Teacher Learning Pack

Version 1.0

A teaching resource for those new to video games, and video game design from the Australian STEM Video Game Challenge

Contents

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History

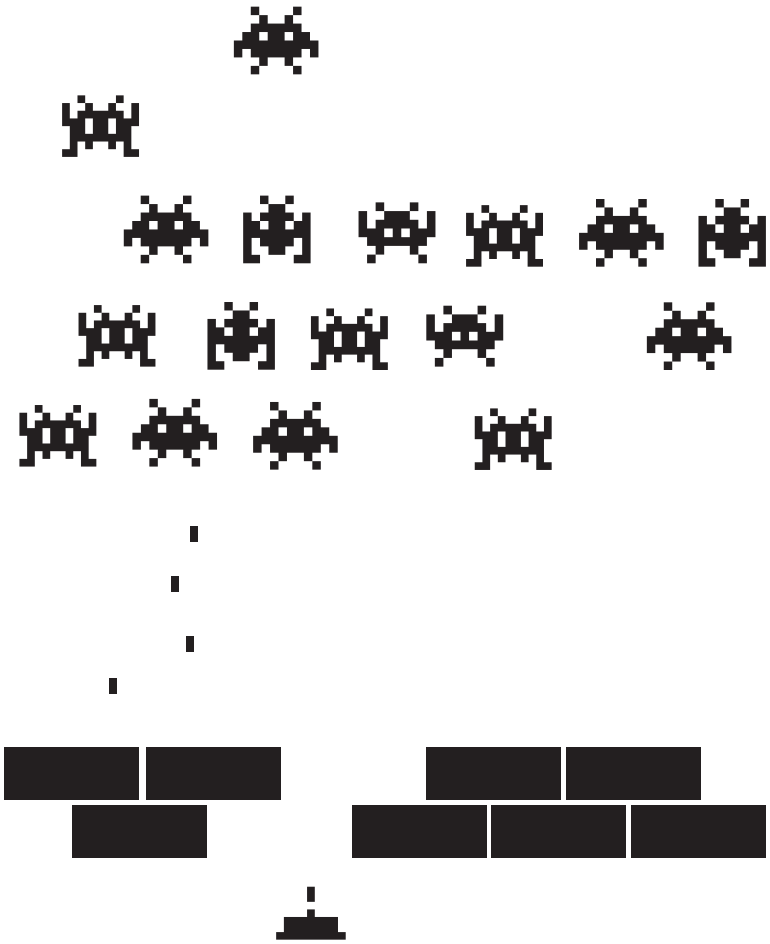
The 'video game', as we understand it in the modern era, is an idea that has origins in the technologies and cultures of the 1950's. Emerging alongside the rise of the cathode ray tube screen, and scientific equipment such as the oscilloscope, the 'video game' spent twenty years gestating in universities and scientific research, before finding their first commercial flowering with the release of *Pong* and *Space Invaders.*

These comparatively primitive games involved simple reaction-based gameplay, and closely mirrored the economic model of pinball tables, and similarly coin-operated carnival games – and would be described as 'arcade machines', which could often be located in dedicated 'video game arcades'. The 1977 release of *Space Invaders* cemented the idea of electronic gaming in the public consciousness, and the game spawned a legion of imitators, in addition to consolidating the presence of the broader video game industry.

In the wake of the success of Space Invaders, the 'Golden Age of Video Arcade Games' began, a period in which the arcade machine became the primary vehicle for the playing of video games, with the release of internationally successful titles such as Pac-Man, Centipede, Tempest, Galaga and Donkey Kong.

The companies which produced these titles became global powerhouses, straddling both the technology and culture industries – Atari, Midway, Taito and Nintendo would seize control of the arcade machine industry, transforming it into a multimedia enterprise with cross-promotional television programs, cartoons, t-shirts, and collectibles.

During this period, professional video game playing began to emerge, with arcades like Twin Galaxies in Iowa providing some of the first examples of organized video game competition.



