# Computing Technology Stage 5 (Year 10) – sample program of learning

**Software development – creating games and simulations**



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## Rationale

The NSW Department of Education publishes a range of curriculum support materials, including samples of lesson sequences, scope and sequences, assessment tasks, examinations, student and teacher resource booklets, and curriculum planning and curriculum evaluation templates. The samples are not exhaustive and do not represent the only way to complete or engage in each of these processes. Curriculum design and implementation is a dynamic and contextually specific process. While the mandatory components of syllabus implementation must be met by all schools, the approach taken by teachers must be reflective of their needs and faculty or school processes.

NESA defines [programming](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming) as the process of ‘selecting and sequencing learning experiences which enable students to engage with syllabus outcomes and develop subject specific skills and knowledge’ (NESA 2022). A program is developed collaboratively within a faculty. It differs from a unit in important ways, as outlined by NESA on their [advice on units](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming/advice-on-units) page. A unit is a contextually specific plan for the intended teaching and learning for a particular class for a particular period. The organisation of the content in a unit is flexible and it may vary according to the school, the teacher, the class, and the learning space. They should be working documents that reflect the thoughtful planning and reflection that takes place during the teaching and learning cycle. There are mandatory components of programming and unit development, and this template provides one option for the delivery of these requirements. The NESA and department guidelines that have influenced this template are elaborated upon at the end of the document.

This resource has been developed to assist teachers in NSW Department of Education schools to create learning that is contextualised to their classroom. It can be used as a basis for the teacher’s own program, assessment, or scope and sequence, or be used as an example of how the new curriculum could be implemented. The resource has suggested timeframes that may need to be adjusted by the teacher to meet the needs of their students.

## Overview

**Description**: this program of learning addresses the focus area of creating games and simulations. The lessons and sequences in this program of learning are designed to allow students develop the knowledge and skills to create a game or simulation as a solution to a user’s needs.

During Weeks 1 to 8 of the learning sequence, students will gain an understanding of the computational, design and systems thinking used in creating games and simulations. A range of games and simulations will be investigated that allows students to understand how innovation, enterprise and automation have inspired the evolution of computing technology.

During Weeks 9 to 18 of the learning sequence, students will design and test a system, creating a game or simulation which is coded and iterative in design. To develop their coding skills, students work to design, produce and evaluate algorithms and implement them in an object-oriented programming language. Students manage, document and explain individual work practices.

During Weeks 19 to 20 of the learning sequence, students showcase their project to the class and seek self and peer review. Students also investigate careers in the game and simulation industries.

**Duration**: this program of learning is designed to be completed over approximately 20 weeks in 60-minute lesson sequences but can be adapted to suit the school context.

**Explicit teaching**: suggested learning intentions and success criteria are available for some lessons provided. Learning intentions and success criteria are most effective when they are contextualised to meet the needs of students in the class. The examples provided in this document are generalised to demonstrate how learning intentions and success criteria could be created.

## Outcomes

A student:

* selects and applies safe, secure and responsible practices in the ethical use of data and computing technology **CT5-SAF-01**
* applies iterative processes to define problems and plan, design, develop and evaluate computing solutions **CT5-DPM-01**
* manages, documents and explains individual and collaborative work practices **CT5-COL-01**
* understands how innovation, enterprise and automation have inspired the evolution of computing technology **CT5-EVL-01**
* communicates ideas, processes and solutions using appropriate media **CT5-COM-01**
* designs, produces and evaluates algorithms and implements them in a general-purpose and/or object-oriented programming language **CT5-OPL-01**
* applies computational, design and systems thinking to the development of computing solutions **CT5-THI-01**
* designs and creates user interfaces and the user experience **CT5-DES-01**

[Computing Technology 7–10 Syllabus](https://curriculum.nsw.edu.au/syllabuses/computing-technology-7-10-2022) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2022.

**Prior to planning for teaching and learning, please consider the following:**

**Engagement**

* How will I provide authentic, relevant learning opportunities for students to personally connect with lesson content?
* How will I support every student to grow in independence, confidence, and self-regulation?
* How will I facilitate every student to have high expectations for themselves?
* How will I identify and provide the support each student needs to sustain their learning efforts?

**Representation**

* What are some different ways I can present content to enable every student to access and understand it?
* How will I identify and address language and/or cultural considerations that may limit access to content for students?
* How will I make lesson content and learning materials more accessible?
* How will I plan learning experiences that are relevant and challenging for the full range of students in the classroom?

**Expression**

* How will I provide multiple ways for students to respond and express what they know?
* What tools and resources can students use to demonstrate their understanding?
* How will I know every student has understood the concepts and language presented in each lesson?
* How will I monitor if every student has achieved the learning outcomes and learning growth?

## Lesson sequence and details

### Week 1

Table 1 – Week 1 – identifying and defining lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **Outcomes:****CT5-EVL-01****CT5-COM-01****Content:**Students:* explore how the changing needs of society have influenced the development of games and simulations, including the impact of simulations and games on a range of industries
* explore products that simulate the real world and how simulations are used to solve real-world problems
* explore how augmented reality (AR), mixed reality (MR) and virtual reality (VR) create immersive experiences.
 | **Learning intention**Explore how the changing needs of society have influenced the development of games and simulations, including the impact of simulations and games on a range of industries.**Success criteria*** I can define games and simulations.
* I can discuss the development and impact of simulations and games on a range of industries.
* I can explore how augmented reality (AR), mixed reality (MR) and virtual reality (VR) create immersive experiences.

