the task • investigate the fire topic, and consider the users' needs as they prepare to create their design solution • list the possible constraints that their team might have for this brief • indicate who is the problem being solved for? • indicate what is being solved • Suggest why does the problem need to be solved?	• Students develop criteria to evaluate design ideas, processes and solutions, the functionality, aesthetics and a range of constraints. • Students complete basic analysis of the brief. • Students list the different constraints that their team might have in solving this problem. • Students identify who their problem is being solved for. • Students describe what they are going to solve. • Students explain why the problem needs to be solved.	

Week 3

Table 2 – Fire-Ed Up week 3 learning sequence

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
Week 3 – Research (Field work and investigations) **TE4-7DI** Students: • evaluate how existing information systems meet needs, are innovative and take account of future risks and sustainability (ACTDEK029, ACTDIP031) • collect and access data from a range of sources (ACTDIP025)	**Research** **Students** • investigate two information systems that help in managing bushfires. Students to assess how they meet needs are innovative, take into account risks and sustainability. Page 6 SDF **Field measurements** Research and real-world investigations required to predict FBI and AFDR. Pages 8-23 SRF. **Anemometer (Kestrel 3000) – Wind speed, temperature and humidity**	• Students can describe two information systems that help in bushfire management, including how they meet needs, are innovative and take into account future risks and sustainability. • Students conduct a range of field work tasks to determine; temperature, wind speed, humidity, fuel load, fuel moisture content, land slope and determine vegetation type.	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	Teacher • demonstrates the use of the Kestrel 3000 to determine wind speed, temperature and humidity. Instructions for teachers are available from https://www.youtube.com/watch?v=FipQ149mS9E Pages 9-10 SRF • organise for a field trip or organise to conduct field work experiments at school **Students** Use pages 11-13 of the SRF for the following. • visit the BOM website and use their interactive map to select the nearest location. Students then record temperature, relative humidity % and wind speed	• Students evaluate how existing information systems meet needs, are innovative and take account of future risks and sustainability. • Students can collect and access data from a range of sources.	

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
• interpret and visualise data using a range of software to create information	http://www.bom.gov.au/nsw/observations/map.shtml • use the Kestrel 3000 to take weather readings from their location • record and compare actual readings to those on the official BOM site • graph the results using a spreadsheet **Fuel Moisture Content (FMC)** Use pages 14-19 of the SRF for the following. **Teacher** • describe and demonstrate how to determine Fuel Moisture Content (FMC) page 14 SRF • explain the concept of grass curing page 15-17 • after collecting leaves from the area of investigation complete	• Students determine wind speed, temperature and humidity using a website. • Students determine wind speed, temperature and humidity from their location using a Kestrel device. • Students compare results and account for differences. • Students graph results using graph paper or a spreadsheet to show differences.	

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	a 'Leaf Burning' experiment for the students pages 18-19 SRF **Students** • complete leaf crunch test and record the results page 14 SRF • complete a grass curing observation test and record result on page 15 of the SRF, using the curing guide on pages 16-17 • record the results of the leaf angle test performed by the teacher page 18-19 SRF **Land slope** Use page 20 of the SRF for the following. **Teacher** • demonstrate the use of a clinometer to measure the slope of an area. Instructions available from	• Students to determine the dryness of the surrounding vegetation by completing a crunch test. • Students can make accurate observations regarding grass curing in their area and record their findings. • Student to be able to estimate the percentage of fuel moisture content in their area after observing a leaf angle burning test. • Students to be able to accurately determine the slope of the land for which they are investigating for bushfire risk.	

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	https://www.youtube.com/watch?v=dvIjPQyDQWs&t=20s **Students** • complete field work using a clinometer to determine the slope of the area for which they are investigating • complete table on page 20 SRF **Teacher** • Lead class discussion on how different slopes around the school or area of investigation might affect bushfire risks **Fuel Load** Use pages 21-22 of the SRF for the following.	• Students to describe how the slope of the land is important in helping plan for bushfire safety. • Students able to discuss how different slope might affect bushfire risk. • Students can use field work research and investigations to calculate total fine fuel loads. • Students can explain why it is important to know fuel load when predicting bushfires. • Students can describe how knowledge of fuel load can help in planning for bushfire safety.	