Atari took the arcade into the home with the release of the Atari 2600. While home video game systems (or 'consoles' as they would be known) existed prior to the release of the 2600, Atari's marketing blitz and software library was so successful that for a generation, 'video games' were often equated specifically with Atari products. Popularising the use of ROM based cartridges, Atari's catalogue consisted of home versions of arcade machine games, and original software titles by both Atari and third party development studios.

Film tie-ins became popular, with games based on successful franchises such as Star Wars, Raiders Of The Lost Ark, and the infamous E.T catastrophe of 1983. Atari's success seemed to increase in velocity with each year, until the market's saturation point began to affect sales – as did the sheer volume of product released for the 2600, with a highly unstable level of quality in the software.

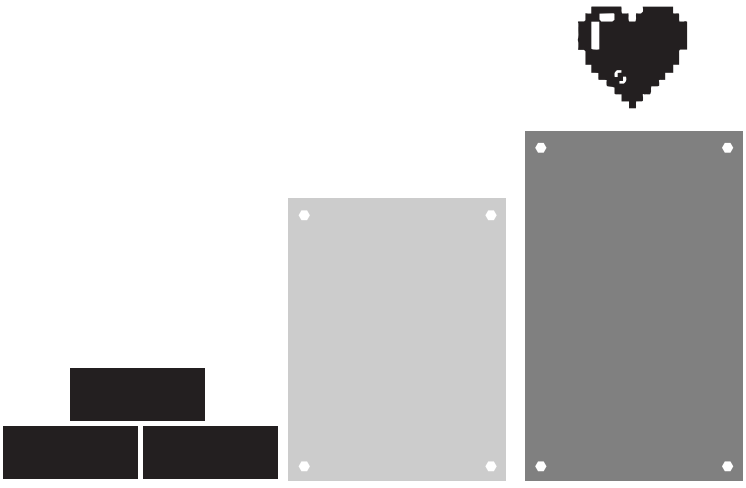
The market buckled beneath the weight of these issues, and with the highly anticipated release of the video game tie-in of E.T – a game that was rush released to meet the Christmas deadline, and suffered because of it – the '1983 video game crash' saw Atari's market collapse. The American market for video games during this period was chaotic, and Atari suffered what would later turn out to be a fatal blow at the hands of the market.

The rise of home computers also began during this period, compounding the decline of the first wave of the console market, and contributing to the destruction of Atari. The PET, Vic-20 and Commodore 64 were three flagship home computers produced by Commodore which were marketed as both productivity devices, but also as viable platforms for video game playing.

By contrast, Apple and IBM had spent much of the 1970's dedicated to enterprise software development and addressing the needs of professionals – Commodore's radically different approach branded their systems as both professional tools and as gaming platforms. Commodore met with huge success, and was soon joined by the European home computer industry – which saw the release of the ZX Spectrum, the BBC Micro, and the Amstrad CPC.

These European-made systems formed the core of the '8-bit Era', named after the microprocessors used in these computers. As Atari floundered in the United States, the home computer industry of Europe, Britain and Australia flourished, with video game titles beginning to move away from reaction-based games involving finely tuned motor skills, and moving towards more cerebral and challenging material.

Pen and paper role playing games became computerised in the form of the Ultima series, experimental pieces such as The Sentinel began to use three dimensional space in challenging and complicated ways, entire universes could fit on a single floppy disk in titles such as Elite, and the European sensibility proved that games could be funny, smart, and deeply human in Pythonesque platform games like Jet Set Willy, Blagger, and Roland In Time.