**Teaching and learning activity**Teacher introduces the learning sequence and gives an overview of the semester, outlining the sequence of activities and assessments.Teacher introduces the concept of games and simulations.Students complete a definition of both games and simulations as well as the difference between the 2.Students research an industry with reference to the impact that gaming and simulation have had on that industry through answering the following question:How do these companies use augmented reality (AR), mixed reality (MR) and virtual reality (VR) to create immersive experiences? | Students commence a glossary of key terms.Students can define the difference between games and simulations giving examples of each.Students can give an example of the impact of games and simulations on a chosen industry.Students can explain how augmented reality (AR), mixed reality (MR) and virtual reality (VR) create a range of immersive experiences. | This section is also for use in school when adjusting to support all students to achieve in their learning.Provide visual and/or multimedia examples and check understanding of concepts.Provide a glossary allow the use of bilingual dictionaries for uncommon terms and use visuals where appropriate. |  |
| **Outcomes:****CT5-EVL-01****CT5-COM-01****Content:**Students:* investigate the representation of logic when designing games and simulations, including sequences, branching and iteration, including logical and relational operators.
 | **Learning intention**Explore how the changing needs of society have influenced the development of games and simulations, including the impact of simulations and games on a range of industries.**Success criteria*** I understand the representation of logic when designing games and simulations.
* I understand structure in development including sequences, branching and iteration, including logical and relational operators.

**Teaching and learning activity**Teacher introduces the concepts of [Sequences, Selections and Loops (2:26)](https://www.youtube.com/watch?v=eSYeHlwDCNA). While watching the video, complete the definitions and questions for standard control structures, including examples where possible.From the video, students are to answer the benefits of using standard control structures.**Practical application – Python Programming**Students are to use the tutorial to learn to build [Tetris](https://simplegametutorials.github.io/pygamezero/blocks/) using IDLE & PyGame Zero, this can be teacher-led or student-driven. The focus should be on students understanding why applying control structures and functions are important. | Students understand representations of logic including branching and iteration.Students practically demonstrate their understanding of control structures through completing the Tetris and other tutorials.Tetris game runs without error but may not be fully complete. | This section is also for use in school when making adjustments to support all students to achieve in their learning.Pre-teach key vocabulary and concepts prior to viewing videos, provide a transcript and use closed captions when viewing.Teacher walks through the tutorial link provided. |  |

### Week 2

Table 2 – Week 2 – identifying and defining lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **Outcome:****CT5-EVL-01****CT5-OPL-01****Content:**Students:* specify the functional requirements of a game or simulation, including stating the purpose of a system, describing use cases and developing test cases of inputs and expected outputs
* specify the non-functional requirements of a game or simulation.
 | **Learning intention**Explore how games and simulations have functional and non-functional requirements.**Success criteria*** I can explain the non-functional requirements of a game and/or simulation.
* I have specified, in a table, the functional and non-functional requirements of a chosen system.

**Teaching and learning activity**Teacher introduces the concept of [functional vs. non-functional requirements (1:36)](https://www.youtube.com/watch?v=zCX-N1H8Vps) in software design.Students complete a definition of both functional and non-functional requirements for software design.Students complete a table listing 3–5 functional and 3–5 non-functional requirements of a game they would design. | Students can define functional requirements as well as non-functional requirements of software design.Students can create a table listing 3–5 functional and 3–5 non-functional requirements of a game or software product they would design. | This section is also for use in school when making adjustments to support all students to achieve in their learning.Pre-teach key vocabulary and concepts prior to viewing videos, provide a transcript and use closed captions when viewing.Provide a glossary and allow the use of bilingual dictionaries for uncommon terms. |  |
| **Outcomes:****CT5-EVL-01****CT5-OPL-01****Content:**Students:* specify the functional requirements of a game or simulation, including stating the purpose of a system, describing use cases and developing test cases of inputs and expected outputs
* specify the non-functional requirements of a game or simulation
* age suitability
* motivation or immersion
* visual appeal of a game
* world or simulation
* describe inputs, storage, transmission, processes and outputs in games and/or simulations.
 | **Learning intention**Explore how games and simulations have functional and non-functional requirements.**Success criteria*** I have the skills to discuss functional requirements including the purpose of a system, describing user cases and developing test cases of inputs and expected outputs.
* I can apply my understanding of inputs, storage, transmission, processes and outputs in games and/or simulations.

**Teaching and learning activity**Teacher introduces the concept of [use case diagrams (4:21)](https://www.youtube.com/watch?v=Omp4RbHbB0s) in software engineering and their purpose.As a class, choose a familiar game. Create a use case diagram. Outline the actor and key interactions that allow for the game to function. Some games could include *Snake*, *Space Invaders* or *Flappy Bird*.Students answer the following questions after watching the video.* Who are the users?
* What information is used in the process?
* What kind of inputs and outputs are used?

Teacher leads discussion around the functions of a system and how they all work together.Using students’ understanding of the game chess and a flight simulator, students describe the inputs, storage, transmission, processes, and outputs that make up these products, specifically providing examples from the game and simulation. | Students can describe the purpose of use cases.Students create an interactive use case diagram showing the functional requirements of a game they are familiar with including the purpose of the system, describing user cases and test cases of input and expected output. | This section is also for use in school when making adjustments to support all students to achieve in their learning.Complete examples as a class.Providing prompts or visuals to help with understanding the concepts.Provide a glossary and allow the use of bilingual dictionaries for uncommon terms. |  |

### Week 3

Table 3 – Week 3 – identifying and defining lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **Outcome:****CT5-SAF-01****Content:**Students:* consider the social impacts and ethical and legal responsibilities in games or simulations
* explore games and simulations, considering the perspectives of diverse groups, including Aboriginal and Torres Strait Islander Peoples, culturally and linguistically diverse people, people of different ages and genders, and people with disability.
 | **Learning intention**We will compare the ways games or simulations impact social, ethical and legal responsibilities.We will explore how games and simulations help diverse people in society.**Success criteria*** I can evaluate social and ethical considerations of games and simulations.

