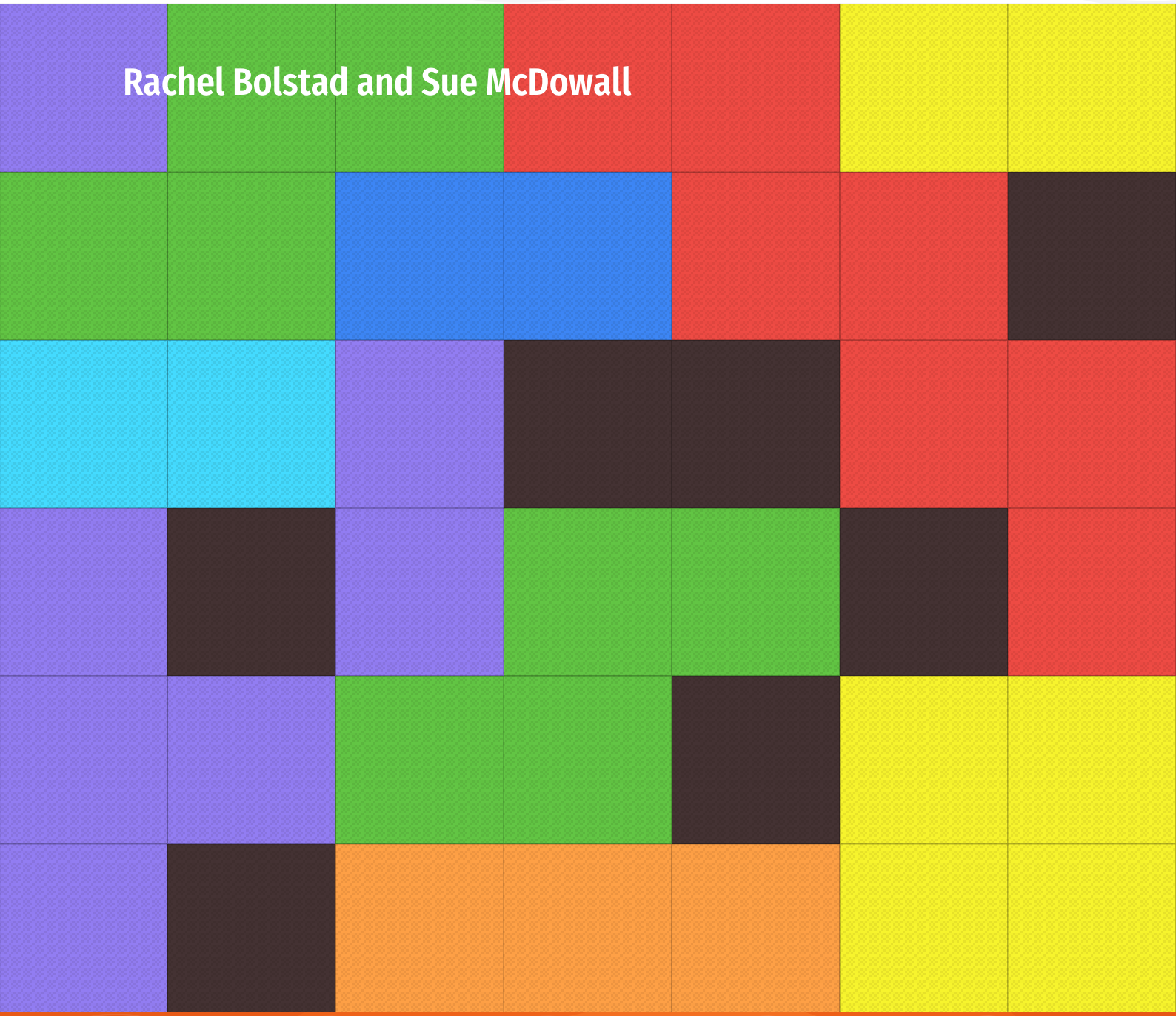
# Games, gamification, and game design for learning

## Innovative practice and possibilities in New Zealand schools

Rachel Bolstad and Sue McDowall



NZCER
Rangahau Mātauranga o Aotearoa

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## Innovative practice and possibilities in New Zealand schools

Rachel Bolstad and Sue McDowall

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GAMES FOR LEARNING
A RESEARCH PROJECT

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# Summary

This report discusses the potential of games to support learning, and what innovative game-based (or "gameful") learning and teaching practices can look like in a range of New Zealand school settings. Over 2 years, we undertook fieldwork in 14 schools, interviewed 21 teachers and more than 100 students ranging from Year 3 to Year 13. We looked at learning and teaching practices involving all kinds of games (physical, role play, tabletop, and digital), and how games, game design, or gamification fitted in with teachers' curriculum and pedagogical goals. We also undertook an extensive review of New Zealand and international literature, and convened workshops and a national conference.

A key finding is that educators who are open to working with the wide-ranging affordances of games apply creative and nuanced pedagogical thinking to the design of gameful learning. This generates an array of curriculum-linked learning opportunities, with an emphasis on "front end"[1] aims of *The New Zealand Curriculum* (Ministry of Education, 2007), development of key competencies, and creating an inclusive learning environment that supports and enables diverse strengths and interests to emerge, benefiting individuals as well as the collective.

## What makes games so engaging?

Many adults working in education recognise the "pull" of entertainment games on young people. Students we interviewed could easily articulate features of games that hooked them in and maintained their motivation. Games, they said, provided a sense of autonomy and creativity, challenge, and purpose, safe opportunities to "fail", and incremental information about how much progress they were making towards achieving in-game goals. Comparing their in-game learning experiences with their school learning experiences, students could pinpoint several things they felt games did better than conventional school activities. The questions teachers often ask are "How can we harness that sort of motivation for learning in other contexts?" and "How can we ensure that what students are learning through games is worthwhile learning?"

## How can games support school learning?

Game-based learning (GBL) is an umbrella term that describes all kinds of different practices that involve games. In GBL, students might be learning through playing, making, or analysing games, or through learning activities that have been "gamified". GBL can involve digital or non-digital games, games that have been designed specifically for a learning purpose, or commercial entertainment games that have been co-opted for a learning purpose.

1 For example, the vision, values, and principles outlined on pages 8–10.

In primary and intermediate classrooms, GBL often began with traditional and tabletop games. Teachers had multi-layered learning intentions in mind. These included: building social cohesion in the classroom; giving students a chance to develop and practise collaborative and problem-solving skills; and getting students to think and talk about what knowledge, skills, and capabilities different games required. Some secondary teachers and students were playing complex role-playing games to stretch students' critical thinking, problem solving, and ability to reflect on their learning both in the context of disciplinary learning and in co-curricular contexts.

Some schools integrate Māori games and play (tākaro) into the curriculum, particularly with regards to physical play and cultural learning contexts. Games were a mechanism for connecting with other forms of cultural diversity too; for example, when teachers or community members taught students games from their own cultural traditions, or students researched these as part of their own game design processes.

In some classrooms, GBL was geared towards the development of students' digital capabilities, and potential future prospects in science, technology, engineering, and mathematics (STEM) fields. Students developed these capabilities through playing and trying to make their own digital games, learning how to use a variety of digital tools, and gaining greater insight into how much work goes into the creation of the games they play.

In some classrooms, "gamification" meant that learning could be spontaneously "hacked" by both teachers and students to make it more engaging. In other classrooms, teachers shaped a larger piece of learning into an extended gamified "quest" for students, with learners gaining points, or achieving other intrinsic and extrinsic payoffs, levelling up, and so on.

Finally, some classrooms were reconceived as collaborative game design spaces, often associated with changes in the physical arrangements and social interactions within the classroom. Interactions in these collaborative spaces were underpinned by a pedagogical focus on "idea generation and improvement". This frequently led to specific "emergent" opportunities in each classroom, especially as students began to own and drive their own process forward.