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	Teacher • describe and demonstrate how to determine fuel load calculated at tonnes per hectare. Page 21-22 SRF. • organise a field trip or use school grounds to complete a fuel load assessment. **Students** • complete a ground litter assessment and a scrub survey and complete the table on page 21 of the SRF. • calculate the total of fine fuels in tonnes per hectare **Data sheet summary** Using the table on page 23 of the SRF	• Students can describe how different fuel loads might affect bushfire risks in their area.	

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	Students • collate all the field work data from the field trip or from the school environment in the table on page 23 of the SRF, to be used for analysis on the Fire-Ed Up Raspberry-Pi unit	• Students and collate data from conducting investigations and field work to be used in digital systems.	

Week 4

Table 3 – Fire-Ed Up week 4 learning sequence

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
Week 4 – Research (Fire-Ed Up Unit) **TE4-7DI** Students: • evaluate the suitability of hardware with particular performance characteristics against the needs of different users (ACTDIK023)	**Traditional knowledge** **Teacher** • discusses how First Nations people actively managed the environment using fire • show Traditional Knowledge – Cool Burning video https://www.youtube.com/watch?v=YzuV5jsoqGY&t=2s (2:26 minutes) **Students** • discuss how traditional and modern fire management techniques are similar and are different	• Students can explain how First Nations people managed the environment using fire. • Students can compare and contrast traditional vs Modern fire management practices.	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
• Investigate how digital systems represent text, image and audio with whole numbers (ACTDIK024)	**Raspberry Pi Micro-controller** **Teacher** • explains what are microcontrollers and the functions are they perform • explain what are Programmable Logic Controllers (PLC's) • describe how microcontrollers work • introduces the raspberry pi microcontroller **Students** • familiarise themselves with the raspberry pi microcontroller components to support their future coding practice **Teacher** Use the guide provided by core electronics to direct student activities coreelec.io/fire-edup	• Students can connect a raspberry pi Fire-Ed Up unit to a computer. • Students can safely use of the raspberry pi units • Students can evaluate the suitability of hardware with particular performance characteristics against the needs of different users.	

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	• explains and demonstrates how to connect the raspberry pi to a computer • describes the safety concerns when using a microcontroller **Students** • connect the raspberry pi to a computer and follow the instructions from coreelec.io/fire-edup **MicroPython** Use page 28 SRF for this section. **Teacher** • describe what is the Micro Python programming language • explain why we are learning about the Micro Python programming language • demonstrate how to install Micro Pthyon using the Thonny free open source integrated	• Students to be able to describe what is Micro Python. • Student can describe reasons why Micro Python would be chosen for the Fire-Ed Up prototype device. • Students to be able to install Thony and load Micro Python code into a raspberry pi unit.	

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	development environment **Students** • complete introductory coding exercises for Fire-Ed up on coreelect.io/fire-edup **Variables** Use page 29 of the SRF for this section. **Teacher** • explain 'what is a variable' and why we need to use them in coding • describe how to create variables • discuss the following variables that will be used in the Fire-Ed Up program, fuelload, fuelmoisture, temperature, humidity and windspeed **Students**	• Students can describe what is a variable and identify variables in sample code.	

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	• identify the use of variables in the Fire-Ed Up device code **Constants** Use page 30 of the SRF for this section. **Teacher** • explain what is a constant and why we need to use them in coding • describe how to create constant • discuss the following constants that will be used in the Fire-Ed Up program, vegetation and slope **Students** • identify the use of constants in the Fire-Ed Up device code • set a number of constants in the Fire-Ed Up device code	• Students can describe what is a variable and identify variables in sample code. • Students can set constants in the sample code.	