**Teaching and learning activity**Teacher introduces the case study of the gaming company Blizzard Entertainment and explains how they are working on being more inclusive of diverse groups.Students are given inclusivity initiatives. They are then required to research how this initiative is being done in games that Blizzard Entertainment have created.Teacher uses the discussion questions to provide more thought-provoking responses. | Students can evaluate social and ethical considerations of games and simulations.Students can list and describe examples from Blizzard Entertainment company and games.Students can communicate how games impact social, ethical and legal responsibilities of developers and consumers. | This section is also for use in school when making adjustments to support all students to achieve in their learning.Prompt student discussion with real-world scenarios and examples.The teacher can use a group task instead of individual and provide visuals or structured questioning to support discussion. |  |
| **Outcomes:****CT5-SAF-01****CT5-THI-01****Content:**Students:* consider the social impacts and ethical and legal responsibilities in games or simulations.
 | **Learning intention**Explore how games and simulations help diverse people in society.Compare the ways games or simulations impact social, ethical, and legal responsibilities.**Success criteria*** I can respond to ethical dilemmas in gaming using my knowledge of ethics.
* I can discuss the differences in legal responsibilities of game classifications.
* I can apply my understanding and skills to examine how use of augmentative and alternative communication (AAC).

**Teaching and learning activity**Teacher discusses the definitions of social impact, ethical and legal responsibility.Students relate these concepts to how they fit into the gaming and simulation industry.**Activity 1**In groups, students read and discuss the gamified ethical dilemma scenarios provided in the teacher resources. Students are required to look at both choices and as a group list the consequences for both choices from an ethical standpoint.**Activity 2**In groups, students are assigned the role of game developers and they are employed to create a hypothetical game project while navigating ethical dilemmas that may arise during development.Students are to read the scenario, consider the ethical dilemmas and answer the guiding questions as a team. Once completed, students report back to the class.The teacher uses the guiding questions as support to keep students on track or as a structured discussion.Students research different country regulations and rating systems for video games. | Students can apply their understanding of social impact, ethical and legal responsibilities to accurately respond to the ethical dilemma scenarios.Students understand and can recall differences in countries regulations and rating systems. | This section is also for use in school when making adjustments to support all students to achieve in their learning.Provide a glossary and allow the use of bilingual dictionaries for uncommon terms.Utilise the guiding questions as structured discussion points to support learners.Students can work through these activities as groups with guided support.Provide each group with a country to research and present on. |  |

### Week 4

Table – Week 4 – identifying and defining lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **Outcome:****CT5-EVL-01****Content:**Students:* explore design principles and issues relevant to game design.
 | **Learning intention**Explore how design principles relate to game development and player experience.**Success criteria*** I can explain a variety of game principles and what this looks like within a game.
* I can explore games and distinguish with design principles relate to them.

**Teaching and learning activity**Students research the most common game design principles.Students describe what the principle means in relation to gaming.Students analyse how the game design principles can be applied to each.Students research the relevant discussion points, which will help with design principles. | Students examine a variety of design principles and understand their meaning.Students investigate a range of games and link appropriate game design principles.Students demonstrate understanding in class discussions around questions on design principles. | This section is also for use in school when making adjustments to support all students to achieve in their learning.Scaffold of research is required.Group activity with guided scaffold. |  |
| **Outcome:****CT5-EVL-01****Content:**Students:* explore how predefined algorithms and artificial intelligence (AI) control computer components.
 | **Learning intention**Explore real-world problems.**Success criteria*** I can explain how predefined algorithms and artificial intelligence (AI) control computer components.

**Teaching and learning activity**Students will investigate the algorithms that control the ghosts in the [original Pac-Man game (19:33)](https://www.youtube.com/watch?v=ataGotQ7ir8).Teacher formulates class discussion surrounding how AI can be utilised in game design in this modern time. | Students demonstrate an understanding of how algorithms are used to create AI and control computer components in games and simulations. | This section is also for use in school when making adjustments to support all students to achieve in their learning. |  |

### Week 5

Table 5 – Week 5 – research and planning lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **Outcome:****CT5-SAF-01****Content:**Students:* explore how games and simulations address environmental, lifestyle, societal and economic challenges including cyber safety.
 | **Learning intention**Investigate how games and simulations address environmental, lifestyle, societal and economic challenges including cyber safety.**Success criteria*** I can describe how design principles and issues relevant to game design.
* I can evaluate an existing game or simulation in terms of its mechanics, aesthetics and usability.

**Teaching and learning activity**Teacher-led discussion on how games and simulations can address various challenges.As a class watch, [Two Point Campus | Official Announce Trailer (1:38)](https://www.youtube.com/watch?v=_14i0Zxsfos).* In groups, students research examples of how the game Two Point Campus address the challenge.
* Teacher to use discussion questions to get students to link the game and real-world together.
 | Students provide answers to the case study questions.Students can discuss how the case study impacts environmental, lifestyle, societal and economic challenges relating to the game and real-world. | This section is also for use in school when making adjustments to support all students to achieve in their learning.Scaffolded discussion and examples could be provided. |  |
| **Outcome:****CT5-DPM-01****Content:**Students:* evaluate an existing game or simulation in terms of its mechanics, aesthetics and usability.
 | **Learning intention**Explore how evaluating current solutions can lead to alternative designs in game development.**Success criteria*** I can evaluate an existing game or simulation in terms of its mechanics, aesthetics and usability.
* I can generate alternative designs and evaluate them against the requirements to select a preferred design.