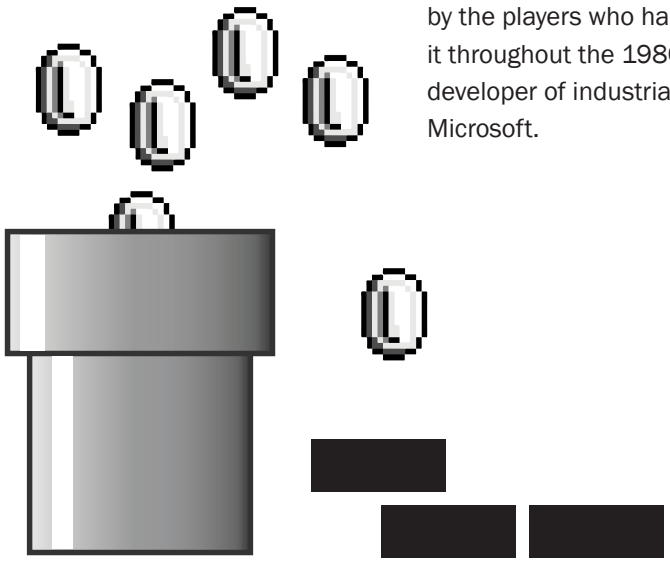


By 1985, a profound shift occurred as Nintendo revitalised the flagging console market with the release of the Nintendo Entertainment System, accompanied by the celebrated Super Mario Brothers.

In addition to being a technological marvel, Super Mario Brothers proved that arcade-quality graphics were possible in a home console, pulling the developmental centre of console gaming away from the United States and firmly placing it in Japan. Nintendo's system proved an enormous success in Asia and North America, where it immediately replaced Atari's systems as the video game system du jour for many gamers.

The home computer market continued to iterate, with Commodore's Amiga heralding the end of the 8-bit era, and the introduction of the 16-bit era – powerful home systems capable of three dimensional graphics, a full colour palette, and stereo sound powered by sophisticated audio hardware. The Amiga and Atari's 'ST' – Atari's attempt to reposition themselves as European-style computer manufacturers – were highly successful, although not on the scale of their 8-bit predecessors.

The home computer market, however, was about to be transformed not by the players who had dominated it throughout the 1980's – but by a developer of industrial software named Microsoft.



The release of Microsoft Windows would undermine Apple's attempt to seize control of the home computer industry – which they were primed to capture through the Macintosh line. Instead, Microsoft made their software accessible to any hardware maker – dedicated Microsoft partners were not needed to build systems capable of running DOS or Windows.
This openness allowed Microsoft to open up the home computer market (now known as the PC market) to thousands of hardware and software providers, without having to undergo a process of certification.

The modern video game era was born in the early 1990's with the release of the Sony Playstation. The CD-ROM format allowed multimedia content, 3D graphics, and studio-produced sound to be embedded into the era's releases, creating a fusion of cinema and video gaming which continues to be iterated to this day.

The home computer industry, by comparison, moved even deeper into hobbyist territory, capturing imaginations with games like iD Software's Doom – games with an appeal that was partly because of their design, but also because of the enormous potential for user-made modifications.

Doom was a watershed moment in video game history – a mainstream success with a lifespan extended infinitely by the community through fan-made levels, graphics, and audio files. The idea that a video game can have a lifespan encompassing years – or even (in Doom's case) decades – powers recent successes such as Skyrim and the crossover hit of the 2010's, Mojang's Minecraft.

Gaming is now an industry worth over 11 billion dollars globally.

Positioning

Game creation is a deceptively complex process, and as it relates to STEM areas, is a rewarding intellectual and academic pursuit. There are many ways that games are made, from the aforementioned modifications of existing software, to the creation of completely custom engines, to the use of authoring packages such as Gamemaker or Scratch. Regardless of the chosen vehicle for game development, a number of core skills can be viewed as being transferrable between development environments and academic disciplines.

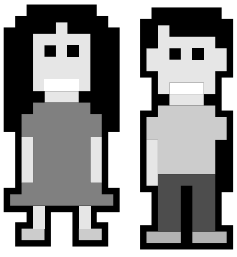
Language/Literacy
Games generally require a significant investment in printed text. Whether a first person shooter or a role playing game, participants will require text-based instructions and developers must write them.

Mathematics
Coding a game heavily relies on arithmetic language. The core of game design is a core which revolves around numeracy – the language through which software, hardware, and the product which ultimately arrives onscreen is a mathematical one. Thus, game design is a powerful method of numeracy education.

Scientific literacy
Game design engages powerfully with scientific literacy education – from understanding the principles of physics and motion, the psychology of perception and interaction, and the principles underpinning the ways that humans hear, see, and experience the world. These are all elements which must be understood and manipulated in order to produce good, engaging game design

I.T literacy
The technologies involved in video game creation are disparate, complex, and often challenging for both neophyte and experienced development staff. Developers must often straddle multiple design roles, requiring the ongoing skill development of multiple I.T-based literacies and competencies in specific platforms. Graphic design suites, compilers, audio recording software, and animation packages may all need to be mastered during a role in a small design team, resulting in rich opportunities for I.T teaching and learning.