## How does GBL benefit learners?

Teachers predominantly talked about the learning benefits of GBL in terms of key competencies and other cross-cutting and transferable capabilities. Teachers talked about students' engagement and motivation, a greater sense of cohesion, collaboration, and inclusion across the class, and ways in which GBL revealed unexpected strengths and interests in students. Teachers identified benefits to specific learners with learning, behavioural, or social inclusion challenges, or students they described as "quirky". Primary and intermediate teachers frequently talked about the engagement benefits of GBL in relation to literacy and numeracy, particularly for boys who were less engaged with these aspects of learning.

Students described learning about themselves and others through being part of a collaborative group, learning to take feedback, persist, and solve problems, and developing a greater appreciation of what goes into making the games they play.

## Can games help students learn subject knowledge?

Collectively, teachers described many ways in which specific instances of GBL supported specific subject or disciplinary learning. The GBL examples we saw touched on almost every learning area, including health and PE, science, technology (especially digital technology), social sciences, te reo Māori, English, mathematics, and the arts, but disciplinary-specific learning was always integrated with other cross-cutting learning goals. In general, teachers believed that games could be most effective in supporting

subject or content learning when game play (or game design) was woven into a well-thought-out pedagogical process that helped students to make explicit connections with subject knowledge. Teachers didn't think games were always the answer, or that they could replace all other modes of learning and teaching. Instead, their GBL pedagogies involved supporting students, through dialogue, to make explicit connections with particular knowledge concepts that they might be learning, or had previously learned.

## Challenges for implementing GBL

For teachers, challenges include:

- knowing where to start when you don't know much about games
- finding relevant games and GBL resources
- budgetary, technical, and logistical constraints
- colleagues or senior leaders questioning the value of GBL
- time.

### System-level recommendations for strengthening GBL in Aotearoa New Zealand include:

- **building teachers' pedagogical capabilities in GBL**, through professional learning and development (PLD) and communities of practice that encourage teachers to explore, innovate, and share ideas around GBL, and networking and collaboration opportunities between educators, students, and game designers and the game design industry, with an emphasis on collaboration, co-creation, and mutual learning
- **supporting equity, inclusion, and wellbeing for all learners** through PLD and resources that demonstrate how GBL can meet inclusive practice goals through intentional pedagogical and curriculum design, and targeted support to ensure equity of access and equity of opportunity for high-quality GBL for all young New Zealanders
- **strengthening development and discoverability of GBL resources** relevant for Aotearoa through curation and profiling of GBL resources that link with *The New Zealand Curriculum* (Ministry of Education, 2007) and *Te Marautanga o Aotearoa* (Ministry of Education, 2008), supported by reviews and case studies from teachers and students, and investment in high-quality Aotearoa-based GBL resources.

# 1. Introduction

Games for Learning was an exploratory research project undertaken by a small team of researchers at NZCER[2] between July 2015 and December 2018. The project began with a very broad question: "How can games help learners to develop their potential as expressed in the vision and intentions of *The New Zealand Curriculum?*"

The research involved fieldwork in 14 schools,[3] and interviews with 21 teachers and more than 100 students ranging from Year 3 to Year 13. We looked at learning and teaching practices involving all kinds of games (physical, role play, tabletop, and digital), and how games, game design, or gamification fitted in with teachers' curriculum and pedagogical goals. We explored teachers' and students' perceptions of games, and what they felt they could learn through playing, critically analysing, or making and designing games, or "gamifying" learning. In addition to the school-based research, we also undertook an extensive review of New Zealand and international literature, and convened several workshops and a national conference.

This report brings together the key findings from the project, and builds a case for the role that games, game design, and "gameful thinking" can play in supporting meaningful learning for diverse learners in a complex world.

## Why research games and their role in learning?

Games have a complex, and sometimes troubled, relationship with modern systems of formal education. Games may be viewed as a "natural" partner to learning, or as a distraction from learning. Sometimes, games are even considered to provide a dangerous kind of learning, generating concerns about violence or other unsavoury content, or fears about players' attention span, ability to socialise, or "addiction" to gaming.

This mixture of contradictory perspectives invites closer examination. Our research suggests that educators who take the time to dig deeper into games will discover a wealth of ideas and possibilities to enrich their practice. However, the rich affordances of games for learning may lead to pedagogical opportunities that disrupt certain norms associated with school-based practice. This can lead to some interesting opportunities—and challenges—for the game-curious teacher.

2 The team comprised Rachel Bolstad, Sue McDowall, and Elliot Lawes. Sarah Beresford was with the project from 2015–2016.
3 The schools in this study were all English-medium, and a limitation of this study is that it does not address game-related practices in Māori-medium contexts.

Games are systems designed for interaction. They are dynamic and can yield different outcomes. A whole range of things *might* happen in a game, but it is impossible to know exactly what will happen until play begins. This is especially true in games that allow many different possibilities, or give players many different choices during gameplay. For education systems that are used to planning and carefully managing learning in predictable, measurable increments, the slightly wild and untameable nature of games may feel—consciously or subconsciously—like a problem or a risk that needs to be managed.

On the other hand, when viewed through the long lens of human history, the natural fit between games and learning seems obvious. Games have existed for millennia, and, like any product of human culture, games have served a variety of different purposes in human societies, providing leisure and entertainment, helping to cultivate certain skills and knowledge, and passing on cultural and social norms from one generation to the next.

Somewhere along the line, modern Western culture seems to have fallen into a complicated love–hate relationship with games. David Parlett, an historian of board and card games, makes the generalisation that:

> It is largely because westerners tend to perceive games as childish, and play as antithetical to work, that so little attention has been paid to them as a subject worthy of serious attention. (Parlett, 1999, p. x)[4]

It seems that some of these assumptions about games and play—that they are at best childish and frivolous, or at worst, distracting and dangerous—have led many educators to overlook the theoretical, philosophical, and practical gifts that a game-based view of learning can offer. We believe they are often overlooked because they become difficult to research in ways that do justice to the subject matter.[5]

Educators who do take the time to give serious attention to games find they have much to offer. Many educators intuitively use games or game-like elements to make learning more fun and engaging for students. Teachers and students in our research sometimes described games as a kind of "learning in disguise", saying that students "learn without realising they are learning" or it "doesn't feel like learning, because it is fun".[6]

The idea of games as a Trojan horse for learning hints at the power of games to put players into a different state of mind, changing how they experience the world while they are in "play mode". Stromberg (2009) calls this "being caught up in play". Most people have some familiarity with that immersive "caught up" feeling when one's brain, body, and emotions are fully captured, and one is carried along in a pleasurable state of flow. For some people, it happens when playing games; for others, it happens when enjoying other forms of entertainment (e.g., books, films, or television). Curious educators who observe young people thoroughly absorbed in play or games may start to wonder about how to get the same level of engagement with other learning activities. As one teacher in our project put it:

> Something happens when students start playing games, and I want to understand what that is. (Teacher, Years 7–8)

Dozens of students we interviewed were able to articulate how they felt when they played games, and what kinds of things they had learned from games. At times, students' excitement in talking about games (or their own game designs) built to such a level that they were physically unable to contain themselves in their chairs. They would crowd forward around the interview tables, asking us more questions to try to keep the interview going even after we felt it had reached a natural conclusion. One group of Year 10 boys

4 Parlett notes that the idea that games are a childish pastime is ironic, considering that "the playing of formal games—as opposed to 'just playing'—has throughout history been an essentially adult activity" (Parlett, 1999, p. x).