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
Algorithms TE4-4DP Students: • design algorithms that use a range of data types, branching and iteration and represent them diagrammatically and in English (ACTDIP029)	**Understanding algorithms** Use pages 31-32 of the SRF for this section. **Teacher** • explain what an algorithm is and explain where they are used • describe how algorithms work and why they are important • describe the characterises of a good algorithm • give examples of algorithms both simple and more complex • use a plain English algorithm example for making vegemite on toast, page 32 SRF • explain the basic operation of the Fire-Ed Up algorithm to determine the Fire Behaviour Index (FBI)	• Students can define and produce simple algorithms using plan English and visual means. • Students can produce simple algorithms which demonstrate the characteristics of a good algorithms. • Students can design algorithms that use a range of data types, branching and iteration and represent them diagrammatically and in	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	Students • design a number of simple algorithms using a range of variables and/or constants using Pseudo code and a flowchart	English. • Students can describe the basic operation of the Fire-Ed Up algorithm.	
Fire-Ed Up TE4-4DP Students: • design algorithms that use a range of data types, branching and iteration and represent them diagrammatically and in English (ACTDIP029) • model objects or events using structured data (ACTDIP026)	**Fire-Ed Up Core Electronics Exercises** Visit coreelec.io/fire-edup for instructions of exercises. **Teacher** • direct students to complete Fire-Ed Up specific coding activities that have been abstracted for the real-world fire example **Students** • complete a range of simple coding exercises for students to develop an understanding of	• Students can model objects or events using structured data • Students can design algorithms that use a range of data types, branching and iteration and represent them diagrammatically and in English • Students can modify Micro Python code in the Fire-Ed Up interface device to modify	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	how the Fire-Ed Up algorithm works for the devise using Micro Python	basic operations.	

Weeks 5 and 6

Table 4 – Fire-Ed Up weeks 5 and 6 learning sequence

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
Week 5 – Identifying and defining TE4-1DP, TE4-2DP, TE4-4DP Students: • develop criteria to evaluate design ideas, processes and solutions, the functionality, aesthetics and a range of constraints, eg accessibility, cultural, economic, resources, safety, social, sustainability, technical (ACTDEP038, ACTDIP027, ACTDIP031) • define and decompose real-world problems, taking into account functional requirements and a range of	**Assessment Task** Review Fire-Ed Up assessment task **Brainstorming** **Teacher** • explain how to use the space, saturate and group method of brainstorming page 7 SDF. • organise students to into their groups and get them to brainstorm ideas on 'all the problems that they can solve related to the brief and bushfire management.	• Students complete an assessment task. • Students can develop criteria to evaluate design ideas, processes and solutions, the functionality, aesthetics and a range of constraints. • Students can define and decompose real-world problems, taking into account functional requirements and a range of constraints.	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
constraints, eg economic, environmental, social, technical and usability (ACTDIP027) • evaluate how student solutions address defined functional requirements and constraints (ACTDIP031)	**Students** • use the space, saturate and group method of brainstorming to come up with a range of ideas for different problems they can solve related to the brief **Synthesize** **Students** • choose the top four ideas from the brainstorming session. On pages 8 and 9 of the SDF, document and evaluate these ideas, listing their pros and cons • select and combine the top aspects from the four ideas evaluated. Detail and sketch this chosen problem on page 10 of the SDF	• Students can evaluate how student solutions address defined functional requirements and constraints • Students generate a broad range of ideas for the design problem. • Students select, document and evaluate four different design problems. • Students select a creative problem to be solved and document the details.	

