# Game Making Pedagogy using a Three M Framework

## Notes

Be bold move your model to as near the front as you can. Justify this - all useful and practical advice to teachers - and publishing on new site -

Section on tensions is too long - instead perhaps a summary of tools choice tensions, limits of the classroom and new opportunities. - so move some to 3m as justification and some to limits / tensions

## Summary

* Context

Three main elements - Benefits of game making & what’s unique about gaming - 3M Framework in relation to the above - Tensions involved in my study and research - tools Outro

* Overcoming Challenges of classroom application

## Intro

In a previous chapter in this collection I outlined the opportunities of a project based approach to learning computing and in particular the craft of coding. In this chapter I explore the potential of Computer Game Making as a way of undertaking computing projects in line with the principles of PBL and UDL.

I’ll make a summary of research around project approaches to game making and draw out some of the benefits and some elements that are special about making games.

My aim is to engage with research on game making but also to keep things grounded. To do this l I look at tensions to game making approaches especially those that impact the use of game making in the classroom.

As a fruit of my own research with families making games together, I share a framework which aims to incorporate some of the thinking and techniques that are explored in relation to research.

### Context Background (UK)

Research on the use of games in education has often focused on game playing and the use of specialist educational games. In the context of computing however the promise if game making especially to develop coding skills is also explore to a lesser but still significant degree.

The RSA report After the Reboot<Do Zotero Refresh: [-@the\_royal\_society\_after\_2017]> examined classroom practice and updated research after x years since the introduction of a new Computing curriculum in the UK. The report found that girls, ethnic minorities and students of lower socio-economic status were all less likely to take computing as a subject at GCSE level.

One of the areas of promise they outlined was the use of game making as a way of increasing engagement in the process of coding. The review highlighted several area of promise but which needed more research. The areas were the promise of using games for engagement, use of game patterns and involvement in girls in coding and social and cultural aspects of coding <Do Zotero Refresh: [@waite\_pedagogy\_2017]>.

* transition from following tutorials to creating new games;
* using a design pattern specific pedagogy for teaching gaming rather than teaching programming constructs;
* social and cultural dimension of gaming;
* gender differences.

While the focus of this research was to support the computing curriculum, it is worth mentioning that there is a rich stream of computing projects and associated research that happen outside of the classroom. I aim to bring some of the benefits into focus, suggesting that there is scope to bring this into formal environments.

In this writing I use the term learning design instead of pedagogy. I do this because I feel that term is more accessible and because it is a specific implementation of several underlying pedagogic principles.

### Research on benefits (and uniqueness) of Game Making (merge with above?)

In the following section we draw from educational research to explore what is already known to be beneficial in terms of game making.

The review of research on the value of game making by Kafai and Burke - <http://tiny.cc/2tzutz> - outlines broad areas of game making knowledge for individual learners. Namely, to support coding and computing, to help learn content from other subject areas and to promote meta-cognition - students learning about their own learning. The review also explores social and cultural elements of game. SPECIFICALLY REVEVANT IS the evolution of learning communities - making a link with Samba school?

We previous saw that Waite’s review for RSA also highlighted the importance of social and cultural approaches to game making including the roles of gender. ADD LINKS HERE

Other studies have addressed the issue of how to use games and other techniques to overcome exclusion from the culture of computing <Do Zotero Refresh: [@kafai\_diversifying\_2017; @kafai\_beyond\_2014]>. More recent definitions of inclusion consider aspects beyond SEND issues. If students feel excluded from the school cultures then making bridges to home cultures is vital. One way to make those connections to home cultures is to allow for more choice of what can be incorporated into computing projects.