5 See Bolstad and Roberts (2018).

6 The implicit idea within these turns of phrase is that what is learning is not fun, and what is fun is not learning. The deep cultural and historical roots of these ideas, and their implications for learning and society, are discussed extensively in the game studies literature as well as in the fields of play and play-based learning.

who had spoken passionately about the role of videogames in their lives and learning for almost an hour said, at the end of the interview:

> This is like the most we've ever talked, and like talked about something we actually wanted to, at school. (Student, Year 10)[7]

These visible signs of students' engagement were of great interest to teachers in our project. They used words like "fizzing", "buzzing", and "humming" to describe a dynamic shift of energy and engagement that they had observed in their classes when students were playing or making games. But why did those games "work"? Would they work for all learners? As teachers, how could they most effectively work with the affordances of games?

## Working with teachers to identify questions worth exploring

Early in the project, we convened workshops in Wellington and Auckland, each attended by around a dozen "game-curious"[8] primary, intermediate, and secondary teachers, and a few people working in education-related game development. We wanted to hear about teachers' current game-related ideas and classroom practices, and what sorts of questions they wanted to see explored through the research. The attendees ranged from self-described "noobs" (people with little to no personal experience with digital games) to self-identified "gamer" teachers.

We used gamestorming[9] techniques to get everyone's questions about games for learning onto post-it notes on the wall, then analysed the questions or comments generated across both workshops to identify major recurring themes (Table 1). Teachers' questions ranged from the very practical (e.g., "How do we keep up with trending games?" and "What kind of games should I be using in the classroom?") to the more philosophical "Why do people love games?", "What makes a game good?", and "Could games ever replace schools?" Given the overall breadth of possible questions to pursue, it was clear that the research focus would need to be both broad and deep, seeking to integrate answers both from theory and practice. Many of the questions generated during the workshops were carried forward into our school-based interviews, and emerging data were shared in blog posts produced during the project.[10,11]

The methodology for the project is described in the Appendix.

## In search of a richer way to talk about games and learning

Stromberg points out that "precisely because it is so pervasive, entertainment is difficult to understand and even to talk about" (p. x). As it turns out, games and the experience of play are both harder to understand, and harder to talk about than you might think—especially in educational settings. One reason for this is the persistence of negative stereotypes. The stigma associated with games was visible in comments from some game-using teachers who felt they needed to "close the curtain" when using games in the classroom (see Section 6).

7 See http://www.nzcer.org.nz/blogs/under-blood-learning-what-students-wish-parents-and-teachers-understood-about-gaming-written

8 This was a term we used frequently throughout the project, to attract teachers who might be at any stage or depth with game-based learning practice, from "curious but not yet doing" through to "expert game-using teacher".

9 See Gray, Brown, and Macanufo (2010); also www.gamestorming.com

10 For example: "What motivates game-using teachers?" and "Why are students so prepared to fail in games but not in their learning?" See http://www.nzcer.org.nz/blogs/games-for-learning

11 Though it is impossible to address every question included in Table 1 through our project, there is other literature that provides good starting points for the pursuit of most of these questions. Some of the questions we have not attempted to answer directly through our project have been fodder for ongoing conversations we have had with game-using, game-curious, and "game wary" educators, game designers, and students over the course of the project.

Negative connotations around games were often—but not always—linked with digital games. Yet some teachers embrace digital games and game design with enthusiasm. Since the earliest days of accessible computing, there have been educators utilising the affordances of digital games for learning. Over time, this has included the development of simple programming languages that enabled students to create their own games, the development of 2D games, virtual worlds,[12] 3D games, kinetic games, virtual reality (VR) and augmented reality (AR), and other newly emerging technologies. The idea that the future of learning will involve digital games as a matter of course is hinted at in a Ministry of Education draft document envisioning learning in 2025.[13] With the recent addition of new material relating to digital technologies and hangarau matahiko in the curriculum, it is certainly timely to consider the role and contribution of digital games and game design in New Zealand classrooms.

Our project set out to examine the role and contribution of games and game-related activities—both digital and non-digital—for learning in New Zealand classroom settings. Based on what we learned from current and emerging practices and research, we offer guidance about effective pedagogies for integrating diverse forms of game-based learning into education, as well as policy implications.

12 For example, *Second Life* or virtual worlds designed specifically for children such as *Quest Atlantis.*
13 See http://www.education.govt.nz/assets/Documents/Ministry/Initiatives/Lifelonglearners.pdf

TABLE 1 **Teachers' questions categorised by theme**

| Theme | Example questions or comments |
|---|---|
| **What kind of games to use in the classroom** | Can one game suit/engage an entire class?<br>How do we keep up with trending games?<br>What games can a whole class play with each other at the same time? |
| **Student motivation to learn through games** | Why are kids so prepared to fail in gaming but not their learning?<br>Why do some kids want to stay at a low-risk end of games and not challenge themselves?<br>Who owns the learning and expertise in games?<br>Why do people love games?<br>What makes a game good? |
| **How to measure or evaluate game-based learning** | Is there always learning involved in games? How do we measure learning?<br>How are games a better medium to learn through? Than what?<br>Does it need to be assessable? Can't it just be about the process (rather than the outcomes)? |
| **Where do games fit within the structures of schooling?** | How do we justify using games in the classroom?<br>Could games ever replace schools?<br>Are we trying to make games "fit" into curriculum or do we need to flip it?<br>How does gamification fit into a credit-counting system?<br>How can the principles of game design infuse all teaching?<br>How can gaming connect to critical pedagogy? |
| **Game design and game creation** | Is game development completely different as a "thing" compared with game playing?<br>What does game design and development look like in the classroom?<br>How do the games children make draw on the games they play and the other media they consume? |
| **The social/intellectual effect of gaming in learners' lives** | Is a focus on winning (in games) having long-term social effects?<br>Is a game just a game to a child, or can they be more emotionally connected/invested?<br>Does gaming impact on traditional age-based levels of education?<br>So many games [that] involve war and killing are so engaging for students. Why? |
| **What motivates game-using teachers?** | What motivates teachers to use games at school?<br>What help do teachers need to start using games in school? How do they get it?<br>Is there one essential idea that all game-using teachers share that makes them different? |
| **How gaming and gamers are regarded** | What does culturally responsive pedagogy for gamer students look like? How can their gamer culture be recognised in schools?<br>What is the impact of the negative messages gaming students get about gaming from parents or teachers (or peers)? |
| **Games and adult anxieties** | Why are (some) adults fearful of games?<br>Why are some people in senior management worried about gaming in school? |

# 2. What makes games so engaging?

Adults working in education may recognise the "pull" of games on young people, but, as we discovered, many have had little exposure to the extensive body of research knowledge associated with games. There are several places to go looking for this knowledge. First, games and play have been extensively studied within academia, beginning with historians and cultural theorists who considered the origins, evolution, and cultural meanings of games and play (Callois, 1961; Huizinga, 1949). As games have diversified and become more complex, the field of game studies has grown into an established, multidisciplinary field, producing many books, journals, courses of study, professional conferences, and associations dedicated to the rigorous study of games, their play and design, and their potential contributions to domains such as education and health.

The second place to look for relevant knowledge is within the games industry. Around the early 20th century, games started to become successful commodities. The 20th century saw the emergence of the first commercially successful game designers[14] who capitalised on the burgeoning potential of tabletop games as a middle-class recreational pursuit (Donovan, 2017; Pilon, 2015). The diversity of game genres and game mechanics has continued to expand and proliferate over the past 40–50 years, notably in the digital environment.[15] The global games industry, said to be worth upwards of $90 billion per annum, has collectively amassed a wealth of knowledge about games, including how to make them as engaging and enticing as possible.[16]

14 Examples include Milton Bradley and George Parker, of Parker Brothers, both of whose names became synonymous with 20th century tabletop games. Another game designer who was largely forgotten for almost 100 years is Elizabeth Magie, a social activist and the inventor of a game called *The Landlord's Game*. Her game was later modified and renamed *Monopoly* by Charles Darrow, who became the first millionaire game designer. Magie's story is an interesting example of how game history intersects with social history (see Pilon, 2015). See also https://99percentinvisible.org/episode/the-landlords-game/

15 Early computer designers were tinkering with simple computer games at least as early as the 1940s, and from the 1970s onwards, arcade and home video game systems were beginning their rise to ubiquity. As computing power increased, and new programming languages were invented, the visual sophistication and complexity of digital games increased. Gaming quickly adapts every new and emerging technology, from mobile phones, to VR (virtual reality) and AR (augmented reality), and whatever else is yet to come.

