Australian Curriculum: Digital Technologies V 9.0
Years 5–6 sample teaching unit – Design and create a solar system quiz game

Unit task: Students create user stories, determine design criteria and design and create a solar system quiz game using a visual program

Prior learning – Content descriptions
Digital Technologies content descriptions • recognise different types of data and explore how the same data can be represented differently depending on the purpose AC9TDI4K03 • define problems with given design criteria and by co-creating user stories AC9TDI4P01 • follow and describe algorithms involving sequencing, comparison operators (branching) and iteration AC9TDI4P02 • generate, communicate and compare designs AC9TDI4P03 • implement simple algorithms as visual programs involving control structures and input AC9TDI4P04 • discuss how existing and student solutions satisfy the design criteria and user stories AC9TDI4P05 • use the core features of common digital tools to create, locate and communicate content, following agreed conventions AC9TDI4P06 • use the core features of common digital tools to share content, plan tasks, and collaborate, following agreed behaviours, supported by trusted adults AC9TDI4P07 **Mathematics content descriptions** • acquire, validate and represent ordinal and discrete numerical data using software including spreadsheets; discuss and report on data distributions in terms of highest frequency (mode) and shape, in the context of the data AC9M5ST01 • interpret line graphs representing change over time; discuss the relationships that are represented and conclusions that can be made AC9M5ST02 • plan and conduct statistical investigations by posing questions or identifying a problem and collecting relevant data; choose appropriate displays and interpret the data; communicate findings within the context of the investigation AC9M5ST03 **Science content descriptions** • describe the movement of Earth and other planets relative to the sun and model how Earth's tilt, rotation on its axis and revolution around the sun relate to cyclic observable phenomena, including variable day and night length AC9S6U02 • use equipment to observe, measure and record data with reasonable precision, using digital tools as appropriate AC9S5I03 • construct and use appropriate representations, including tables, graphs and visual or physical models, to organise and process data and information and describe patterns, trends and relationships AC9S5I04

Content descriptions for the unit
Aspects of the following content descriptions can be addressed in this unit of work: **Digital Technologies content descriptions** • explain how digital systems represent all data using numbers AC9TDI6K03 • define problems with given or co-developed design criteria and by creating user stories AC9TDI6P01 • design algorithms involving multiple alternatives (branching) and iteration AC9TDI6P02 • design a user interface for a digital system AC9TDI6P03 • generate, modify, communicate and evaluate designs AC9TDI6P04 • implement algorithms as visual programs involving control structures, variables and input AC9TDI6P05 • evaluate existing and student solutions against the design criteria and user stories and their broader community impact AC9TDI6P06 • select and use appropriate digital tools effectively to create, locate and communicate content, applying common conventions AC9TDI6P07 • select and use appropriate digital tools effectively to share content online, plan tasks and collaborate on projects, demonstrating agreed behaviours AC9TDI6P08 **Design and Technologies content descriptions** • generate, iterate and communicate design ideas, decisions and processes using technical terms and graphical representation techniques, including using digital tools AC9TDE6P02 **Mathematics content descriptions** • recognise situations including financial contexts, that use integers; locate and represent integers on a number line and as coordinates on the Cartesian plane AC9M6N01 • locate points in the four quadrants of a Cartesian plane; describe changes to the coordinates when a point is moved to a different position in the plane AC9M6SP02 • interpret and compare ordinal categorical, discrete and continuous numerical data sets using comparative displays or visualisations and digital tools; compare distributions in terms of mode, range and shape AC9M6ST01 **Science content descriptions** • use equipment to observe, measure and record data with reasonable precision, using digital tools as appropriate AC9S6I03 • construct and use appropriate representations, including tables, graphs and visual or physical models, to organise and process data and information and describe patterns, trends and relationships AC9S6I04