A cultural-social approach to education values the importance of mediation, cultural artefacts, and the joint emergence of new tools and practices. The kind of research to study a coding work environment, communities of practice, and communities of learners has advantages as it allows;

* exploration of social/ 21st C skills
* inclusive and motivating approaches via authentic projects
* the incorporation of funds on knowledge from the learners home life

In previous chapter the inclusive possibilities of creative computing projects were summarised as;

* learner choice in projects increases motivation and allows for differentiation in line with UDL
* real projects that can be shared
* encouraging self regulation but also providing structured guidance for goal setting
* varied approaches to support project navigation

### Family Game Experience as a Fund of knowledge

Research by the UK National Literacy Trust <Do Zotero Refresh: [-@picton\_video\_2020]> of 11-16 year olds found that 96% percent of boys and 65.2% of girls play video games (http://tiny.cc/videogstats). This shows that while there is a disparity of genders, game playing is extremely common and you are unlikely to be part of a household where no games are played. Thus even if not all young people play games they will have knowledge of the conventions and culture of video games allowing educators to draw on these interests and experiences.

The term Funds of Knowledge came out of work in Latino communities in the US where home cultures, skills and traditions were invisible in the school cultures resulting in a form of deficit thinking about the performance of these communities <Do Zotero Refresh: [@moll\_funds\_1992]>. The concept of funds of knowledge is draw on Gutiérrez <Do Zotero Refresh: [-@gutierrez\_syncretic\_2011]> in the promotion of a concept of creating third space, neither home life, nor a traditional classroom. This kind of third space is perfect to create new kinds of working relationships between students and with teachers as facilitators.

There is a related stream of UK based research by Sonia Livingstone that examines family cultures and the role of digital media including video games which echoes some of the findings of the NLT that playing video games and conversations about video games can bring families together.

Thus this process is this useful not only for an inclusive approach it is also good for navigating computing projects too.

More research is needed on ways to draw out attitudes and knowledge of game cultures and to make this as accessible as possible. see later. (missions? methods?)

The concepts of a third space normally happens outside of the school environment, thus the challenge exists how to create such a third space within the classroom. Suggestions now, and the methods part of the 3M framework (drama process).

To allow students to bring their own home funds on knowledge into their work teachers can adopt the following techniques.

* Allow students to base their coding projects on well known game tropes or genres.
* Allow for choice over the narrative of the game and the characters to allow for student choice

### Developing Social and 21st Century Skills

Project-based game making is inherently collaborative, involves creative design and problem solving. This is a good base for the development of 21st Century skills as potential benefits. The term 21st Century Skills is used quite flexibly in educational research but there is broad understanding that they cover skills like social skills, self reflection, cultural awareness and a range of technical abilities that allow participation in information society.

Studies <Do Zotero Refresh: [@baytak\_case\_2010]> including my own show the potential of making games to create a collaborative classroom community. Learners are often keen to share their games for others to play and play those of others. This motivation can be leveraged to provide detailed feedback.

More research is needed as may studies focused on observations of collaborative skills in passing rather than the core element. For the broader perspective the potential to develop such skills is exciting, however even from a narrow perspective of delivering the computing curriculum, collaboration can be used not as the end goal but a useful educational approach in itself. <- HOW SO?>

### Authentic projects creating real results

An important concept in both project and inclusive approaches to education is to make projects as authentic as possible to increase learner motivation. For game making this authenticity or realness applies not only to the tangible, shareable nature of resulting game created but also a link to the real world of game design.

On an immediate level the desire to create a good game for peers as a source of pride and kudos is a good reason to share created games in the class and potentially publicly.

When learners are designing with someone else in mind, this guides them to shaping their game design effectively. The process of projecting beyond your own experience to an imagined user is a vital design skill that is potentially well developed by making games.

As game making is a huge well known industry, learners understand that the resulting knowledge and skills is not inert but authentic thus and can be applied outside of the classroom.

According to BiE authenticity in project-based education comes in different grades. They offer advice on making PBL work seem real-er to students. https://www.pblworks.org/blog/four-ways-think-about-authenticity-through-lens-gold-standard-pbl-videos

It may not be possible to create a technically commercial advanced game but other audiences exist. For example, so-called Indy Games are made by enthusiasts and often released at low cost or for free on the internet. They often appeal to a retro game aesthetic and are thus easier and quicker to make. Highlighting this movement can reduce student dissatisfaction at not being able to code something like a 3D racing game immediately. As another way to increase authenticity schools sometimes enter online game making competitions or wider creative competitions like the Coolest Project. You may be able to add authenticity in a similar way by providing a frame for your game making.