16 Knowledge about how to design games that attract and retain players is just one of many valuable knowledge discourses in the industry. As well as exploring the potential of new and emerging technology platforms for gaming, and monetisation, there are also discussions about the need to recognise and design for the diverse interests and experiences of players, and the importance of having diversity *within* the industry itself so that games reflect many different worldviews, perspectives, experiences, and tastes.

Knowledge that has been developed in academia and industry provides key insights into how and why people engage, stay engaged, interact, and learn in an environment that often looks very different from the learning environment of a traditional classroom. However, for educators new to games, it can be difficult to quickly find and absorb all this knowledge and determine how it might apply to their work. Fortunately, there is another quick way in to understanding what makes games engaging: talking to the people who play them. This section foregrounds students' perspectives on games, engagement, and learning, and then considers what the literature has to say.

## Student views on why games are engaging

In the first year of the Games for Learning project we interviewed many students about their experiences playing games in their personal lives, why they found games engaging, and how this compared with their experiences at school. When explaining their engagement with games—digital games in particular—students discussed features such as autonomy and creativity, challenge, and purpose.[17]

Students liked the feeling of autonomy they had when playing digital games, with the power they had to shape the direction of their game play. They felt like they could "influence what happened", and had the power to do things in games that they could not do on their own in their everyday lives. Some games, such as *Minecraft*, amplified their sense of creative possibilities.

> You get to use your imagination, your autonomy. You get to choose your own players in the game, and whatever you choose you get to do. (Student, Years 7–8)
>
> It's creative freedom. It's kind of like letting your creative mind shine through. (Student, Year 10)

Students found the challenging nature of games engaging. Games required focus, concentration, and "hard thinking", and that this was part of their appeal.

> Most game makers make them really hard so you have to problem-solve to do it. It has to be really challenging. (Student, Years 7–8)
>
> The creativity helps you think in more complex ways. (Student, Years 3–4)
>
> Strategy games actually get you to think. They expand your mind. (Student, Years 7–8)

Students described having a strong sense of purpose when playing digital games, and of being deeply invested in that purpose.

> There's a goal—something you want to reach towards. (Student, Years 5–6)
>
> A good game has to have a point or a reason. (Student, Years 7–8)

In contrast to the games they played, students did not always understand the purpose of much of their school learning, especially when they experienced skills and content taught in isolation, as ends in themselves. Students were not always aware of why they were learning them or how the skills and content they were learning would be of use to them.

We asked students if any of the learning they did at school made them feel the way they did when gaming. The most frequent response, especially from the younger children, was creative writing, free choice reading, or art—activities that, like games, are more open-ended with multiple ways of making meaning or solving problems.

17 See https://www.nzcer.org.nz/blogs/what-makes-learning-through-games-so-engaging-written-sue-mcdowall

> Yeah—with writing I want to keep going. (Student, Years 5–6)
>
> Yes—with reading—free reading. (Student, Years 5–6)
>
> Like when you get absorbed into the narrative, like when you're reading a book and kind of forget it's not real life—you forget that it's just a story. If you can get absorbed and forget it's kind of the best part. (Year 13 student)

Several students from one class also compared the learning they did when playing games with the learning they did in science, observing that both required learning through trial and error, and through problem solving.

> Science is like a game. You're figuring out what's going to happen at the end. (Student, Years 3–4)
>
> Yeah. It [science] is like in *Minecraft.* You have to choose the best material and you have to have a strategy. (Student, Years 3–4)

Some of the students we interviewed acknowledged that some games they enjoyed appeared violent, but claimed that this was not the main attraction to playing them. This was one of the things students said they wished parents and teachers understood about gaming.[18]

## "Failure" in games, compared with failure in school

Many teachers were curious about the resilience and perseverance learners often showed when failing in a game, and wondered why this motivation to keep trying didn't necessarily seem to transfer into their school work. One teacher described a conversation she had with the students in her class about this.

> I said to them, "Well how can we transfer all of those skills into your academic work? How is it when you get a maths question, as soon as you can't do it you give up?" And then, just this silence fell over them. And I am like, "I know. I don't have the answer either". And it was a bit of a revelation for all of us that they were prepared to play a game and fail, fail, fail, fail, and still want to play it. But in their academic work if they fail it, it is just this huge block. (Teacher, Years 7–8)

In the first year of the project, we blogged about what students had to say about this question.[19]

### Instant feedback and opportunities to "try again"

When playing games, students said they got instant feedback, which made it clear what to do differently next time. They also had immediate opportunities to apply what they had learned by "trying again". There was, in contrast, a dearth of instantaneous feedback about what they were doing well or not well at school and a lack of opportunity to rapidly try and retry. These fast cycles of feedback and re-attempts motivated students to persevere.

> In a game if you die you can start again. At school, if you fail, you'll still be on the same level. (Student, Year 6)

### Recognition of progress

Games provided the motivational pay off—the "ding" of gratification or reward through recognition of improvement or progress. While students might repeatedly fail at a particular level, information about improvement (e.g., how close they got in their sixth failed attempt, compared, for example, with their second) kept them motivated. In contrast, students saw achievement at school as being constructed in terms of pass or fail, rather than in terms of progress.

18 See https://www.nzcer.org.nz/blogs/under-blood-learning-what-students-wish-parents-and-teachers-understood-about-gaming-written

19 See original post at https://www.nzcer.org.nz/blogs/why-are-students-prepared-fail-games-and-not-school

> With maths you might keep trying to get the answer right but with games you might keep trying to get better—like win a quest or get to another level. (Student, Years 3–4)

The recognition of progress in games meant all students could experience some level of success. In contrast, some students may not feel as though they have any chance of success at school, and this decreased their motivation to try. Some students felt there was a personal stigma associated with failing at school.

> If you know you're going to fail you don't try. It just blows your whole mind. (Student, Year 10)

> With school [compared with games] you know you're like a bad student if you don't do well and you're put into the bottom class … and everyone's thinking you're dumb and that. (Student, Years 7–8)

With games, losing was acceptable—even expected—especially when playing for the first few times. Students also liked the way in which, if they failed a level, they could try again from the point at which they failed.

> A good game—you have to be able to come back to it, keep playing, come back to it. (Student, Years 7–8)

## What research tells us about games, motivation, and learning

These findings are consistent with Gee's (2003, 2013) ideas about the ways in which games "work" to keep players motivated, involved, and learning. Gee describes good game designers as "practical theoreticians of learning" because they know how to design games in which players are learning[20] without knowing it (Gee, 2013, p. 21). Gee tells us that good video games empower players by allowing them to customise game play or by allowing for different ways of playing; providing characters that players want to identify with or can co-construct through, for example, the selection of traits; and allowing players to easily manipulate characters and objects to meet their goals. Good games support problem solving by: providing problems that are well-ordered in terms of difficulty and progression; adjusting challenges and providing feedback so that the experience is just difficult enough, and so that players know what to do next; providing cycles of practice, tests of mastery, and new challenges; providing information on a "just in time" or "on demand" basis; beginning with a stripped down or easier versions of the game so that new players can understand the game's structure, and experience early success; and providing opportunities to practise skills in the process of accomplishing what players want to achieve. And, finally, Gee argues that good games support understanding by providing players with opportunities to understand the system of the game and opportunities to link words and concepts with experience. The responses of the young people in our study are consistent with what Gee and other theorists[21] say, and affirm that young people are capable of articulating the features of games that hook them in and maintain their motivation.

