Australian Curriculum: Digital Technologies

Year 7/8 JavaScript Challenge

Space Invaders

Overview

https://groklearning.com/course/aca-dt-78-js-invaders/

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Introduction

Space Invaders - The Coding Adventure is an interactive JavaScript coding challenge. It touches a number of the content descriptors of the Australian Curriculum: Digital Technologies and is therefore a suitable entry point into teaching Digital Technologies.

Based on teacher feedback, Space Invaders is an entry-level, step by step activity to developing an exciting computing game project in JavaScript. It aims to capture students' imagination by having a storyline that the students — boys and girls — care about and that meets the expectations of 'generation YouTube'.

Watch the 30-seconds teaser here: https://youtu.be/CFOBVeBCG-I
Watch the storyline here: https://youtu.be/U6tq8UuUpXw

Mapping against the Australian Curriculum: Digital Technologies

Content Descriptor Code	Content Descriptor	Key Concepts	Addressed by Space Invaders through:
ACTDIK024	Representation / Use of Strings	Representations Types of data Binary Representation	Strings, Integers, Binary (Pixel Graphics- Sprites)
ACTDIP027	Define and decompose real-world problems taking into account functional requirements and economic, environmental, social, technical and usability constraints	Defining (Specification) Decompose problem Functional Requirements Constraints	Decomposition of problem into smaller components.
ACTDIP028	Design the user experience of a digital system, generating, evaluating and communicating alternative designs	Designing (Algorithms) UX	Game Design
ACTDIP029	Design algorithms represented diagrammatically and in English, and trace algorithms to predict output for a given input and to identify errors	Designing (Algorithms) Flowcharts Tracing	Arrange sprites in rows and a grid and move them
ACTDIP030	Implement and modify programs with user interfaces in a general-purpose programming	Binary Representation Branching Iteration	JavaScript Algorithms include branching, iteration

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	language involving branching, iteration	Functions Tracing	Visual UI (Screen). Some functionality is encapsulated in functions
ACTDIP031	Evaluate how student solutions and existing information systems meet needs, are innovative, and take account of future risks and sustainability	Evaluate student / existing systems Sustainability; Current and future Innovation	User testing Comparison of software artifact against specification
ACTDIP032	Plan and manage projects that create and communicate ideas and information collaboratively online, taking safety and social contexts into account	Plan, create and communicate with others Manage projects Safety Social Contexts	Includes decomposition of problem into smaller components, which are separately developed, followed by integration testing

What are students learning?

In this coding challenge, students learn about programming in JavaScript, including data representation, decomposition, design, branching, iteration, functions, variables, animations, tracing and evaluation. That's a broad coverage of the key concepts of the Australian Curriculum: Digital Technologies.

The focus of this course is on JavaScript. We have taken care of the complexities of HTML and CSS that are required to make workable JavaScript programs, but and have hidden those from the students. However, there are other good course available that teach those.

Story

The distant planet Zarg has been hit by a global catastrophe. Its water has evaporated into space.

The student assumes the role of the commander of the Zargan space fleet. Leaving the space station, the student goes on a journey to the only planet in the known (by the Zargans anyway) universe that has an abundant source of water. Yes, let's invade good old planet Earth !

On the journey, the student has to assemble a fleet of drone spaceships from resources that they mine on moons and planets that they visit. Because Zargans have advanced 3D spaceship printers, the student can code these printers to make drone spaceships. They slingshot around a black hole, visit the moon of Xobron IV and meet a mysterious scientist, called THE DOCTOR, who