## Preface to 3M ( including some tensions around tools )

While the potential benefits of game making are striking many challenges exist. Later in the final section of this chapter I explore some tensions and limitations more generally. In the next section I look at a design that aims to address key challenges and tensions.

The 3M game making model - (made up of Missions, Maps and Methods) - that I now share with you is the result of a trial and error process evolved over several years working with families to make games together. I have also tested it out in a local Primary school.

Before outlining the specifics of the learning design I will give an overview of some of the choices available to you to use when making games. While many game making tools for beginners use a GUI to abstract away the detail of the underlying, I only include tools that allow users to code the game directly.

**Phaser.js in a Code Playground:** The first tools I chose to use was an authentic javascript game-making framework called phaser used an online coding environment called a code playground. Code playgrounds are a tool used by both expert and novice coders to share examples of code that can be edited and preview online. The killer feature is the ability to make changes and quickly see the new results appear. The concept is also very useful for learners and exists for block coding in tools like Scratch and for text coding in Trinket. Many text based code playgrounds exist and I tried a few and settled on Glitch.com - although the game also works well in Trinket. The use of a text coding environment was a choice that prioritised authenticity of the environment.

**Pygame** is an add on for Python that makes game making a bit easier. Clearly python is a good choice for a class that has had experience of coding in that language. There are good resources available too.

There are some interesting resources and books to support game making with Pygame on the website of the Raspberry Pi foundation. https://www.raspberrypi.org/blog/tag/pygame/ and some good tutorials here - https://www.pygame.org/wiki/resources

**P5.play** is a an add on to the p5.js javascript framework. P5 which has become popular not only with artists and designers but increasingly with educators. This is partly due to the ability to use it in code playgrounds with all of the advantages previously discussed. While P5.play is limited to 2D games, it add some useful design patterns like animation support, basic collision detection and help for mouse and keyboard interactions.

**MakeCode Arcade** which is a block based programming environment similar to Scratch but with some interesting features which are tailored to game making like gravity, lives and a game over block. In addition, the multi-media making abilities are very stripped down, you can download the games to hand held devices or run them easily.

**Scratch** Scratch was one of the first block based programming environment to really catch on in schools. Scratch was designed for more general multi-media projects rather than to make games. However, given free reign games are often what young people try to create first. The ability to create your own graphical and audio assets is a real advantage. However, from my experience, while it is quick to get started, the lack of program common game patterns like gravity and collisions means that complexity of the code you need quickly mounts. And even then actual game play of the games is always a bit unsatisfactory. Where Scratch does stand out is the community element of the website where learners can get inspired by the creations of other young coders and remix their work as a way start to get used to the tools and the way of working.

**This isn’t just about tools is it?**

While I hope this summary of the tools is useful the following sections are to do with a learning design that can be applied using any of the tools above.

In truth The evolution of the process has been both trial and error and collaborative from working with families, to volunteers from PGCE computing course. One of the first design choices that emerged was to start with a common but incomplete template of a 2D platform game which they then adapted to their own designs in an increasingly sophisticated way.

This approach is well document in research on creative coding and game making as the Use Modify and Create model (http://tiny.cc/usemodifycreate) <Do Zotero Refresh: [@lee\_computational\_2011]>. This model is designed both to limit learner anxiety as they potentially meet code and a coding interface for the first time and to scaffold the acquisition of coding and computational thinking concepts. I will explain the three stage model with reference to my own design.

In the **Use** stage learners engage with a starting template of a few games playing them and then opening the code to see if they could guess what any of the code did. This use stage allows learners to gain some familiarity with the coding environment and to recognise some features of the language being used.