The questions teachers often ask are "How can we harness that sort of motivation for learning in other contexts?" and "How can we ensure that what students are learning through games is worthwhile learning? We explore these questions in Section 3, which looks at examples of game-based learning in New Zealand classrooms.

20 That *some kind of learning* occurs when playing games is indisputable—as Farber and Schrier (2017, p. 6) note, "players cannot help but learn while playing a game … even if it is just a glimpse into a new world, view, system, or set of rules". The question that educators often ask is whether what players learn in a game is worth learning.

21 See, for example, Kapp (2012); Salen (2008); Young and Slota (2017).

# 3.

# How can games support school learning?

There are many ways to weave games into learning and teaching practices. These practices are described in different ways, using terms such as "gamification", "gaming", "game design", and "learning games", but the meaning of these terms isn't always clearly defined or understood, and they can mean different things to different people.

One way to discuss different game-using practices might be to split them up according to different types of games used (e.g., physical games, tabletop games, role-play games, digital games), or according to the relationship between the games and the learning activities (e.g., whether students are learning through playing games, or designing them, or whether teachers are using "games" or "gamifying" classroom activities). However, in the classrooms we observed, these practices were frequently intermingled, and boundaries between different types and uses of games were fluid.

## Game-based learning: An overview

The term game-based learning (GBL) has emerged as an umbrella term encompassing a broad swathe of learning activities.[22] GBL can include playing games, designing and making games (including hacking and modding[23] existing games), analysing or critiquing games, and gamification.[24] GBL can involve any "type" of games, including digital games, non-digital games, games that have been designed *specifically* with an educational purpose in mind (i.e., learning games, educational games, or "serious games"), and commercial off-the-shelf (COTS) or entertainment games that are co-opted for a learning purpose.

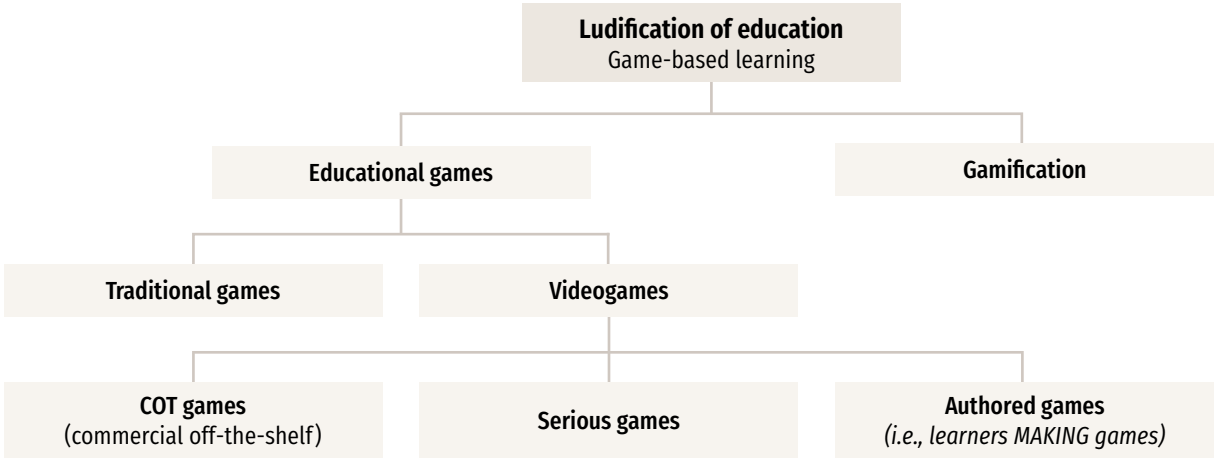
22 Some researchers and expert practitioners are cautious about the term "game-based learning". Shapiro, Salen Tekinbaş, Schwartz, and Darvasi (2014 p. 40) suggest it "seems to be a misnomer, as the learning is not based on games, but enhanced by them". They describe games as "elastic tools" that can be "repurposed and modified to support curricular goals, as opposed to driving them". Some people prefer to use other terms such as game-infused, game-inspired, or "gameful" to describe the rich variety of practices in which games can be woven in, around, and through learning. In this report, GBL is used as a gloss for all these terms.

23 Short for "modifying", this can include users modifying software or hardware to perform a new function or achieve a bespoke specification.

24 In layman's terms, gamification refers to the use or integration of game elements into a non-game context. Turning a learning activity into a challenge that involves wins or points, for motivational purposes, is one simple example. Karl Kapp's definition of gamification: "using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems" (Kapp, 2012, p. 10).

The various facets of GBL listed above are often researched as discrete areas in the academic literature. For example, Martí-Parreño, Méndez-Ibañez, and Alonso-Arroyo (2016) proposed a typology for classifying game-based learning (they call this ludification[25] of education), represented in Figure 1, with minor modification (*in italics*). Their typology differentiates between learning that involves actual "games" (which are further divided into different types of games), and "gamification", which can be defined as infusion or integration of some game elements (such as challenge, competition, points systems) into a non-game context.

FIGURE 1 **A typology for ludification of education, proposed by Martí-Parreño et al. (2016)**

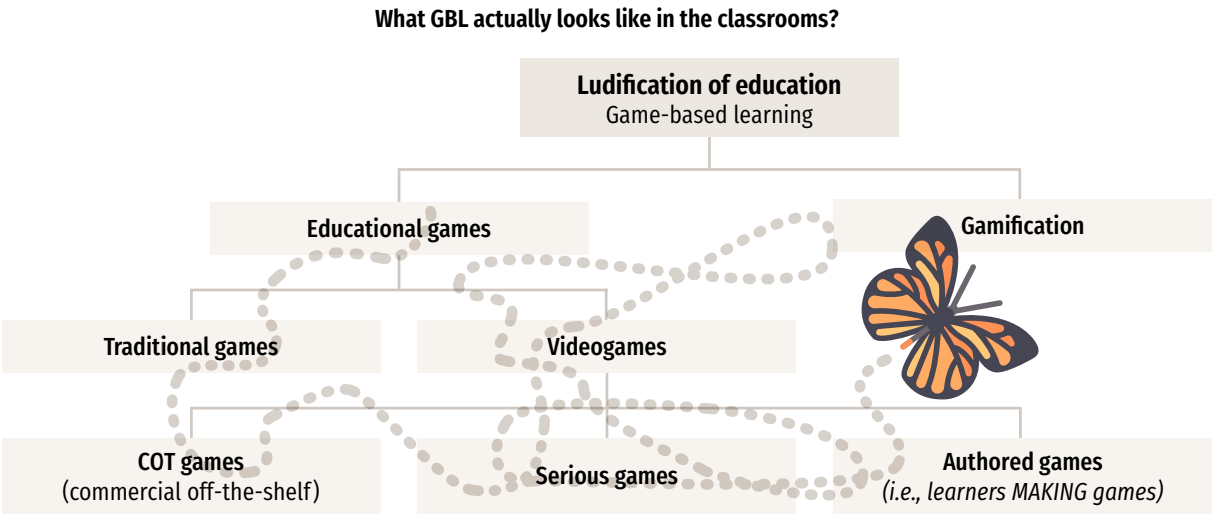



Martí-Parreño, J., Méndez-Ibañez, E., and Alonso-Arroyo, A. (2016).

In classroom settings, we saw a high degree of fluidity *and* interplay *between* these different forms of game-based learning. To use a visual metaphor for what we saw in classrooms, imagine a butterfly fluttering all over this typology (Figure 2).