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
Identifying and defining TE4-1DP, TE4-2DP, TE4-4DP Students: • develop criteria to evaluate design ideas, processes and solutions, the functionality, aesthetics and a range of constraints, eg accessibility, cultural, economic, resources, safety, social, sustainability, technical (ACTDEP038, ACTDIP027, ACTDIP031) • define and decompose real-world problems, taking into account functional requirements and a range of constraints, eg economic, environmental, social, technical and usability (ACTDIP027)	**Empathy mapping** **Teacher** • describes what is an empathy map and how to create one, page 11 of the SDF **Students** • complete an empathy map for their selected Fire-Ed Up program problem using the template on page 12 SDF **Design brief statement** **Teacher** • describes what is a design brief statement • provides examples of design brief statements related to the Fire-Ed Up program, page 13 SDF	• Students develop criteria to evaluate design ideas, processes and solutions, the functionality, aesthetics and a range of constraints. • Students describe 'What is an Empathy Map'. • Students produce a empathy map for the Fire-Ed Up problem selected. • Students define and decompose real-world problems, taking into account functional requirements and a range of constraints.	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	Students • produce a design brief statement based on their brainstorming for the Fire-Ed Up brief, page 13 SDF	• Students produce a clear and concise design brief statement that meets the brief from the Fire-Ed Up problem.	
Identifying and defining TE4-1DP, TE4-2DP, TE4-4DP Students: • develop criteria to evaluate design ideas, processes and solutions, the functionality, aesthetics and a range of constraints, eg accessibility, cultural, economic, resources, safety, social, sustainability, technical (ACTDEP038, ACTDIP027, ACTDIP031) • define and decompose real-world problems, taking into account functional	**Identify the constraints** Use pages 14-15 of the SDF for this section. **Teacher** • explain 'what are design constraints' • show video from Dr Nick De Leon from the Royal College of Art on constraints • discuss why constraints are important • discuss the types of constraints that might be on a project like Fire-Ed Up	• Students develop criteria to evaluate design ideas, processes and solutions, the functionality, aesthetics and a range of constraints. • Students define what are constraints. • Students mind map ideas on the different constraints for the brief • Students list a number of constraints for the complete of the Fire-Ed Up design task.	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
requirements and a range of constraints, eg economic, environmental, social, technical and usability (ACTDIP027) • plan and manage projects individually and collaboratively (ACTDEP039)	• describe how to produce a quality mind map of constraints, page 15-16 SDF • discuss how to identify the criteria for success • explain the importance of project management • demonstrate how to produce a Gannt Chart and a basic action plan **Students** • using the template on page 16 of the SDF as a guide produce a detailed mind map for the constraints of the Fire-Ed Up program • documents all the pertinent constraints on page 17 SDF • produce a list of criteria for success for the Fire-Ed Up brief	• Students produce a list of criteria to assess the success of their design solutions. • Students produce a simple Gannt chart and action plan for the completion of the Fire-Ed Up design project. • Students can define and decompose real-world problems, taking into account functional requirements and a range of constraints.	

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
Week 6 – Researching and planning TE4-1DP, TE4-2DP, TE4-4DP Students: • design the user experience of a digital solution, generating, evaluating and communicating alternative ideas (ACTDEP036, ACTDIP028, ACTDIP032) • evaluate how student solutions address defined functional requirements and constraints (ACTDIP031)	**Brainstorming - Sketching your ideas** Use pages 20-23 of the SDF for this section. **Teacher** • provide instruction on how to produce 3D sketches • use video catalogue from the Splat 3D website to demonstrate how to produce 3D shapes https://www.youtube.com/c/splat3d • explain how to brainstorm by producing annotated thumbnail sketches **Student** • practice drawing objects in 3D using the exercise on page 20 of the SDF	• Students can design the user experience of a digital solution, generating, evaluating and communicating alternative ideas. • Students produce quality 3D sketches using a range of techniques. • Students can evaluate how student solutions address defined functional requirements and constraints. • Students produce a large number of annotated thumbnail sketches.	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	• brainstorm ideas by producing simple, annotated 3D thumbnail sketches, page 21 SDF **Brainstorming** **Teacher** • describe how to effectively brainstorm to come up with creative solutions to problems • set the rules for successful brainstorming, page 22 SDF • demonstrate how to brainstorm using the Crazy 8's process **Students** • complete an individual Crazy 8's brainstorming session, and discuss with group • complete a group Crazy 8's brainstorming session	• Students performing brainstorming following the standard rules. • Students produce creative design solutions using Crazy 8's brainstorming technique • Students evaluate design solutions.	