knows a lot about programming. They eventually run into a terran spy station in the asteroid belt and have to race to Earth using an experimental wormhole drive.
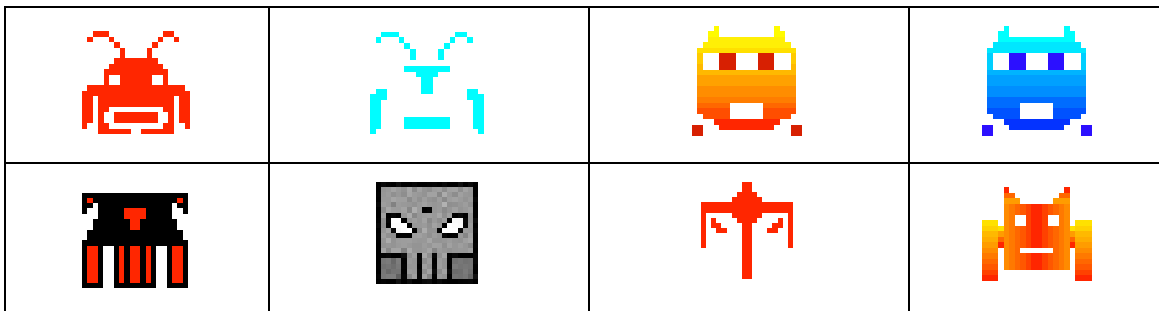
Module overview

Space Invaders - The Coding Adventure consists of four modules, which are summarised below. Many short 10-sec video sequences augment the coding exercises and keep the story engaging.

Module 1: The journey begins

This module sets the context and purpose of the coding challenge. Students learn how to program one spaceship and then position it anywhere on the screen. They learn about the cartesian coordinate system as a foundation to positioning spaceships freely in the window.
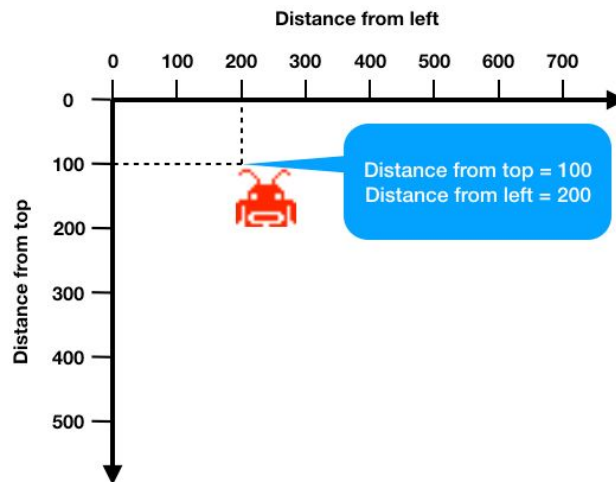
Students can choose from eight different spaceship skins to design their fleet.
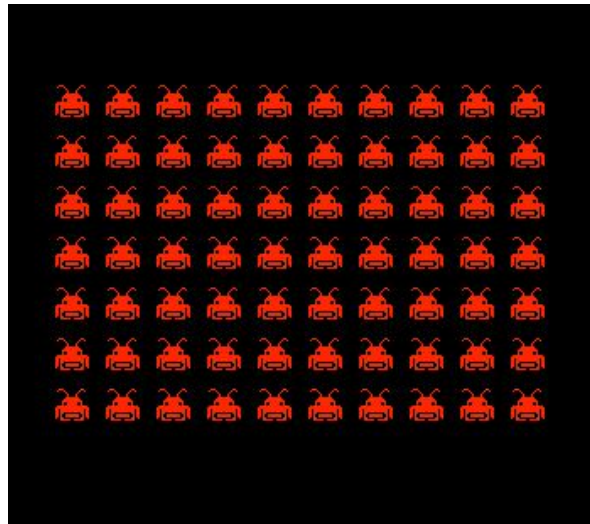

Log on to Grok and start module 1, problem 0
https://groklearning.com/learn/aca-dt-78-js-invaders/1/0/

Module 2: Growing the fleet

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This module is about the growth of the spacefleet. Students apply their knowledge from the previous module to make two spaceships. They then reflect on the length of their code and realise that making 100 spaceships this way will require too many lines of code. This realisation serves as the rationale for the introduction of re-usable functions that encapsulate code. This module repeatedly makes the point of reducing code length through functions and loops. By the end of this module, students will have coded a grid of spaceships.

Log on to Grok and start module 2, problem 0
https://groklearning.com/learn/aca-dt-78-js-invaders/2/0/

Module 3: Stardrive operation

This module introduces the concept of animation. Students program a spaceship's guidance system and learn how to change the position of their fleet horizontally and vertically. By repeatedly applying position changes, the fleet moves continuously.