Then we quickly asked learners to **Modify** a broken game with very simple changes which they could choose from a set of printed cards. These small changes to variables or swapping out media assets with their own builds confidence, gives a greater sense of ownership over the project and is a fun and challenging experience.

In my **Create** stage learners we asked to choose from a menu of different game design patterns to add to the game. In early stages learners patch or copy code examples into their existing code. As they do this gain familiarity with a wider variety of coding constructs and concepts. Later makers can take up extra challenges which involve them making additions to the code with no direct support from the materials.

The 3M process has evolved with the aim that it is accessible to parents, teachers and learners. Part of that accessibility is the playful, game like approach to it. I was inspired by a session by one of my PhD supervisors Nicola Whitton who created a game to help people learn about game concepts. In a similar way this game making model involves game techniques of missions, maps and playful methods to help with the engagement, immersion and navigation of our game making learners.

My design focuses on making games to learning the craft of coding, to build meta-cognitive skills (especially goal setting and reflection) and to explore some systems concepts. You may have other goals which you need to steer your learners towards. Later in the chapter I share ideas on how to adapt this version of the 3M framework to suit your own needs.

CHECK THIS LATER TO MAKE SURE I DO

### Missions (using Game Patterns and secret side-missions)

Many open world games have a concept of a main mission and then optional side missions. The guiding challenge or main mission of this design was to create a playable game around a theme (environmental in my case) for a real or imagined audience.

Due to the challenging nature of coding a game from first principles, I have adopted a common approach of starting with a templated game to remix. This choice leads to a tension in design; given this templated starting point, how much freedom of choice do learners have over the game they create. A tension being, if you provide too much choice then you may struggle to support learners as they get stuck with a huge variety of diverse problems.

To help resolve this tension we can look at the concept of open world games for inspiration. Open world games provide the player with a series of choices but also to have restrictions to the wide extent of the world/choices. The feeling is of freedom, but there is an acceptance of bounds for example player accept that they don’t have choice over their starting point.

In my this design I chose a starting point of an incomplete platform game. I asked my family learners what they would like to add to this game. They came up with a list of features that we can describe as game design patterns. By game design patterns here I mean common features that game players would commonly expect from a game. For example moving around the screen, avoiding hazards, collecting coins, jumping on enemies, finding a door or flag to progress to the next level.

Game designs have a solid place in the way that professional coders learn their trade. W

Thus, the core of my learning design is the use of game design patterns as a relatable way for student to choose their paths and to structure the support through coding concepts linked to these patterns. You can see how this is in line with some of the concepts of inclusive and project based approaches discussed earlier.

I found that result of this approach is a kind of creative chaos. It resolved tensions around groups getting stuck. But provided another tension around how much guidance to give learners in the code examples provided. For my group of novice coders I chose to provide almost complete code help. This was because I was looking to follow the Use Modify and Create pattern. This design helps build familiarity with code and the code environment.

One of the things game designs are good at are heling learner navigation, this brings us to the next M - maps

### Maps

I kept a journal and recorded sessions to identify learning tensions that blocked progress. Some of these tensions can be summarised as learner confusion about what they should do next or at the other extreme being overwhelmed at choices available, getting stuck or being unsure of what coding progress was being made. To try to resolve some of these tension I drew on the use of another technique from open world adventure games that of Maps.

The first step was to try to address issues of being unsure what to do next or jumping around from one thing to another without completing them. I printed out a large scale map of the different kinds of game pattern missions represented as different islands. When learners selected their next mission, they moved their counter onto that spot. Thus learners had to be intentional about their next steps. They also kept a track of the missions that they had completed by tracing a trail as they progressed. Having a physical map in my family setting this process was particularly useful to help the parents encourage goal setting and progressing from one task to another rather than getting stuck in a loop of asset design.

map of learning design

map of learning design

In addition this chaotic, colourful and visual representation served to encourage peer knowledge of what other people were up to, build a sense of community and to encourage reflection as each design patter was completed.