**Teaching and learning activity**In Python, students add multiple data types and structures for the Tetris game or any other program that is being completed in class.Students work on Assessment task 1, focussing on evaluating current solutions and creating alternative designs. | Students evaluate a specific element of game design and then recreate that element in a simulation. | This section is also for use in school when making adjustments to support all students to achieve in their learning.Teacher can provide students with alternative problems that students can create solutions to. |  |

### Week 6

Table 6 – Week 6 – research and defining lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **Outcome:****CT5-SAF-01****Content:**Students:* investigate data collection and interpretation adhering to privacy and cybersecurity principles, including specifying what data is collected, who owns it, and how it will be protected.
 | **Learning intention**Investigate data collection and interpretation adhering to privacy and cybersecurity principles.**Success criteria*** I can specify what data is collected, who owns it, and how it will be protected.

**Teaching and learning activity**Teacher to lead a brainstorm as to why it is important to have data privacy and cybersecurity in today’s digital world. Students should think about their concerns about sharing personal information online.Students are to outline how games or developers collect data. They should think about all aspects of game design including profiles, device information, communication features and social media. | Students can demonstrate their understanding of how data is collected and why it is important to have data privacy.Students provide points for each of the table headings under how data is collected via games and developers. | This section is also for use in school when making adjustments to support all students to achieve in their learning.Teacher can provide thinking points to start the brainstorm.Provide key headings and subheadings to stimulate the students’ thinking about data collection by games and developers. |  |
| **Outcome:****CT5-SAF-01****Content:**Students:* investigate data collection and interpretation adhering to privacy and cybersecurity principles, including specifying what data is collected, who owns it, and how it will be protected.
 | **Learning intention**Investigate data collection and interpretation adhering to privacy and cybersecurity principles.**Success criteria*** I can specify what data is collected, who owns it, and how it will be protected.

**Teaching and learning activity**Teacher introduces [What data experts say about the data collected by TikTok (8:03)](https://www.youtube.com/watch?v=hZNHJNcO7BM).Students outline concerns that users should be aware of when using different apps.Teacher uses the reasons game developers would collect data from users when playing to get students to explain these relating to their own gaming knowledge and experience. | Students can apply data collection concerns to different apps after watching the video.Students can explain why data is collected by developers. | This section is also for use in school when making adjustments to support all students to achieve in their learning.Teacher can use different data collection videos for other apps that are related to the calibre of students.The teacher could create a group task instead of an individual task.Teacher could provide definitions of the reasons to support student understanding. |  |

### Week 7

Table 7 – Week 7 – research and planning lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **Outcome:****CT5-SAF-01****Content:**Students:* investigate data collection and interpretation adhering to privacy and cybersecurity principles, including specify what data is collected, who owns it, and how it will be protected.
 | **Learning intention**Learn to represent data and code to facilitate computation.**Success criteria*** I understand data collection and interpretation adhering to privacy and cybersecurity principles.

**Teaching and learning activity**Provide students with brief background information regarding companies collecting data from players.Teacher leads brainstorming on who owns the data that is generated by players.Use the scenarios to understand rights and responsibilities. For each of the scenarios, in groups or as a class, answer the discussion points about rights, responsibilities and ethical ways to handle data. | Students contribute to creating a brainstorm.Student answer and participate in discussing the scenario questions.Students participate in collective discussion on data collection, privacy and cybersecurity principles when going through scenarios. | Teacher can provide starting points and have students explain.Class activity or in groups.Additional key questions or answers can be provided to stimulate discussion. |  |
| **Outcome:****CT5-SAF-01****Content:**Students:* investigate data collection and interpretation adhering to privacy and cybersecurity principles, including specify what data is collected, who owns it, and how it will be protected.
 | **Learning intention**Learn to represent data and code to facilitate computation.**Success criteria*** I understand data collection and interpretation adhering to privacy and cybersecurity principles.

**Teaching and learning activity**Teacher introduces cybersecurity and as a class students watch [Cyber Security in 7 Minutes (0:00-5:43)](https://www.youtube.com/watch?v=inWWhr5tnEA).Students list all the possible cyber-attacks in the video that lead to the need for cybersecurity.Students research real-world data breaches in the gaming industry, examples include Sony and Epic Games. Students provide an overview of what happened and discuss the consequences for both the user and the developer or company.Teacher to use scenario cards to get students to research cybersecurity best practices and strategies and devise a plan to address the scenario. | Students investigate and answer questions on cyber-attacks.Students participate in class discussions.Students’ presentation of scenarios demonstrates their understanding of privacy and cybersecurity principles. | Provide students with a scaffolded worksheet.Scaffolded worksheet and key guided answers to focus student research. |  |
| **Outcome:** **CT5-THI-01****Content:**Students:* represent data and code to facilitate computation, including selecting appropriate data types, understanding data type limitations and structuring code systematically.
 | **Learning intention**Learn to represent data and code to facilitate computation.**Success criteria*** I have the knowledge to select appropriate data types.
* I have developed knowledge to understand data type limitations.