Log on to Grok and start module 3, problem 0
https://groklearning.com/learn/aca-dt-78-js-invaders/3/0/

Module 4: The battle for Earth

Having reached Earth, the students try to land at least one of their spaceships in the Pacific ocean off the coast of Australia. This is made harder by Earth's global defence system that we, the Australian Computing Academy, have developed and which we interlink with the student's code in the background. This module is a battle of strategies in which students have to find an optimum fleet size, gap between spaceships, velocity, etc in order to achieve their objective.
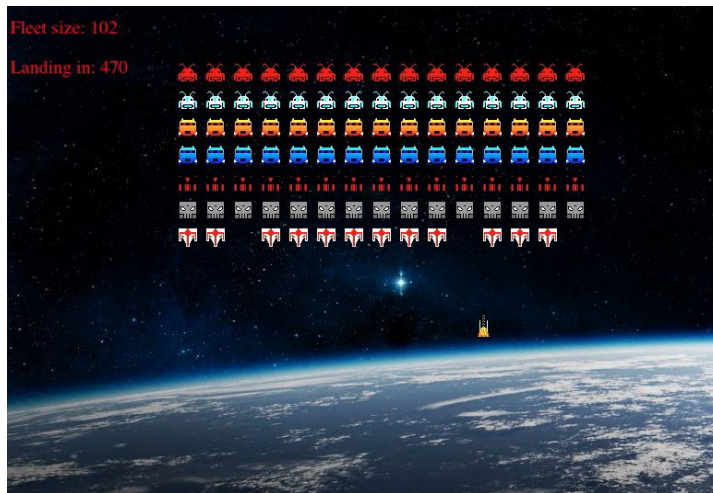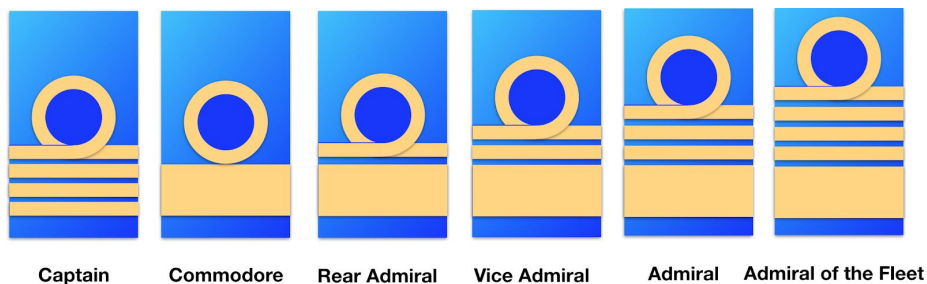

Log on to Grok and start module 4, problem 0.
https://groklearning.com/learn/aca-dt-78-js-invaders/4/0/

Badges

Upon completion of each module, students are promoted in rank. The ranks are : Captain - Commodore - Rear Admiral - Admiral of the Fleet. The insignia of the ranks are based on those of the Royal Australian Navy[1], though we have taken some artistic license in terms of colour in order to adjust from the naval background to deep space. Please note that the ranks of vice admiral and admiral are presently not used and are reserved for future coding modules.

| **Captain** | **Commodore** | **Rear Admiral** | **Vice Admiral** | **Admiral** | **Admiral of the Fleet** |

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[1] https://en.wikipedia.org/wiki/Royal_Australian_Navy

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Related topics

Whilst the topic of space invasion is of course engaging and entertaining for the young minds, we invite and encourage teachers to explore with their students some of the assumptions made in Space Invaders. Potential entry points are:

Water and the Environment

- What could have caused the environmental catastrophe on planet Zarg?
- What is the role of water in an ecological system?
- Do we have an example of a planetary drought in our own solar system (ref. Mars - Curiosity mission)?
- Have we examples of drought in Australia? How are people, animals and plants affected and what do they do to cope?

Ethics and Science

- Could the Zargans have pursued an alternative course of action?
    - Ethics: Rather than invading Earth, could they have tried to open negotiations?
    - Could Zargans have learned about water management from Earth (examples Australia) and water-effective farming (Israel)?
    - Science: Instead of invading Earth, could the Zargans have used their advanced technology to make water? How is water made