Maps can also be used retrospectively to help

The has been a growing tendency in socio-cultural research to look at the learning that is happening in any given activity from an observational perspective. That is to say that rather than deciding what you want to teach and planning around that, you choose an existing authentic activity and map the learning that actually happens in reality.

This is the approach adopted in an interesting research program which looked at hands on tinkering with Science exhibits in a museum setting. In an article called – It looks like fun but what are they learning –Bevan and Petrich worked with educators to examine video footage of families interacting with exhibits. The resulting map of learning dimensions is notable as not only are the underlying science concepts explored but, more general skills and attributes and helping behaviour common to an exploratory process is also present.

While this is an informal way of using maps the are other approaches that are more formal including one called a concept map which is a visual representation of target specialised knowledge. There is a section on concept maps as part of the teach computing website here. https://blog.teachcomputing.org/how-we-teach-computing/

### Methods (Inclusive)

The third M in this 3M framework stand for methods, these are broadly speaking educational, design and drama methods to support an inclusive process. These may help with participation and to maximise some of the potential benefits of game making explored in the first part of this chapter.

#### Fun, Interactive and Physical ways into Game Making

Making games lends itself well to creating a fun and welcoming classroom environment with links to the learning happening later in the session. In a family learning setting I was able to make the most of this by playing physical warm up games, playing video games on arrival leading to then analysing what made them challenging, .

Most computing teachers will be familiar with some of the positive impacts of Unplugged activities.

To add to the impact of playing games on entry. I ended up using some making some very simple arcade cabinets out of wood. The process of building their own versions was a very engaging activity and a fantastic target to work towards. Making the digital physical has been a guiding principle for inclusive learning designs for some time.

This can be done in very low tech ways with cardboard materials.

On these starting activities - see what kind of game player you are - opened up another very interesting method which I describe below.

#### Game Maker Types

As digital and online games became more complicated Richard Bartle proposed that players to get different things out of them. He created a test to finds out what kind of game player you are. https://matthewbarr.co.uk/bartle/

This model holds that there are four different kinds of player styles: Griefers, Achievers, Explorers, and Socializers. Achievers get satisfaction by progressing by playing by the rules of the game’s missions. Explorers discover the systems governing the operation of the game world. Socializers form relationships with other players by telling stories within the game world. Griefers (or Killers) interfere with the functioning of the game world or the play experience of other players. Open world games that allow you to choose how you play the game. If you want to stick to the main missions you can follow guidance to do that but if you just want to explore or be social or mess around you have the chance to do that too.

I propose there are also different styles of making games (but not that people fall neatly into any one category). Planners like to study to get a full knowledge of the tools and what is possible before they build up their game step-by-step. Social makers form relationships with other game makers and players by finding out more about their work and telling stories in their game. Magpie makers like trying out lots of different things and happy to borrow code, images and sound from anywhere for quick results. Glitchers mess around with the code trying to see if they can break it interesting ways and cause a bit of havoc.

I wondered if some of the frustration and confusion surrounding learners on-going participation was due to the diversity of the different approaches.

I noticed that sometimes parents would get frustrated at their kids messing around and creating tricky or impossible games. I could hear them struggling to bring their kids back into line with what they thought was the right way to go about making games. At the same time when I reviewed the tapes of what they were doing these young people were often exploring the code, making many changes, and inviting others to play their game for feedback very activity - which are excellent coding practices.

To address this issue I created some extra missions to suit these Glitcher game makers who enjoyed playing against the game. While I guessed planners wouldn’t need them, for magpie makers, and social makers I created other extra missions that might encourage or legitimise their favoured activity. Thus some of the missions were social in nature (Find out who plays the most computer games per week in your group), others were more anti-social in nature (add an usual sound to someone else’s project) and some exploratory missions that encourage feature sharing ()

These extra missions are available here - https://mickfuzz.github.io/makecode-platformer-101/missions

Also while many learners appreciated the quick progress and immediate feedback of patching code to add game design features, other learners wanted to know the full detail of the underlying template code. These planners appreciated having step by step tutorials that explained the code piece by piece.