Multimedia design
Sound design, video design, and the capturing and editing of content for integration into development builds of video games requires an extensive understanding of multimedia practices. From music to sound effects to video-based cutscenes, the multimedia aspect of video game design offers many different paths for skill development.



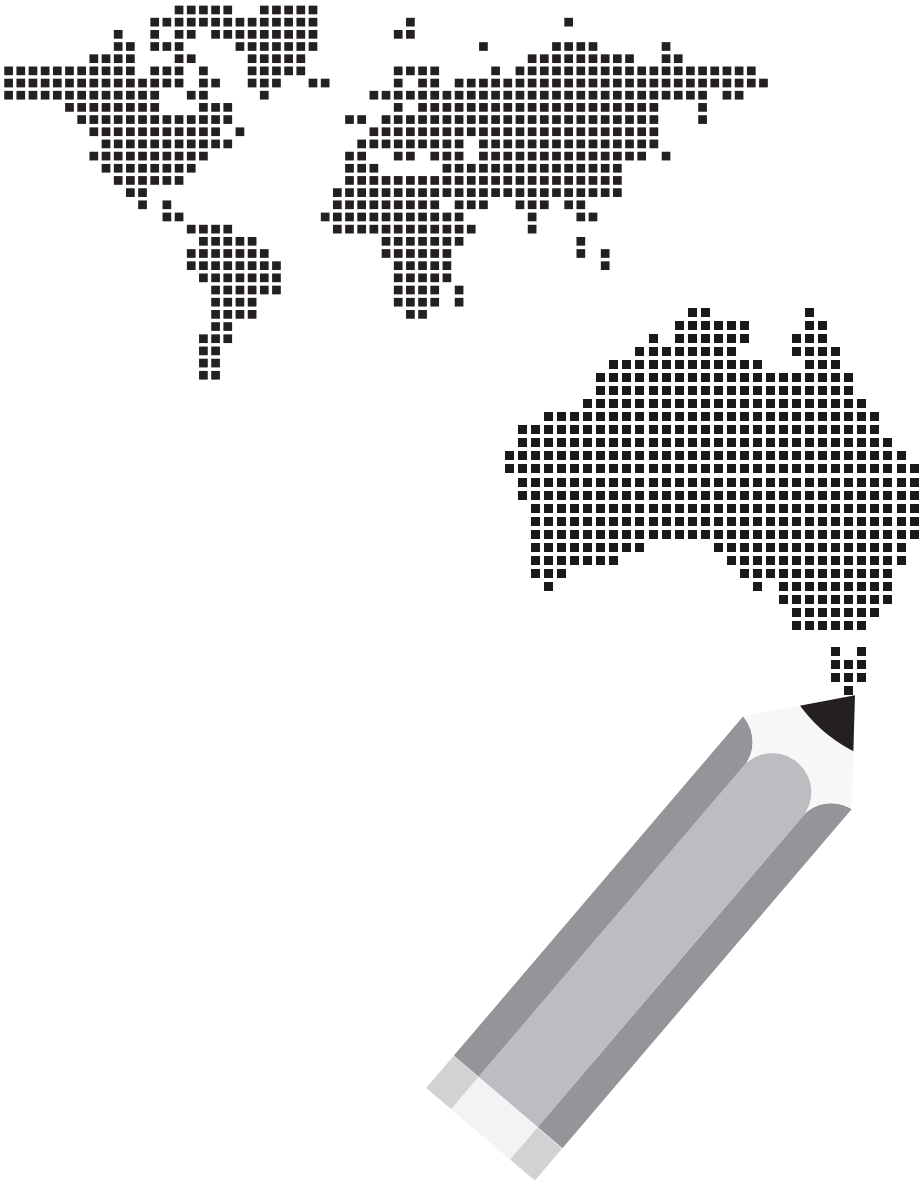
Lessons in Approaching Game Design

Planning the development of a video game is no simple affair; it requires patience, persistence, and the ability and willingness to engage in complex problem solving and project management. There are a number of different design elements which must be considered before embarking on a development cycle:

Genre

A critical decision must be made around your game's genre. The choice of genre will inform all of the other creative and technical decisions that are made during the development cycle. The art style for a first person shooter may be significantly different to that of an RPG or a platform game.