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
Week 6 – Researching and planning TE4-1DP, TE4-2DP, TE4-4DP Students: • design the user experience of a digital solution, generating, evaluating and communicating alternative ideas (ACTDEP036, ACTDIP028, ACTDIP032) • evaluate how student solutions address defined functional requirements and constraints • (ACTDIP031)	**Designing** Use pages 24-28 of the SDF for this section. **Teacher** • explain how design thinking works and define divergent and convergent thinking **Teacher and Students** • complete the divergent/convergent thinking activity based on the work of Anne Manning page 24 SDF **Students** • choose six designs from the Crazy 8 brainstorming. Sketch these in the circles provided and annotate around them to describe each design in more detail, page 25 SDF	• Students can explain the difference between divergent and convergent thinking. • Students can demonstrate convergent thinking techniques. • Students can design the user experience of a digital solution, generating, evaluating and communicating alternative ideas. • Students can evaluate how student solutions address defined functional requirements and constraints.	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	Evaluate **Teacher** • to explain how to use an impact effort matrix, page 26 SDF **Students** • evaluate their six ideas using the impact effort matrix page 26 SDF **Convergent design** **Students** • select two design ideas and document them on page 27 SDF **Final design idea** • select their final design idea and produce an annotated sketch on page 28 of the SDF • evaluate why this design solution is the best	• Students can effectively evaluate design ideas using a impact effort matrix.	

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
Researching and planning TE4-1DP, TE4-2DP, TE4-4DP Students: • design the user experience of a digital solution, generating, evaluating and communicating alternative ideas (ACTDEP036, ACTDIP028, ACTDIP032)	**Designing** Use pages 29-30 of the SDF for this section. **Teacher** • defines What is design? • explains What are design drawings? • demonstrates how to create an orthogonal drawing • show video on orthogonal sketches, https://iteachstem.com.au/resources/143-orthogonal-drawing-fundamentals/ **Students** • produce an orthogonal sketch of one aspect of their final design idea, page 29 SDF.	• Students can define 'design' and explain what is the purpose of a design drawing. • Students can produce basic orthographic sketches. • Students can produce basic isometric sketches. • Students can design the user experience of a digital solution, generating, evaluating and communicating alternative ideas.	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	Teacher • explains how to produce an isometric pictorial drawing • show video on isometric sketches, https://iteachstem.com.au/resources/142-pictorial-drawing-fundamentals/ **Students** • practice sketching small part of their design solution using an isometric sketch • produce an isometric sketch of their design solution, page 30 SDF		
Researching and planning TE4-1DP, TE4-2DP, TE4-4DP Students: • design the user experience of a digital solution, generating,	**Design drawings** Use pages 31-33 of the SDF for this section.	• Students can design digital solutions and evaluate ideas.	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
evaluating and communicating alternative ideas (ACTDEP036, ACTDIP028, ACTDIP032)	**Teacher** • describes the difference between colouring and rendering • Show video on how to produce high quality rendered 3D design drawings, https://vimeo.com/413405563 **Students** • watch videos on how to render different shapes, see page 31 SDF for links • students produce multiple annotated pictorial sketches of different aspects of their design solutions, page 32 SDF • produce a final set of design drawings of their design solution, page 33 SDF	• Students can design the user experience of a digital solution, generating, evaluating and communicating alternative ideas. • Students can produce rendered drawings of 3D objects, showing the effects of light and shade. • Students to produce a set of annotated and rendered design drawings suitable for construction into a prototype.	