**Teaching and learning activity**As a class, students watch the [benefits and limitations (8:08)](https://www.youtube.com/watch?v=6otW6OXjR8c) of the following [data types (3:52)](https://www.youtube.com/watch?v=A37-3lflh8I).Students complete a table listing the definitions as well as information about Boolean, character, string, integer and float data types. | Students can define different common data types as well as understand the limitations of those data types. | This section is also for use in school when making adjustments to support all students to achieve in their learning. |  |
| **Outcome:****CT5-THI-01****Content:**Students:* represent data and code to facilitate computation, including selecting appropriate data types, understanding data type limitations and structuring code systematically.
 | **Learning intention**Represent data and code to facilitate computation.**Success criteria*** I have the skills to structure code systematically.

**Teaching and learning activity**In Python, students continue to work on the tutorials provided.Students continue working on Assessment task 1. | Students can structure their code systematically and in a logical way.Students receive ongoing formative feedback and summative feedback through Assessment task 1. | This section is also for use in school when making adjustments to support all students to achieve in their learning.Check ins or scaffolds. |  |

### Week 8

Table 8 – Week 8 – research and planning lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **Outcomes:****CT5-OPL-01****CT5-THI-01****CT5-DES-01****Content:**Students:* represent algorithms using flowcharts and pseudocode
* design and/or modify existing algorithms for games or simulations
* validate algorithms with desk checking.
 | **Learning intention**Design algorithms and check they are correct.**Success criteria*** I can represent algorithms using flowcharts and pseudocode.
* I can validate algorithms with desk checking.

**Teaching and learning activity**Students examine the [various elements of a flow chart](https://www.tutorialspoint.com/programming_methodologies/programming_methodologies_flowchart_elements.htm) and their uses.Teacher to walk through an algorithm of their choosing to show how to transform code into a flowchart. Teacher could use the Tetris game.Students create their own flowchart to code either tutorials covered and work to create flowcharts and algorithms for Assessment task 1. | Students create their own flowchart to code a tutorial from pseudocode.Students design algorithms and receive feedback on algorithms in their Assessment task 1. | This section is also for use in school when making adjustments to support all students to achieve in their learning. |  |
| **Outcomes:****CT5-OPL-01****CT5-THI-01****CT5-DES-01****Content:**Students:* represent algorithms using flowcharts and pseudocode
* design and/or modify existing algorithms for games or simulations
* validate algorithms with desk checking.
 | **Learning intention**Design algorithms and check they are correct.**Success criteria*** I can represent algorithms using flowcharts and pseudocode.
* I can validate algorithms with desk checking.

**Teaching and learning activity**As a class, walk through the below algorithms demonstrating how to conduct a desk check.Students are to create flowcharts from the desk check algorithms. | Students desk checks tables with accurate answers.Students develop flowcharts for the 2 algorithms. | This section is also for use in school when making adjustments to support all students to achieve in their learning.Provide tables with variables from the algorithm. |  |
| **Outcomes:****CT5-OPL-01****CT5-THI-01****CT5-DES-01****Content:**Students:* identify and correct types of errors, including syntax, logical and run-time.
 | **Learning intention**Design algorithms and check they are correct.**Success criteria*** I can identify and correct types of errors, including syntax, logic and run-time.
* I can create and modify algorithms and code that use branching and iteration, and represent them diagrammatically and in English.

**Teaching and learning activity**Students research the different types of errors providing definitions, examples, and the impact that error has on running code.After discussion, students are to spot the errors and provide the correction to the error. | Students complete activities in full.Students can spot errors and provide correct code. | This section is also for use in school when making adjustments to support all students to achieve in their learning.Provide students with the table and some filled out sections.Code may be placed into an IDE to visually demonstrate the errors. |  |
| **Outcomes:****CT5-OPL-01****CT5-DES-01****Content:**Students:* design and/or modify existing algorithms for games or simulations.
 | **Learning intention**Design algorithms and check they are correct.**Success criteria*** I can design and/or modify existing algorithms for games or simulations.

**Teaching and learning activity**In Python, students are working on extending their game designs to make arcade style games.Students locate an error they have encountered and provide how they corrected the error. | Students can modify existing algorithms from a tutorial to create a game.Students can locate and correct errors. | This section is also for use in school when making adjustments to support all students to achieve in their learning. |  |

### Weeks 9–10

Table 9 – Weeks 9–10 – producing and Implementing lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **Outcomes:****CT5-DPM-01****CT5-COL-01****Content:**Students:* use program-development support tools, including Input Process Output (IPO) charts/diagrams, decision trees, flowcharts and structured English/pseudocode, in the development of a game or simulation
* develop prototypes to communicate design ideas and features to potential end users.
 | **Learning intention**Plan and manage a project to create a game and/or simulation using an iterative approach.Manage, document and explain work practices during the development of the project.**Success criteria*** I can develop appropriate supporting documentation in a program to ensure it is easy to read, understand and maintain.
* I can develop prototypes to communicate design ideas and features to potential end users.
* I can create a record of project development demonstrating iterative design and evaluation.

**Teaching and learning activity**Students will examine the use of a Gantt chart and how it can be used in the planning phase of a project.As a class watch [How to draw a Gantt chart (2:01](https://youtu.be/NcOmJSrXYoQ)).Students create a project portfolio looking at 4 main areas:* identifying and defining
* research and planning
* producing and implementing
* testing and evaluating.