#### Using a Drama Framework

We met the concept of using a fictional scenario or simulation to increase the authenticity of a project-based learning earlier in the chapter. There are well researched benefits which allow the rapid construction of a community of learners, which while less authentic than a professional community, can still provide some of the benefits.

I was lucky to be able to work with practitioners of Drama Education department at Manchester Met to work on a several process dramas with families, students and staff.

You don’t have to be a drama practitioner to introduce such a fictional scenario but there are some interesting techniques that we can draw on to make this process more engaging for learners.

For example, one which I asked trainee teachers to devise also worked well. Without the space to go into too much detail here are some of the benefits of using a fictional frame using the example of the fiction of making games for a alien race coming to destroy the earth.

* We were able to explore issues of gaming cultures, and hostility to them from a naive alien view point.
* We asking learners to step into a role. “As game designers, we will do Y”
* Drama creates a jeopardy and a commitment to the process
* I used the fictional audience as a way to encourage reflection in learners, at the end of each session they shared their games with the alien audience and talked through their design decisions and challenges.

## Challenges - and how they may link to a classroom setting

This sections acknowledges the complexity and diversity of classroom situations and the challenges of project-based game making within the constraints of the curriculum.

#### Prioritising Learning Dimensions

The potential dimensions of learning in Kafai and Burke’s review of research is very diverse including; 21st Century Skills, developing coding and information technology skills and teaching other subjects through cross curriculum projects. This potential put a responsibility on teachers to prioritise and promote certain learning outcomes over others.

Teaching in more formal environments For my study, I ended up de-prioritising more general communications skills (21st C skills) and highlighting coding concepts and systems concepts.

### Time considerations and classroom culture

Project-based approaches are often explored in after-school clubs or other informal settings, as the time needed to run authentic projects is often scarce due to competing curriculum demands. However they are successfully integrated into core school activities by many educators. Some of the ways to overcome this are explore in previous chapter.

### Starting a community from scratch

Finally, one of the most challenging but rewarding aspects of making games together was the building of a community of learners. As explored previously the benefits of sharing code, playtesting games and the value of the encouragement of peer learners are significant.

In all the programs I ran only one parent and one student had experience of coding. This process of starting up such a community from scratch is challenging. In the previous sections I have shared my tips to help build a small game making community. These include encouraging peer sharing with diversity of learner paths, narratives and activities to encourage group reflection, starting activities which build a team spirit.

At times I felt these community building activities took away from coding and problem solving. A frustration, it felt as if we were just getting going and time was up.

However I leave this to you as educators to resolve.

And don’t forget one last ingredients raw enthusiasm.

## Tensions (perhaps move some into 3M)(and into blog posts if not)

Focus on affordances of tools to build towards model and with inclusion in mind. ()

### Tension balancing simplicity of game making Tools and the flexibility of the product created.

There are several good options for game making depending on what your aims are. As computing teachers it is likely that one of our core aims will be building familiarity and fluency of use of code constructs.

### Tensions around starting code from scratch or from a template

Getting participants up and running from ideas, to a design to then starting to code too a long time when starting from first principles. In order to reduce the test of their patience I quickly adopted the use of a template to help them to get to grips with coding

The framework provided the following advantages, a working example of code syntax, and a structure of variables and functions already working together.

The combination of working with it, gaffer taping bits on to it, and then playing a game to analyse the core line by line.

One participant wrote “that was a great moment - when after struggling to add text on to the code, we played the code matching game. We realised how much we had actually picked up that process”.

Adding onto the template had helped the participant to read and understand code.

This is line with a lot of the research indicated that at good way of starting is by remixing and altering the code of others.

This is foundational to the Use Modify Create framework and also forms an important part of the Scratch community.

Without an existing community of games however I wanted to try another approach - that of using a Half Baked game. A concept was introduced to the field by Kynigos who describes the process of starting with a deliberately incomplete or inappropriate game to provoke students to change it.