Achievement standards for the unit
Digital Technologies achievement standard (Years 5–6) – assessable elements highlighted By the end of Year 6 students develop and modify digital solutions, and define problems and evaluate solutions using user stories and design criteria. They process data and show how digital systems represent data. Students design algorithms involving complex branching and iteration and implement them as visual programs including variables. They securely access and use multiple digital systems and describe their components and how they interact to process and transmit data. Students select and use appropriate digital tools effectively to plan, create, locate and share content, and to collaborate, applying agreed conventions and behaviours. They identify their digital footprint and recognise its permanence. **Design and Technologies achievement standard (Years 5–6) – possible assessable elements highlighted** By the end of Year 6 students explain how people design products, services and environments to meet the needs of communities, including sustainability. For each of the 3 prescribed technologies contexts they explain how the features of technologies impact on design decisions and they create designed solutions. Students select and justify design ideas and solutions against design criteria that include sustainability. They communicate design ideas to an audience using technical terms and graphical representation techniques. Students develop project plans including production processes and select technologies and techniques to safely produce designed solutions. **Mathematics achievement standard (Year 6) – possible assessable elements highlighted** By the end of Year 6 students interpret and use integers to represent points on a number line and in the Cartesian plane. They solve problems using the properties of prime, composite and square numbers. Students order common fractions giving reasons and add and subtract fractions with related denominators. They operate with decimals and connect decimal representations to the metric system. Students solve problems involving finding a fraction, decimal or percentage of a quantity and use estimation to find approximate solutions to problems involving rational numbers and percentages. They model financial and other situations, formulating the problem and justifying choices. Students find unknown values in numerical equations involving combinations of arithmetic operations. They identify and explain rules used to create growing patterns. Students create and use algorithms to generate sets of numbers using a rule. They interpret and use timetables. Students convert between common units of length, mass and capacity. They use the formula for the area of a rectangle and angle properties to solve problems. Students identify the parallel cross-section for right prisms. They create tessellating patterns using combinations of transformations. Students locate an ordered pair in any one of the four quadrants on the Cartesian plane. They compare distributions of discrete and continuous numerical and ordinal categorical data sets as part of their statistical investigations, using digital tools. Students critique arguments presented in the media based on statistics. They assign probabilities using fractions, decimal and percentages. Students conduct simulations using digital tools, to generate and record the outcomes from many trials of a chance experiment. They compare observed frequencies to the expected frequencies of the outcomes of chance events.

Science achievement standard (Year 6) – possible assessable elements highlighted

By the end of Year 6 students explain how changes in physical conditions affect living things. They model the relationship between the sun and planets of the solar system and explain how the relative positions of Earth and the sun relate to observed phenomena on Earth. They identify the role of circuit components in the transfer and transformation of electrical energy. They classify and compare reversible and irreversible changes to substances. They explain why science is often collaborative and describe different individuals' contributions to scientific knowledge. They describe how individuals and communities use scientific knowledge.

Students plan safe, repeatable investigations to identify patterns and test relationships and make reasoned predictions. They describe risks associated with investigations and key intercultural considerations when planning field work. They identify variables to be changed, measured and controlled. They use equipment to generate and record data with appropriate precision. They construct representations to organise and process data and information and describe patterns, trends and relationships. They identify possible sources of error in their own and others' methods and findings, pose questions for further investigation and select evidence to support reasoned conclusions. They select and use language features effectively for their purpose and audience when communicating their ideas and findings.

Unit sequence			
Processes and production skills	**Core concepts**	**Lesson sequence**	**Assessment opportunities**
Prior learning	• *data acquisition* • *data interpretation*	*Students will have previously researched the sun and planets of the solar system, gathered data on the planets and their relative distances from the sun, size, rotation time, etc., and created tables, diagrams and models to represent the data.*	***Prior assessment:*** *Formative* • *Portfolio items: spreadsheet or table; infographic; diagrams*
• Investigating and defining • Collaborating and managing	• design thinking • systems thinking • technologies processes and production skills • project management skills • enterprise skills and innovation • abstraction • data representation • interactions and impact	• define problems with given or co-developed design criteria and by creating user stories* AC9TDI6P01 • select and use appropriate digital tools effectively to create, locate and communicate content, applying common conventions AC9TDI6P07 * The purpose of a user story is to articulate how a piece of work will deliver a particular value back to the customer. Stories keep the focus on the user, drive creative solutions and enable collaboration. **Establish design criteria** Group illustration: Design criteria – what makes a good game? 1. Divide the class into groups and provide art and craft materials and a large sheet of butcher's paper for each group. 2. Pose the question: What makes a good game? Display some prompts for reference. • Visual appeal, interaction, tension, success, audio • What does it look like? Sound like? What do I see when I see people enjoying a game? How can I re-create this? • How could we apply systems thinking to a game scenario? • How are games marketed to make people want to play them? • What price point is attractive to potential game buyers? Students: • work collaboratively to create a group answer to the question • draw, write, cut out pictures and paste them to create a group solution • can include reference to physical games, board games and computer games.	Formative • Portfolio item: group illustration