Students will also examine and create features such as title pages, table of contents, page number, headings and sub-headings. | Students can develop appropriate supporting documentation to accompany a project including a Gantt chart.Students can create a record of project development demonstrating iterative design and evaluation. | This section is also for use in school when making adjustments to support all students to achieve in their learning. |  |
| **Outcomes:****CT5-THI-01****CT5-OPL-01****Content:**Students:* plan and manage a project to create a game and/or simulation using an iterative approach
* implement a game or simulation using the preferred design in a general-purpose or object-oriented programming language
* interpret and extend or implement an object-oriented program (code).
 | **Learning intention**Plan and manage a project to create a game and/or simulation using an iterative approach.Manage, document and explain work practices during development of the project.**Success criteria*** I can describe the features of an object-oriented programming language.
* I can create and modify algorithms and code that use branching and iteration and represent them diagrammatically and in English.

**Teaching and learning activity**Students define and outline the languages used in object-oriented languages.In Python, students extend their game and utilise OOP extensions in the overall structure of the code. | Students implement object-oriented programming into their assessment task.Students use control structures to extend their game. | This section is also for use in school when making adjustments to support all students to achieve in their learning. |  |

### Weeks 11–18

Table 10 – Weeks 11–18 – producing and implementing lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **Outcomes:****CT5-OPL-01****CT5-SAF-01****CT5-DPM-01****CT5-COL-01****CT5-THI-01****CT5-DES-01****Content:**Students:* use program-development support tools, including Input Process Output (IPO) charts/diagrams, decision trees, flowcharts and structured English/pseudocode, in the development of a game or simulation
* create and modify algorithms and code that use branching and iteration, and represent them diagrammatically and in English
* develop an efficient computer program by selecting appropriate data types and structures
* develop prototypes to communicate design ideas and features to potential end users
* implement an event loop in a game or simulation using event-driven programming
* develop appropriate supporting documentation in a program to ensure it is easy to read, understand and maintain
* modify existing programming code to observe the effects of changing variables
* modify existing code to observe changes in an array
* identify and correct types of errors, including syntax, logical and run-time
* select and use specialist terminology in context
* plan and manage a project to create a game and/or simulation using an iterative approach
* implement a game or simulation using the preferred design in a general-purpose or object-oriented programming language
* develop the UI and UX of a game, including using event-driven programming or an event loop to respond to user input
* implement common game features, including the game state
* interpret and modify existing programs (code) for games or simulations
* design and implement modular programs (code) with functions for games
* program selected algorithms and data structures for games or simulations
* validate programs using test cases and debug a range of errors
* interpret and extend or implement an object-oriented program (code)
* create a record of project development demonstrating iterative design and evaluation
* evaluate an existing game or simulation in terms of its mechanics, aesthetics and usability
* generate alternative designs and evaluate them against the requirements to select a preferred design.
 | **Learning intention**Plan and manage a project to create a game and/or simulation using an iterative approach.Using the preferred design in a general-purpose or object-oriented programming language.Apply computational, design and systems thinking to the solution.Learn to develop and apply test criteria for components of a game and/or simulation.**Success criteria*** I can implement a game or simulation.
* I can develop an efficient computer program by selecting appropriate data types and structures.
* I can implement an event loop in a game or simulation using event-driven programming.
* I can simulate a 2D or 3D physical world using fixed time increments.
* I can modify existing programming code to observe the effects of changing variables.
* I can modify existing code to observe changes in an array.
* I can identify and correct types of errors, including syntax, logical and run-time.
* I can develop the UI and UX of a game, including using event-driven programming or an event loop to respond to user input.
* I can implement common game features, including the game state.
* I can interpret and modify existing programs (code) for games or simulations.
* I can design and implement modular programs (code) with functions for games.
* I can program selected algorithms and data structures for games or simulations.
* I have developed the skills to validate programs using test cases and debug a range of errors.
* I have developed the skills to interpret and extend or implement an object-oriented program (code).

**Teaching and learning activity**Students will work on enhancing their arcade game. The criteria for the game are as follows:* The UI is effective and easy to use.
* The game has been created in a meaningful way that adds value to the experience for the player(s).
* The program is broken down effectively into functions.
* Contain examples of Branching (If statements), Iteration (For or While loops) and functions.

As well as creating an improved game, students must record the development process in the portfolio they created in Weeks 9 and 10 including:* Identify the need.
* Define the problem and propose a solution.
* Research existing solutions.
* Plan their own solution (Gantt chart).
* Produce their solution (screenshots of the environment they have built).
* Implement selected features (screenshots of code implementing branching and iteration).
* Testing their solution (show the evolution of different elements of their product or sections of code).
* Evaluation (PMI, peer feedback or other evaluation technique to evaluate the finished product against the initial proposal).
 | Students work individually on Assessment task 2 under the guidance of their teacher to create an enhanced game and supporting documentation. Students receive ongoing formative feedback and summative feedback through Assessment task 2.Students demonstrate practical skills, safely using appropriate tools, equipment, and techniques, to produce a game that reflects the planning undertaken in the research and planning stages of Assessment task 2.Students will be able to record their iterative process using a portfolio.Students can design, produce and evaluate algorithms and implement them in programming language.Students can work in Python and use trouble shooting techniques such as desk checking to eliminate errors.Students will document their troubleshooting process in their portfolio as they test their algorithms to demonstrate their iterative approach to coding.Students receive ongoing formative feedback and summative feedback through Assessment task 2.Students collect peer feedback in Assessment task 2. | This section is also for use in school when making adjustments to support all students to achieve in their learning.Provide visual and/or multimedia examples and check understanding of concepts.Ensure all students understand both technical and culturally-based terms.Message abundancy may be useful when introducing new terminology. The word is spoken, written on the board, represented by visuals.Scaffold may be provided.  |  |