25 The word ludus refers to games. Dutch historian and cultural theorist Johan Huizinga was responsible for revitalising this word from the classical Latin word *ludere*, which has several meanings including play, game, pastime, sport, fun, and school. Huizinga noted that many modern languages don't have one word that covers all different forms of play or playfulness. Instead, they have many different words that connote different kinds of play; for example, differentiating between games of competition versus more free-flowing activities such as hopping, skipping, or dancing, or the sense of joking, jesting, or being light-hearted in one's engagement with an activity. The Latin word ludus therefore stood out to Huizinga in that it seems to cover the "whole field of play", covering "games, recreation, contests, liturgical and theatrical representations, and games of chance" (Huizinga, 1949, p. 35).

FIGURE 2 **What GBL can look like in classrooms**




Teachers and students were often dabbling in different modes of GBL. Sometimes they were playing games, sometimes they were making them. Sometimes they were engaging with digital games, sometimes traditional games. Sometimes they were gamifying learning. Their initial explorations into games, game design, or gamification often ended up snowballing, going deeper and wider than teachers had initially anticipated. This led to emergent learning opportunities that they had not necessarily planned for from the beginning.

Leading GBL researchers advocate taking an *ecological approach*[26] (Salen, 2008; Young & Slota, 2017). This includes exploring not only the learning affordances and effectiveness of games, but also teachers' and students' beliefs, expectations, and interpretations of the games they are engaging with, as well as their ideas and beliefs about learning, teaching, and the curriculum (e.g., A. Bell & Gresalfi, 2017; Prestridge, 2017).

We took a similar approach in the detailed case studies already published from the project (Bolstad, 2017, 2018), and it is our view that GBL is best understood through "zooming in" on rich accounts in context. As the field of GBL research matures, it is becoming easier to find richly detailed accounts of diverse practices in diverse learning contexts. We discovered many recent international publications with strong parallels to our project

The rest of this chapter describes a breadth of practices in New Zealand schools and classrooms, and the pedagogical intentions behind them.[27]

## Getting started with traditional and tabletop games

In primary and intermediate classrooms, GBL often began with traditional and tabletop games. Teachers had multi-layered learning intentions in mind. These included: building social cohesion in the classroom; giving students a chance to develop and practise collaborative and problem-solving skills; and getting students to think and talk about what knowledge, skills, and capabilities different games required. These

26 Ecology refers to the branch of biology that deals with the relations and interactions between organisms and their environment, including other organisms, but it can also be used in a more generic sense to describe the set of relationships existing between any complex system and its surroundings or environment.

27 Most of the examples are drawn from our school-based fieldwork, but some examples come from the conferences and workshops that were convened as part of the Games for Learning project.

ideas were woven into ongoing conversations about what "learning" means, and how in-game learning might relate to other contexts. Sometimes, traditional and tabletop games were the springboard for the class to start exploring other kinds of games, including digital games, as preparation for moving into the design of their own games.

Diana-Grace, a Years 7–8 teacher, got started with game-based learning when an RLTB,[28] who came into her classroom every Monday for a term, introduced traditional/tabletop games to help develop students' social, collaborative, and learning-readiness.

> We did a lot of traditional games, netball, marbles and pulled out all the old school [games] and some of the newer board games and it was really successful [for building engagement and social cohesion] … I thought 'We are onto a winner here …" (Diana-Grace, Years 7–8 teacher)

As students were very keen on digital games, Diana-Grace encouraged them to find, explore, and play online games as well—provided those games were "collaborative". This helped to build a classroom culture where games and gaming were viewed as a shared group experience, rather than an individualised activity. This collaborative culture continued to be fostered as students moved into game analysis and eventually game design.

At Hutt Central School,[29] a syndicate of four teachers rented a large box of tabletop games and gave students time to select, learn, and play during class time, modelling to students that this was a worthwhile use of their learning time. The teachers encouraged the students to figure out how to play the games and notice things about different games. Some games were not easy to learn.

> It was really obvious the soft skills and the key competencies were developing, right from the start. The first afternoon … at least two kids were in tears, because you know "the rules didn't say that, and they weren't letting me do this"… By the end they were sitting down and playing it, reading the rules. They were negotiating, establishing differences on the rules, and that was really obvious soft skill development. (Adam, Years 5–6 teacher)

Teachers encouraged classroom conversations that helped students to reflect on their gameplay and recognise how this connected with learning. These metacognitive conversations helped students to see that "they are learning more than they realise".

> We're not just playing a game for the sake of playing it; we're thinking "Why do we like this game? What are the parts of the game? What is the game making us do? What do I need to do to be good at this game?" (Adam)

## Using complex role-play games to stretch secondary learners

Some secondary teachers and students were playing complex role-playing games. These teachers often played complex role-play games themselves, and were confident facilitating learning around the games, and allocating time for the complexities of the game to unfold. We saw examples where these games were used to stretch students' critical thinking, problem solving, and ability to reflect on their learning both in the context of subject classes, and in co-curricular contexts.

28 Resource teacher: learning and behaviour.
29 For a detailed case study, see Bolstad (2018).

At Wellington High School, history teacher Andrew carefully selected and facilitated complex tabletop and role-play games with his senior history students, aiming not to "teach history" through games, but to get students to consider the complexity of social conflicts, and provide another lens for reflecting on conflicts they studied in history. One role-play game with Year 13 students—the Tanderian Simulation—took six class periods from start to finish. Students took on different identities in a fictional scenario where an ethnic and political conflict had erupted, and their job was to broker a sustainable peace agreement between the factions that were in conflict (see Bolstad, 2017).

Secondary school teaching colleagues Pete (mathematics), Justin (science), and Jeremy (English) were interested in games that called on students to think, problem-solve, and stretch themselves—particularly students whose needs and interests were not necessarily well met by other school curricular and co-curricular activities. The teachers used games within their subject teaching to an extent; for example, co-operative boardgames such as *Pandemic* (in science) and role-play games such as *Werewolf* (in English). However, they also wanted to give students time to focus on the open-ended learning opportunities that the games offer, unconstrained by learning area, time, and assessment demands.

This led to the initiation of co-curricular gaming opportunities such as a weekly after-school gaming club, and an end-of-year "gaming camp" for Year 10 students. The teachers likened this to other co-curricular learning, such as school camps, where students are frequently encouraged to try new things and step out of their comfort zones.

> … in gaming we get them to do that as well. You know, 'do the game that's got a really complicated monetary system' or 'do the game that's got, you know, really complicated statistics', and then in role-playing … we say: 'Right, it's okay to play that female cleric. You've got to role-play that role.' (Teachers)

The teachers described role-play games as a kind of "next level gaming … because they're so immersive". The teachers felt games could help students become better problem-solvers, become "experts", and master things that weren't necessarily easy to achieve.[30]

## Valuing culture through games

Some schools[31] integrate Māori games and play (tākaro) into the curriculum, providing a broad range of opportunities to strengthen mātauranga Māori, te reo Māori, and the cultural, social, and historical connections that can be made with different tākaro and kēmu (games). Māori physical play and game traditions can also be aligned with Sport NZ's principles of play,[32] and the goal of ensuring that young people develop a lifelong love of community sport and being physically active.[33]

30 Read more at: https://www.nzcer.org.nz/blogs/what-motivates-game-using-teachers-episode-2
31 The role of games and tākaro in Māori-medium kura was not directly explored in our project, but we hope that future work can be done in this area.
32 See https://issuu.com/sport-nz/docs/sport_20new_20zealand_20play_20prin?e=5937312/55399533
33 See https://www.sportnz.org.nz/assets/Uploads/attachments/About-us/SportNZ-LetsGetFun-v01.pdf

Harko Brown is an educator and advocate for ngā taonga tākaro. The notion of games and play as a taonga—a treasure that one generation safeguards and hands on to the next—provides a counterpoint to the low regard sometimes given to "games" in contemporary Western culture. As Brown notes, traditional tākaro were highly localised in nature, reflecting the diversity and creativity of different iwi and hapū.