The engine for a puzzle game may not have the same technical requirements as the engine for a third-person adventure game. Having a clear sense of your game's genre is the first step in developing a sound, achievable development cycle, and the documents that will guide your work.



Audience

Who is your audience? Who do we want to play our game? Why would they want to play our game – and what design elements have we used to ensure that they will stay? These are all critical questions regarding the potential audience for your game, and it is important that you begin to define who your target audience will be. Is it a platform game for children? An adventure game for adults? A mobile game for girls? A handheld game for boys? Know your audience and work to their strengths.

Platform
There are two different platforms that you should be considering:

Gaming Platform
Which gaming platform will the game be developed for? A PC game? A mobile game for iOS? What kinds of games work best on which platforms, and what kinds of design elements can you use to your advantage? If your game is played best with a keyboard and mouse, is an iPad the best platform for it? If it requires a lot of tapping on icons, should it be developed for a desktop PC? Choose the platform that is right for your game.

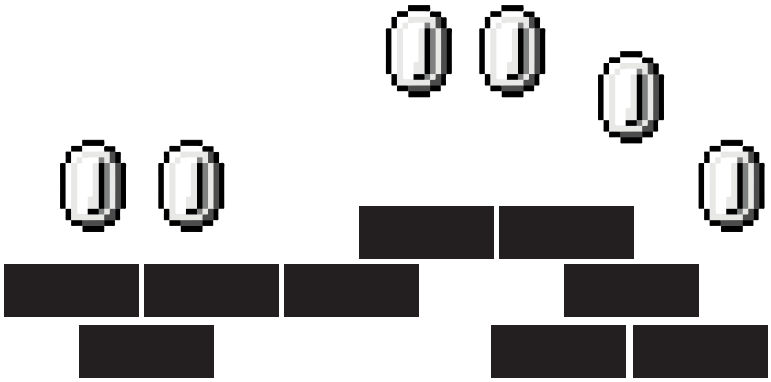
Development Platform
Which development platform will the game use? Would it work in Gamemaker or RPG Maker? Do you need a 3D engine like Unity or UE3? If you are developing an RPG for adults, does it need an engine which is capable of three dimensional graphics? If your game is text heavy, will it work well in Unity? Investigate the engines on offer and choose the one that is the best fit for the game that you are trying to develop.

Design
What do you want your game to look like? To sound like? What kind of art style are you capable of creating that is pleasing, genre-appropriate and consistent? Can you make your own sound effects? What kinds of sound effects do you need? Lasers? Clashing steel? A car engine?

It is important that you scale the design of your game to the resources that you have, while ensuring that it remains appropriate to your audience. What kinds of graphics would a racing game for children look like? Or a visual novel, built for desktop PC's, for an audience of teenagers? You need to develop a clear understanding of how your game's visual and audio design will complement your chosen genre, and will be appropriate to your audience – while remaining achievable within your own resourcing.

Resourcing
Your favourite game may be *Fallout*. It may be *Mario Kar*t. It might even be *Call Of Duty* or *Battlefield*. These are all games with multi-million dollar development budgets, and teams of hundreds of people. While amazing games have been made with small teams on limited budgets, it is important that you understand what is capable with the resources that you have available to you, and you design a game that maximises the strength of your resourcing.