### Weeks 19–20

Table 11 – Weeks 19–20 – identifying and defining lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| **Outcomes:****CT5-OPL-01****CT5-THI-01****Content:**Students:* evaluate their own project and that of their peers using predetermined functional and non-functional requirements
* evaluate whether solutions meet social, ethical and legal responsibilities and cybersecurity principles
* validate algorithms and programs through tracing and test cases
* test and evaluate the functionality and performance of a simulation or game for specified requirements
* evaluate social, ethical and cybersecurity considerations of games and simulations.
 | **Learning intention**Learn how to evaluate your own project and that of your peers.Learn about careers in the field of game and simulation design and development.**Success criteria*** I can examine functional and non-functional requirements and evaluate these in multiple projects.
* I can evaluate whether solutions meet social, ethical and legal responsibilities and cybersecurity principles.
* I can validate algorithms and programs through tracing and test cases.
* I can test and evaluate the functionality and performance of a simulation or game for specified requirements.
* I can evaluate social, ethical and cybersecurity considerations of games and simulations.
* I can research and explore careers in game and simulation design and development.

**Teaching and learning activity**Teacher explains to the class that students will showcase their final project and go through self and peer review.Students participate in self and peer review through a showcase of student projects looking at the functional and non-functional requirements of the project.Students will evaluate their peers’ projects using a PMI technique or another evaluation technique; rubric could be use that was provided in Assessment task 2.Students can be guided to give [peer feedback](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/549#.Y0OpnJdqu3E.link).Teams of students present their project evaluation to the class and receive feedback. | Students can evaluate their own project and their peers against functional and non-functional requirements.Students can showcase their complete project.Students can play their peers games and give game performance feedback. | This section is also for use in school when making adjustments to support all students to achieve in their learning.Include multiple opportunities to respond, for example:* verbally
* individually
* partner turn and talk.
* non-verbally
* gesture
* response cards.
 |  |
| **Outcome:****CT5-OPL-01****Content:**Students:* explore careers in game and simulation design and development.
 | **Learning intention**Learn about careers in the field of game and simulation design and development.**Success criteria*** I can research and explore careers in game and simulation design and development.

**Teaching and learning activity**Teacher explains the vast number of pathways into the industry, with a focus on tertiary education. Explain the competitive nature of the industry and the prevalence of small start-up companies.Teacher shows a range of career profile videos on gaming and simulation [chosen career](https://www.youtube.com/playlist?list=PLA8lfpEv0vOvo5f78SHdtb3UgAsWfYnpR) (playlist) in the [video game industry (2:43)](https://www.youtube.com/watch?v=58JHaUtcrE0).Students investigate various job search websites and create a table of research showing job description, pay and education requirements. | Students can describe specific careers in the video game industry.Students can research careers and look at current job advertisements to understand tertiary education requirements and experience needed to apply for positions.Students can document a range of current jobs available after completing further education. | This section is also for use in school when making adjustments to support all students to achieve in their learning.Provide visual and/or multimedia examples and check understanding of concepts. |  |

## Additional information

For additional support or advice, contact the Technological and applied studies (TAS) curriculum team by emailing TAS@det.nsw.edu.au.

### Further implementation support

Curriculum design and implementation is a dynamic and contextually-specific process. The department is committed to supporting teachers to meet the needs of all students. The advice below on assessment and planning for the needs of every student may be useful when considering the material presented in this sample program of learning.

### Assessment for learning

Possible formative assessment strategies that could be included:

* Learning intentions and success criteria assist educators to articulate the purpose of a learning task to make judgements about the quality of student learning. These help students focus on the task or activity taking place and what they are learning and provide a framework for reflection and feedback. [Online tools](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/622) can assist implementation of this formative assessment strategy.
* Eliciting evidence strategies allow teachers to determine the next steps in learning and assist teachers in evaluating the impact of teaching and learning activities. Strategies that may be added to a learning sequence to elicit evidence include all student response systems, [exit tickets](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/543), mini whiteboards (actual or [digital](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/575)), [hinge questions](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/560), [Kahoot](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/621), [Socrative](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/587), or quick quizzes to ensure that individual student progress can be monitored and the lesson sequence adjusted based on formative data collected.
* Feedback is designed to close the gap between current and desired performance by informing teacher and student behaviour (AITSL 2017). AITSL provides a [factsheet to support evidence-based feedback](https://www.aitsl.edu.au/teach/improve-practice/feedback#:~:text=FEEDBACK-,Factsheet,-A%20quick%20guide).
* [Peer feedback](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/549) is a structured process where students evaluate the work of their peers by providing valuable feedback in relation to learning intentions and success criteria. It can be supported by [online tools](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Browser?cache_id=1d29b).
* Self-regulated learning opportunities assist students in taking ownership of their own learning. A variety of strategies can be employed and some examples include reflection tasks, [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645), [KWLH charts](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/562), [learning portfolios](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/583) and [learning logs](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/583).

The primary role of assessment is to establish where individuals are in their learning so that teaching can be differentiated and further learning progress can be monitored over time.

Feedback is one of the most powerful influences on student achievement. Feedback that focuses on improving tasks, processes and student self-regulation is the most effective. Students engaging with feedback can take many forms including formal, informal, formative, summative, interactive, demonstrable, visual, written, verbal and non-verbal. [What works best update 2020](https://education.nsw.gov.au/about-us/education-data-and-research/cese/publications/research-reports/what-works-best-2020-update) (CESE 2020a).