Unit sequence			
Processes and production skills	**Core concepts**	**Lesson sequence**	**Assessment opportunities**
		Group writing: Design criteria – what makes a good digital game? 1. Using the group illustrations, students: • walk around and view other groups' illustrations • discuss what they originally illustrated and add annotations for elements they might not have considered. 2. State that the students are going to create quiz games to help people understand more about the solar system. Pose the questions: How will we know we are successful? What makes a good digital game? Write some prompts on a board for reference. For example: • Who will our users be and what will they be looking for in an educational quiz game? Create a user story using the following template: 'A <type of user> wants <some goal> so that <some reason>', for example, 'A museum wants to install an interactive solar system game to educate visitors so that they understand the relationships between the planets.' • What elements do we need to include? Visual, interaction, tension, success, audio, etc. • What does it look like? Sound like? What do I see when I see people enjoying a game? How can I re-create this? • What data will be included? Sounds, images, text … • How could we apply systems thinking to a game scenario? • Who will be the buyers of our game? How will we market our game to potential buyers? 3. Students will work collaboratively to create a group answer to the question, 'What makes a good digital game?' They must now focus their attention on digital games and consider the user stories and data needed for a quiz game about the solar system. They will create a table and write text to plan their game design detailing: • the game's user story	Formative • Portfolio item: group writing – user story and design criteria

Unit sequence			
Processes and production skills	**Core concepts**	**Lesson sequence**	**Assessment opportunities**
		• the visual and audio elements • how they will create tension • how the user will interact with it • details of scoring systems. This table of text will become the design criteria that the finished game will be evaluated against.	
• Generating and designing • Collaborating and managing	• design thinking • computational thinking • technologies processes and production skills • project management skills • enterprise skills and innovation • abstraction • data representation • specification • algorithms • interactions and impact	• generate, iterate and communicate design ideas, decisions and processes using technical terms and graphical representation techniques, including using digital tools AC9TDE6P02 (Design and Technologies content) • design algorithms involving multiple alternatives (branching) and iteration AC9TDI6P02 • design a user interface for a digital system AC9TDI6P03 • generate, modify, communicate and evaluate designs AC9TDI6P04 • select and use appropriate digital tools effectively to create, locate and communicate content, applying common conventions AC9TDI6P07 • select and use appropriate digital tools effectively to share content online, plan tasks and collaborate on projects, demonstrating agreed behaviours AC9TDI6P08 **Design game** Group design: annotated design sketch – Solar system game Divide the class into groups and provide sketching materials and A3 and A4 sheets of paper for each group. Students might also design their plans using digital tools. Students: 1. draw what each game screen will look like and annotate their drawings with explanatory labels, deciding on quiz game content and how players will interact with the game 2. create a plan for the steps needed to construct their quiz game	Formative • Portfolio item: group game design sketch with annotations Portfolio item: group game content – What questions will be asked in the quiz and what are the answers? • Portfolio item: group think-aloud video – Who our target audience is (user story). What our game is designed to do. What requirements will be needed to meet needs of the user.

Unit sequence			
Processes and production skills	**Core concepts**	**Lesson sequence**	**Assessment opportunities**
		3. create the algorithms both on paper and by exploring visual programming blocks to determine what is required for the game, which will include branching and repetition. (Students can add scores, variables and animations as desired.) 4. create a group think-aloud video to explain their planning documents, what the game is designed to do and how it meets the needs as determined by their user story. (Note: This does not need to be a high-quality video. It is the content that is important.)	
• Producing and implementing • Collaborating and managing	• computational thinking • technologies processes and production skills • project management skills • abstraction • data representation • algorithms • implementation • interactions and impact	• implement algorithms as visual programs involving control structures, variables and input AC9TDI6P05 • select and use appropriate digital tools effectively to create, locate and communicate content, applying common conventions AC9TDI6P07 • select and use appropriate digital tools effectively to share content online, plan tasks and collaborate on projects, demonstrating agreed behaviours AC9TDI6P08 **Create game, test and debug** Students work collaboratively to construct their group game. Students: 1. can work independently to create backgrounds, audio clips, visuals and code, which they then contribute to the collaborative game. Each student should have the opportunity to create code in the game. 2. work as a team to test the game and modify it as they go 3. keep a group journal to document their progress and make notes as they modify the program.	Summative • Portfolio item: group game • Portfolio item: group journal – notes from testing Sample starter game: scratch.mit.edu/projects/248771101/
• Evaluating • Collaborating and managing	• design thinking • systems thinking • technologies processes and production skills	• evaluate existing and student solutions against the design criteria and user stories and their broader community impact AC9TDI6P06 • select and use appropriate digital tools effectively to share content online, plan tasks and collaborate on projects, demonstrating agreed behaviours AC9TDI6P08	Summative • Portfolio item: group journal – notes from evaluation against design criteria and user story