Weeks 7 and 8

Table 5 – Fire-Ed Up weeks 7 and 8 learning sequence

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
Week 7 – Producing and Implementing TE4-1DP, TE4-4DP Students: • plan and manage projects individually and collaboratively (ACTDEP039) • implement and modify programs involving branching, iteration and functions in a general-purpose programming language (ACTDIP030)	**Prototyping** Use pages 34 of the SDF for this section. **Teacher** • defines 'Prototyping' • describes the different types of prototypes, page 34 SDF • direct students to produce prototype solutions • assist students in the completion of their digital prototypes **Students** • working in teams students produce prototype Fire-Ed Up solutions using digital solutions and using coding	• Students can describe different types of prototypes. • Students have produced a basic prototype of their design idea based on their design documentation. • Students can manage projects by following a set design process. • Students can apply findings from testing and evaluation to improve design solutions • Students demonstrate that they can modify code using MicroPython. • Students can make changes to a functioning user interface.	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
Week 8 – Testing and evaluating TE4-1DP, TE4-1DP, TE4-4DP Students: • plan and manage projects individually and collaboratively (ACTDEP039) • implement and modify programs involving branching, iteration and functions in a general-purpose programming language (ACTDIP030) • Implement a functioning user interface (ACTDIP030) • Evaluate how student solutions address defined functional requirements and constraints (ACTDIP031)	**Prototype testing** Use pages 35-36 of the SDF for this section. **Teachers** • revise criteria for success and discuss how these will be tested • describe ways in which design solutions can be tested, page 35 SDF • Show video of how to test a prototype, https://vimeo.com/413403698 **Students** • document their criteria for success, page 35 SDF • plan how they will test their prototypes • document the production of their prototypes, page 36 SDF	• Students can manage projects by following a set design process. • Students demonstrate that they can modify code using MicroPython. • Students can make changes to a functioning user interface. • Student document the production and any problems encountered during the prototyping phase.	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	• list the steps in producing their prototype design and describe how they overcome at least two problems, page 36 SDF		
Testing and evaluating TE4-1DP, TE4-4DP Students: • plan and manage projects individually and collaboratively (ACTDEP039) • design the user experience of a digital solution, generating, evaluating and communicating alternative ideas (ACTDEP036, ACTDIP028, ACTDIP032) • implement and modify programs involving branching, iteration and functions in a general-	**Evaluate and testing** Use pages 37-39 of the SDF for this section. **Teachers** • describe how to complete a PMI evaluation • explain how to evaluate using a SWOT analysis **Student** • complete further testing and modification of their prototypes • complete a PMI based on the result of one of the tests, page 37 SDF • evaluate their design solutions against the criteria to evaluate	• Students can complete evaluations of their design ideas using, PMI and SWOT.	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
purpose programming language (ACTDIP030) • Evaluate how student solutions address defined functional requirements and constraints (ACTDIP031)	the success of their prototypes using the table on page 38 SDF • argue if their prototype has been successful based on the evaluation against the criteria for success set at the beginning of the process • complete a SWOT analysis of their prototype designs		

Weeks 9 and 10

Table 6 – Project-based learning weeks 9-10 learning sequence

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
Week 9 – Producing and Implementing TE4-1DP, TE4-1DP, TE4-4DP Students: • plan and manage projects individually and collaboratively (ACTDEP039) • implement and modify programs involving branching, iteration and functions in a general-purpose programming language (ACTDIP030) • Implement a functioning user interface (ACTDIP030)	**Iteration** Use pages 40 - 42 of the SDF for this section. **Teacher** • explains the importance of iteration • assist students in the iteration of their prototypes **Students** • document 4 possible improvements to their designs that they learnt from testing and evaluation, page 40 SDF • based on the results of the testing and evaluation make modifications to their prototype designs	• Students can manage projects by following a set design process. • Students can apply findings from testing and evaluation to improve design solutions. • Students demonstrate that they can modify code using Micro Python. • Students can make changes to a functioning user interface using microcomputer technologies.	(Add adjustments and registration)

Outcomes and content	Teaching and learning	Evidence of learning	Adjustments and registration
	• produce design drawings or plans for improvements to their Fire-Ed Up design solutions, page 41 SDF • draw a top view and side view of their new design solutions for their final idea, page 42 SDF		
Week 10 – Testing and evaluating TE4-1DP, TE4-2DP Students: • plan and manage projects individually and collaboratively (ACTDEP039)	**Communications** Use pages 44 - 45 of the SDF for this section. **Students** • complete any further iterations to their design solutions • produce pictorial drawings of their final design solution, pages 43 and 44 • produce a final rendered drawing of the design solution page 45 SDF	• Students can manage projects by following a set design process. • Students can apply findings from testing and evaluation to improve design solutions. • Students can document design projects using graphical techniques.	(Add adjustments and registration)