### Differentiation

Differentiated learning can be enabled by differentiating the teaching approach to content, process, product and the learning environment. For more information on differentiation go to [Differentiating learning](https://education.nsw.gov.au/teaching-and-learning/professional-learning/teacher-quality-and-accreditation/strong-start-great-teachers/refining-practice/differentiating-learning) and [Differentiation](https://education.nsw.gov.au/campaigns/inclusive-practice-hub/primary-school/teaching-strategies/differentiation).

When using these resources in the classroom, it is important for teachers to consider the needs of all students in their class, including:

* **Aboriginal and Torres Strait Islander students**. Targeted [strategies](https://education.nsw.gov.au/teaching-and-learning/aec/aboriginal-education-in-nsw-public-schools) can be used to achieve outcomes for Aboriginal students in K-12 and increase knowledge and understanding of Aboriginal histories and cultures. Teachers should utilise students’ Personalised Learning Pathways to support individual student needs and goals.
* **EAL/D learners**. EAL/D learners will require explicit English language support and scaffolding, informed by the [EAL/D enhanced teaching and learning cycle](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/resources-for-schools/eald/enhanced-teaching-and-learning-cycle) and the student’s phase on the [EAL/D Learning Progression](https://education.nsw.gov.au/teaching-and-learning/curriculum/multicultural-education/english-as-an-additional-language-or-dialect/planning-eald-support/english-language-proficiency). In addition, teachers can access information about [supporting EAL/D learners](https://education.nsw.gov.au/teaching-and-learning/curriculum/multicultural-education/english-as-an-additional-language-or-dialect/planning-eald-support/english-language-proficiency) and [literacy and numeracy support specific to EAL/D learners](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/resources-for-schools/eald).
* **Students with additional learning needs**. Learning adjustments enable students with disability and additional learning and support needs to access syllabus outcomes and content on the same basis as their peers. Teachers can use a range of [adjustments](https://education.nsw.gov.au/teaching-and-learning/disability-learning-and-support/personalised-support-for-learning/adjustments-to-teaching-and-learning) to ensure a personalised approach to student learning. Subject specific curriculum considerations can be found on the [Inclusive Practice hub](https://education.nsw.gov.au/campaigns/inclusive-practice-hub).
* **High potential and gifted learners**. [Assessing and identifying high potential and gifted learners](https://education.nsw.gov.au/teaching-and-learning/high-potential-and-gifted-education/supporting-educators/assess-and-identify#Assessment1) will help teachers decide which students may benefit from extension and additional challenge. [Effective strategies and contributors to achievement](https://education.nsw.gov.au/teaching-and-learning/high-potential-and-gifted-education/supporting-educators/evaluate) for high potential and gifted learners help teachers to identify and target areas for growth and improvement. In addition, the [Differentiation Adjustment Tool](https://education.nsw.gov.au/teaching-and-learning/high-potential-and-gifted-education/supporting-educators/implement/differentiation-adjustment-strategies) can be used to support the specific learning needs of high potential and gifted students. The [High Potential and Gifted Education Professional Learning and Resource Hub](https://schoolsnsw.sharepoint.com/sites/HPGEHub/SitePages/Home.aspx) supports school leaders and teachers to effectively implement the High Potential and Gifted Education Policy in their unique contexts.

All students need to be challenged and engaged to develop their potential fully. A culture of high expectations needs to be supported by strategies that both challenge and support student learning needs, such as through appropriate curriculum differentiation. [What works best update 2020 (CESE 2020a:6)](https://education.nsw.gov.au/about-us/education-data-and-research/cese/publications/research-reports/what-works-best-2020-update)

### Support and alignment

**Resource evaluation and support**: all curriculum resources are prepared through a rigorous process. Resources are periodically reviewed as part of our ongoing evaluation plan to ensure currency, relevance, and effectiveness. For additional support or advice contact the TAS curriculum team by emailing TAS@det.nsw.edu.au.

**Alignment to system priorities and/or needs**: [School Excellence Policy](https://education.nsw.gov.au/policy-library/policies/pd-2016-0468), [School Success Model](https://education.nsw.gov.au/public-schools/school-success-model/school-success-model-explained).

**Alignment to the School Excellence Framework**: this resource supports the [School Excellence Framework](https://education.nsw.gov.au/policy-library/policies/pd-2016-0468) elements of curriculum (curriculum provision) and effective classroom practice (lesson planning, explicit teaching).

**Alignment to Australian Professional Teaching Standards**: This resource supports teachers to address [Australian Professional Teaching Standards](https://educationstandards.nsw.edu.au/wps/portal/nesa/teacher-accreditation/meeting-requirements/the-standards/proficient-teacher) 3.2.2, 3.3.2.

**Consulted with**: Curriculum and Reform and subject matter experts

**NSW syllabus**: Computing Technology 7–10

**Syllabus outcomes**: CT5-SAF-01, CT5-DPM-01, CT5-COL-01, CT5-EVL-01, CT5-COM-01, CT5-OPL-01, CT5-THI-01, CT5-DES-01.

**Author**: TAS, Curriculum Secondary Learners, Curriculum Reform

**Publisher**: State of NSW, Department of Education

**Resource**: Program of learning

**Related resources**: further resources to support Computing Technology 7–10 can be found on the [TAS curriculum page](https://education.nsw.gov.au/teaching-and-learning/curriculum/tas).

**Professional learning:** relevant professional learning is available through the TAS statewide staffroom.

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## Evidence base

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