> Māori thrived on diversity, on intellectual curiosity and stimulation and differences were a key part of hapū life because they morphed out of their environmental habitats, which were never alike from tribe to tribe. (Brown, 2016, p. 27)

Brown's work has included researching diverse customary play practices in different iwi and rohe, as well as innovating new games and sports that weave together traditional practices with game and play traditions from a range of cultures around the world. He encourages utilising natural and locally-sourced materials (shells, flax, wood, etc.) to create the implements for play and games.

Brown's work shows how teachers and students can adopt place-based approaches,[34] exploring traditional tākaro from their local area, as well as taking a localised approach to the development, revitalisation, or modification of their own unique tākaro. These approaches align well with guidance from *Te Takanga o te Wā*,[35] guidelines for teaching Māori history in Years 1–8.

Digital gaming provides another avenue for strengthening mātauranga Māori, particularly through endeavours that support Māori game developers and emerging game developers (rangatahi) to design and create games grounded in kaupapa Māori and te reo.

One international example that has captured the imagination of many is *Never Alone (Kisima Innitchuna),* an award-winning game developed by E-Line in collaboration with an Alaskan Indigenous community, the Iñupiat. *Never Alone* was designed to support the passing down of Iñupiat language and cultural knowledge. The core mechanics of the game are built around Iñupiat values such as interdependence, and players can unlock cultural insight videos to hear stories and knowledge from members of the Iñupiat community. Amy Fredeen, the lead cultural ambassador for *Never Alone*, was a keynote speaker at the 2017 Games for Learning conference,[36] and inspired and connected with a number of Māori game developers while in Aotearoa.

Maru Nihoniho is one of Aotearoa's Māori game developers, and also presented at the Games for Learning conference.[37] Maru's games include *Tākaro*, a game designed to engage young Māori in STEM, and *Guardian*,[38] an interactive which explores Māori culture through a "Choose your own adventure" style of play.

At the time of writing, other initiatives were underway around Aotearoa in relation to Māori game development, including projects by Māori game developers to tell Māori stories through games,[39] and programmes that aim to support young Māori to learn through digital game design and game development.[40]

34 See http://maorihistory.tki.org.nz/en/programme-design/place-based-education/
35 See http://maorihistory.tki.org.nz/en/programme-design/te-takanga-o-te-wa-maori-history-guidelines-year-1-8/
36 See www.nzcer.org.nz/blogs/exploring-and-extending-culture-through-games-amy-fredeen-never-alone
37 See www.nzcer.org.nz/blogs/game-developers-educational-mission-dan-milward-and-maru-nihoniho
38 See https://www.metia.co.nz/guardian-game
39 For example, see https://koidigital.io/titans-of-aotearoa
40 Examples include Digital Natives Academy (https://digitalnatives.org.nz/) and Te Hiko Tākaro (https://www.pataka.org.nz/te-hiko-takaro-game-development-club/).

We saw other examples where games were a mechanism for celebrating cultural diversity within the school and community. In one primary school, students learned a range of traditional games from parents from diverse nationalities. In another school, a junior primary teacher noted that "a lightbulb went on" for her when she heard another teacher describe using traditional Chinese games for learning mathematics. This made her think about using games as a possible conduit for engaging with the large population of Chinese new immigrant families in her school.

> That could be a fantastic way to get our [community] on-board. "Come and teach us how to play Mah-jong". We get a lot of the grandparents that will sort of stand [outside the door for drop offs and pick ups]. … maybe if I just put some Mah-jong tiles just inside the door so they have to step over the threshold, [they would] come in and show us how to make this part of our learning. (New entrant teacher)

## Building digital capabilities through digital game design

In some classrooms, GBL was geared towards the development of students' digital capabilities, and potential future prospects in STEM fields. In these classrooms, playing and making digital games were valued learning activities, linking students with industry tools and practices, and cultivating their problem-solving and design skills.

Sheridan, an HOD of digital technology at a boys' high school, had been re-orienting the Level 1 digital technology course, shifting away from a focus on MS Office-based computing skills, and instead selecting achievement standards that suited a "game design curriculum". Part of her motivation for making this change was that many Māori and Pasifika students were not continuing from Level 1 into Level 2 and Level 3 digital technology courses.

> I thought, I've got to change my Level 1 programme to try to engage and retain these students … So I was thinking "How can I do that?" The natural thing was gaming, because that's what the boys thought they'd be doing in digital technology.

Over the course of the year, the students undertook research into digital games, including playing 1980s Commodore 64 games, through to looking at emerging fields such as virtual reality and using Google Cardboard. They worked through a storyboarding process, and designed game objects that they then created through 3D modelling and 3D printing. They built games in Gamefroot, a digital 2D game-building platform, and wrote about computer science concepts they were learning. The final step was to use graphic design tools to mock up a product and packaging "as if they were to put it their game up on the App store, what that would look like, with description, screenshots, etc.".

> All I want them to get out of [the game design process] is to think. [About] the development of the game, the logic of how these things work … the problem-solving, "How do we make it do this or that?" If they pick up a few programming skills or a few design skills along the way, all well and good, but [for me] it's all about thinking and problem solving. (Sheridan)

From Sheridan's perspective, the shift in focus in the Level 1 programme seemed to be working. Having everything linked to the digital games meant there was less "jumping around" in the course content. More of the targeted students were continuing to Levels 2 and 3, students were more engaged, and a wider range of students was choosing to take digital technology subjects than had in the past.

Another example is Pakuranga College's approach to student game design, an adoption of the "emerging technology" of VR, which has been documented in a TKI video story.[41] Teachers from the College shared some of their experiences, learning, and examples of a successful student-made VR game at the 2018 Games for Learning workshop.

## Spontaneously gamifying (and hacking) everyday learning

Some teachers and their students developed a classroom culture where learning could be spontaneously gamified or "hacked" by both teachers and students.

Imogen, a Years 7–8 teacher, had a lifelong passion for games.

> I identify very strongly with the kids in that respect. I know what they are getting out of it, because I feel the same buzz as them.

Imogen used her gaming instincts to gamify everyday learning. The core principles of "collaboration, challenge, and reward" underpinned her gamified pedagogical design. One of many examples she gave was a "dictionary game" she'd made up to help students learn how to use a dictionary as part of their literacy learning.

> I challenge them to look through the dictionary and find words. Then they give me the first letter and the definition, and I have to figure out what the word is. And they absolutely love it. They can't quite get over the fact that I get most of [the words], they hate it and they see it then as a real challenge! They start thinking a bit smarter, like 'Well okay if she always gets the really long complicated ones beginning with X, maybe I will go for a really short one with a vague definition." It really gets them thinking about words and definitions, and they help each other reading them out. (Imogen)

If there were things her students normally struggled to engage with, she would come up with an idea for turning them into a game. She was often surprised that even the silliest game ideas she could come up with seemed to work.

> I just find it fascinating what I can get away with if I call it a game. I sometimes think they are going to rumble me, any minute they are going to say "But Miss isn't this kind of like what we would normally do [just dressed up as a game]?", but they never do, it's amazing. (Imogen)

41 See http://elearning.tki.org.nz/Teaching/Future-focused-learning/Virtual-reality/Setting-up-virtual-reality-at-Pakuranga-College

Hayley, a beginning teacher of Years 5–6, did not initially think of herself as a gamer. However, after a term-long focus on games and game design with her class and syndicate, she and the students had come to realise the power of "hacking". This concept was introduced to them by a visiting game designer, who explained that it was a routine aspect of game design practice.

> The idea of hacking has been eye opening for both me and the kids, and we often talk about "How could we hack this?', and it might not even be a game [but any aspect of our learning]. (Hayley)

This encouraged a classroom climate where both teacher and students could offer ideas and suggestions to make learning more engaging and fun.