Unit sequence			
Processes and production skills	**Core concepts**	**Lesson sequence**	**Assessment opportunities**
	• enterprise skills and innovation • project management skills • abstraction • interactions • impact	**Evaluate game against design criteria and user stories and showcase** Students will evaluate their game, prepare a promotional video, showcase their game and judge other games. Students: 1. evaluate their game against their original design criteria and user stories and record notes in the group journal. (This should also form part of the producing and implementing phase. This allows students to modify their games as they discover they did not meet their own criteria.) 2. create a group video to promote their game to their target market as determined in their user story (a promotional video or trailer). In this video they need to explain how their game meets needs and impacts on the broader community. (Note: The quality of the video is not being assessed. It is the content that is important.) 3. view each of the promo videos as a teaser for a showcase day 4. play the other groups' games as part of a showcase 5. judge the other teams' games based on their design criteria 6. complete a self-assessment to determine: • their level of understanding of the process • the impact of their game and how well it met user needs • how well they worked in a collaborative project.	Portfolio item: group video – promotion for game • Portfolio item: student self-assessment

Assessment marking guide: Digital Technologies portfolio

	Investigate and define	Generate and design	Produce and implement	Evaluate	Collaborate and manage
Relevant sections of the achievement standard	define problems using user stories and design criteria	develop and modify digital solutions design algorithms involving complex branching and iteration	implement them [algorithms] as visual programs including variables	evaluate solutions using user stories and design criteria	select and use appropriate digital tools effectively to plan, create, locate and share content, and to collaborate, applying agreed conventions and behaviours
Assessment item	Formative • Portfolio item: group illustration and group writing – design criteria	Formative • Portfolio item: group game design sketch with annotations Portfolio item: group game content • Portfolio item: group think-aloud video	Summative • Portfolio item: group game • Portfolio item: group journal – notes from testing	Summative • Portfolio item: group journal – notes from evaluation against design criteria and user story • Portfolio item: group video – promotion for game • Portfolio item: student self-assessment	All portfolio items
Level of achievement: Above standard The student:	• describes a range of elements that influence a variety of effective games • explains how game design is influenced by features of technologies and needs of varied users • justifies choice of user and describes a detailed user story for their quiz game	• generates an improved user interface design for their quiz game • designs algorithms that align with the design criteria and consider user story • represents algorithms diagrammatically and accurately • describes how user inputs affect the game play	• implements a quiz game that addresses the identified user story and design criteria • records justification for modifications in a journal • implements a functional quiz game	• records in group journal justification for modifications to meet defined user needs and design criteria • considers opportunities for future market strategies • explains how the quiz game could be improved to better meet user needs	• works collaboratively, negotiating and developing plans to complete tasks • uses collaboration tools effectively to record progress on a project plan and integrate ideas from group members

	• explains design criteria and how they will meet targeted user needs				
Level of achievement: At standard The student:	• describes elements that make an effective game • describes user story and design criteria for their quiz game	• creates annotated diagrams which describe requirements for their quiz game • writes a series of questions for the quiz game • designs the user interface for a quiz game • designs algorithms involving complex branching and iteration for the quiz game	• implements algorithms for a quiz game as a visual program using variables • records progress notes in a journal	• creates a promotion explaining the features of the game and how it will meet needs of identified user • explains how their quiz game meets the design criteria	• selects and uses appropriate tools to communicate design ideas with group members and makes contributions to all portfolio items using agreed protocols and appropriate file types and naming conventions
Level of achievement: Below standard The student:	• makes comments about users of games • identifies an element of a game that meets a defined need of a user	• draws a diagram of the user interface for a quiz game • writes questions for the quiz game • designs algorithms	• implements an algorithm that produces an output	• identifies an element of their game that meets the need of a user	• communicates ideas • contributes to group activities