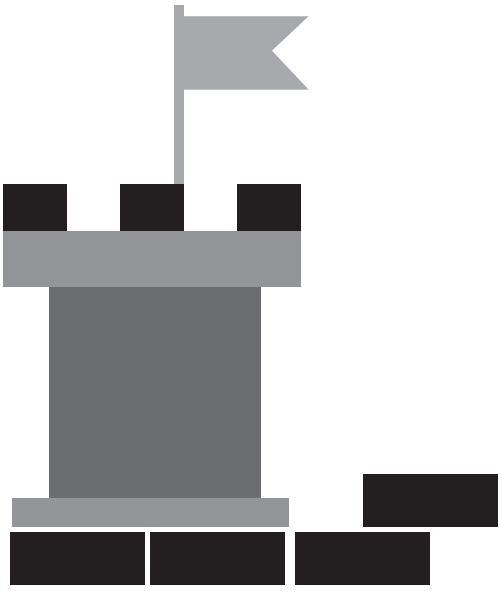
Does your school have an audio recorder that you could use? Do you have friends who can help you make sound effects? Are you great with Gamemaker, but you have a friend who is good at writing stories? You need to figure out what you have that can make your game the best that it can be, and draw on those resources. Don't try to make a game that you aren't resourced to make – make an amazing game that is designed around what you have.



Monitoring and Goals

It is critical that you set achievable, manageable goals for your students as they embark on the journey of video game creation. The design, coding, and construction of a video game is a very complex affair, with many different production elements required to work simultaneously in order to ensure that the final product is coherent, functional, and appealing to an audience. It is, then, necessary for you to ensure that your students are working to a carefully structured, realistic timeline which will allow each part of the game's design (graphics, sound, coding, text) to be completed comfortably, and to allow for an extended period of reflection and iteration.

Mapping the different elements of design to a set of achievable milestones requires you to possess an understanding of the different tasks that students will need to complete in order to design a working game for submission. We suggest that, based on a six month production cycle, a timeline might look something like this:



01 ***Initial concept drawings, story outlines, and the creation of a working, iterative GDD.***

Genre should be selected, audience should be selected, and the team should have a solid understanding of what kinds of assets will need to be created for their game.

02 ***Asset, script and engine design.***

Visual assets (characters, sprites, backgrounds, and GUI assets) should be at a prototype stage.
Students should start recording audio – sound effects, voices, etc.

The story script should exist in draft form, including character dialogue and narration.

The game engine should be chosen and initial coding work should be underway.

03 ***Working prototype.***

A basic, playable build of the game should have – or should be nearing – completion. Having some placeholder assets is fine, but the game's look should be largely decided, and the characters, backgrounds, and menu assets should have a unified and consistent visual style. The script should be completed.

Having a working prototype ready by the third month will allow your team to iterate and bug test the game.

04 ***Bug testing.***

Your team should be spending a considerable amount of time testing their game for bugs and errors. Spelling and grammatical mistakes in the script should be gone. Assets should be finished and in place – and should be rendering properly on the game's target systems. Sounds should be recorded, edited, and live in the game's prototype build. Your objective during month 4 should be iterating your game around the bugs and glitches that your team has located, and preparing it to go in front of a test audience.

05 ***Play testing.***

The current build of the game needs to be playtested by friends and family, and you need to set aside time to respond to their criticisms. If your instructions are universally misunderstood, you need to have time to change, rewrite, or recode them. Month 5 should be seen as a time for you to collect feedback on how users are engaging with your game, whether they find it fun, whether they find it coherent and playable, and adjusting your design according to their comments.

06 ***Final testing and submission.***

The final month should be dedicated to polishing, refining, and perfecting the different aspects of your game. By now, you should have completed bug testing and received some player feedback on the game – your job should now be to ensure that it is ready to be submitted to the STEM Video Game Challenge, and can be shown to a wider audience as an example of your skills, dedication, and passion for the medium.

Resources & Assessment

Now that the pieces of a game are a bit clearer, you can begin to think about using game design and development in classes. The best place to start is to pick the parts that might be relevant for your subject and looking at how they fit into the new digital technologies framework in the Australian curriculum.

As a starting point, it helps to understand the components of the Digital Technologies strand of the Australian Curriculum:

The Australian curriculum for Digital Technologies:
http://acer.ac/digitaltechnologies

Background for the process:
http://acer.ac/gblbackground

Resources for integrating games into your class are sometimes hard to filter through the search results, this is a curated list that allows you to pick the area you would like to focus:

STEM Video Game Challenge Resource Library
https://www.stemgames.org.au/resources

Or if you prefer to jump right in:

Google Computer Science First Program
https://www.cs-first.com/