> Yesterday or the day before we started to do something, and one of the boys in my class just went "I don't want to do it." I said "Ok if your motivation is like that, how can we hack this? We really need to get this activity done, but what could we do to suit your needs?" He went from going "Eurgh, don't want to do this, this is stupid" to "Oh well, if we did it like this that would make it more enjoyable, and it's meeting my needs."

## Creating extended gamified quests for students

In some schools, extended gamified quests were woven around a longer chunk of learning. The excerpt below from our case study at Hutt Central School models how a real-world quest can be contextualised in a gamified structure.

In the *Curiosity Connections* game at Hutt Central School, a class of Years 5–6 students embarked on a quest to track down people from an archived school photo from 1983 that had no names on it. Steph, their teacher, wanted students to grow their capabilities to be curious and ask good questions, as well as developing the strategies and perseverance they would need to follow through on finding the answers to their questions.

Each person in the photograph was numbered and a giant copy of the picture was pinned up on the classroom wall. Students were randomly assigned one of the people in the photo as their "clients" and set about trying to find out information about that person. The ultimate goal was to contact each person and ask them for a memory of their time at the school.

The photo was shared on the school's Facebook page, and immediately people in the wider community began to post and tag in the names of people they recognised. One of the pictured students, now a local real estate agent, asked to come into the school to talk about his memories of the school. Some students were harder to track down, and sometimes a new lead would unexpectedly open up for the students to pursue.

> It's been crazy, and it does take a lot of time, but when I look through all the things we've covered, it's been massive. We talked about the wonderful stuff about social media, and the stuff we can't do [online], and why. There's been heaps of digital citizenship. The whole community has come along. (Steph)

The *Curiosity Connections* game could be described as an alternate reality game or augmented reality game (ARG)—a genre "in which players collaboratively hunt for clues, make sense of disparate information, and solve puzzles to advance an ever-changing narrative that is woven into the fabric of the real world" (Bonsignore, Hansen, Kraus, & Ruppel, 2013, p. 25). The game was documented by School Kit and NZStory[42] as well as one of our case studies (Bolstad, 2018).

42 To watch the video, see https://youtu.be/SaS2XplFGGc

Another example is Simon Christie's (2018) account of reconceiving the Royal Society Te Apārangi's First CREST Award for Year 7 students, using elements of live-action role-play (LARP) and gamification.

## Rethinking classrooms as collaborative game design spaces

Many of the key learning benefits that students and teachers identified from GBL (discussed in Section 4) stemmed from their efforts to design games. These included all kinds of games, including physical games, tabletop games, and digital games. In some cases, students were working to a brief to design a game for a particular goal or purpose. Examples we saw included:

- designing games about road safety or the future of transport for the 2016 and 2017 NZTA student game design competition
- designing a game "about" positive behaviour for learning (PB4L)
- designing a game about a school value such as "respect".

In other cases, the game students designed didn't have to fit a particular brief; it just had to reach a playable outcome that could be play tested by peers.

Often, game design was a collaborative endeavour, and collaborative processes, particularly in primary and intermediate classrooms, were often associated with changes in the physical arrangements and social interactions within the classroom. Interactions in these collaborative spaces were underpinned by a pedagogical focus on "idea generation and improvement". This frequently led to specific "emergent" opportunities in each classroom, especially as students began to own and drive their own process forward.

Diana-Grace was teaching Years 7–8 student in an open-plan space with a co-teacher. She was interested in how the physical organisation of the space for collaborative game design could facilitate a more "networked" mode of learning. She felt that "how you set up the room is vital" for getting students into a collaborative and creative headspace.

> I often make sure that the lights are off, usually because there's enough natural light, and these doors are open so there's fresh air, because what we're talking about here is new ideas. I think it's quite important, as opposed to that feeling of being stuck in a room.

The furniture in the learning space was set up in what she called a "game design format", and this setup was used even when classes were doing something other than game design. Table groups were circled around the edges of the open space with a large open space area in the centre of the room. All groups had easy walk-up access to each other's table groups, through the central clear space, as well as access to whiteboards and wall-spaces around the room.

Diana-Grace wanted students and anyone visiting the space "to understand the idea that we are a network"

> ... that if you're moving around and helping each other, and then you're going back to your home base, you're actually physically seeing that happening. You've got that [decentralised network] happening in almost like a symbolic way.

Like many other teachers in our research, Diana-Grace talked about game design as a process and a "framework" that could be established in a classroom. What emerged within that framework could not necessarily be known in advance.

> You've planned the structure, you know the direction you're going in as a class, but we're not really sure how we're going to get to all those places. Once the teachers set that direction, and if they allow the students the space to move in it, the students take it. We know we're going to get there, and the students start looking at possibilities of *how* to get there.

Diana-Grace had begun sharing her collaborative game design classroom practices in workshops with other teachers and wanted them to understand game design as a process for working with complexity in the classroom. Diana-Grace later moved into a teaching role in initial teacher education, and then began to work as an RTLB. She has continued to build GBL and game design as a core part of her process and share her knowledge with other educators.

In 2015, Leanne began exploring digital games and game design with her Years 3 and 4 class. She saw games and game design as a natural extension of the "makerspace" activities she was already facilitating, with students able to choose from many kinds of activities, from box construction, sewing, movie-making, through to coding.

Over the course of 2015, Leanne and her students began exploring games and game design in all sorts of ways. They tinkered with digital game creation tools such as Scratch and Adventure Creator. They used a collaborative design process to create and test their own physical education game, which became so popular that the class ended up teaching it to other classes in the school.

In 2016, Leanne moved to a new school where she continued to weave games and game design processes into her practice, teaching Year 6 students. Towards the end of 2016, her class took on its most open-ended game design process. The process began with an idea development phase, where she used techniques to encourage students to generate as many ideas as possible; for example, aiming for "fifty ideas in five minutes". She wanted students to feel that "no idea is a bad idea, it is just ideas".

The next stage was a "speed dating" activity, where each student paired up with another student to tell them their 10 or so "best" idea for quick feedback. When other students liked an idea, it got a tick. This helped students see which of their ideas were the most popular with their classmates.

By the end of the process each student had at least one idea "that they could take to the next level". Students then worked in smaller groups to continue to refine and improve some of their best ideas. Finally, every student was given the option to "pitch" their idea to the whole class. For the game to go to the design stage there needed to be at least two others who were willing to "back" the idea, and join the team to actually build the game.

The collaborative group design process was often challenging for students, which Leanne saw as its strength. Leanne described game design as an authentic way of putting a "Growth Mindset" into practice.

> [Realising] that you learn through your mistakes, and failure is not a bad thing. There is a lot of failure right throughout the [game design] process. Things don't work straight away, and you have to work together as a team.

## Is game design the "gold standard" for GBL?

Based on what we have seen in New Zealand classrooms, we think learning through game design presents some of the greatest challenges and greatest rewards of any form of GBL. The learning potential of game design is so tantalising that some GBL researchers and practitioners consider game design to be the "gold standard". Using *Minecraft* as an example, Dr Bron Stuckey, a keynote speaker at the 2017 Games for Learning conference, argued that "it does matter who does the designing".[43]

> [Some] teachers get very excited about building the entire Roman Empire, or a village in London, and then having their students come in and play in it. Who did the biggest learning? The person who did the design and built it. Because students, if they were doing it, are reifying their knowledge, their research, their understanding of what's happening there. (Bron Stuckey, keynote address)

Dr Yasmin Kafai, another keynote speaker, presented insights based on more than 25 years of studying what students learn from making digital games. Kafai and Burke (2015, 2016) have synthesised many studies which collectively suggest that making games supports a range of rich learning benefits, including

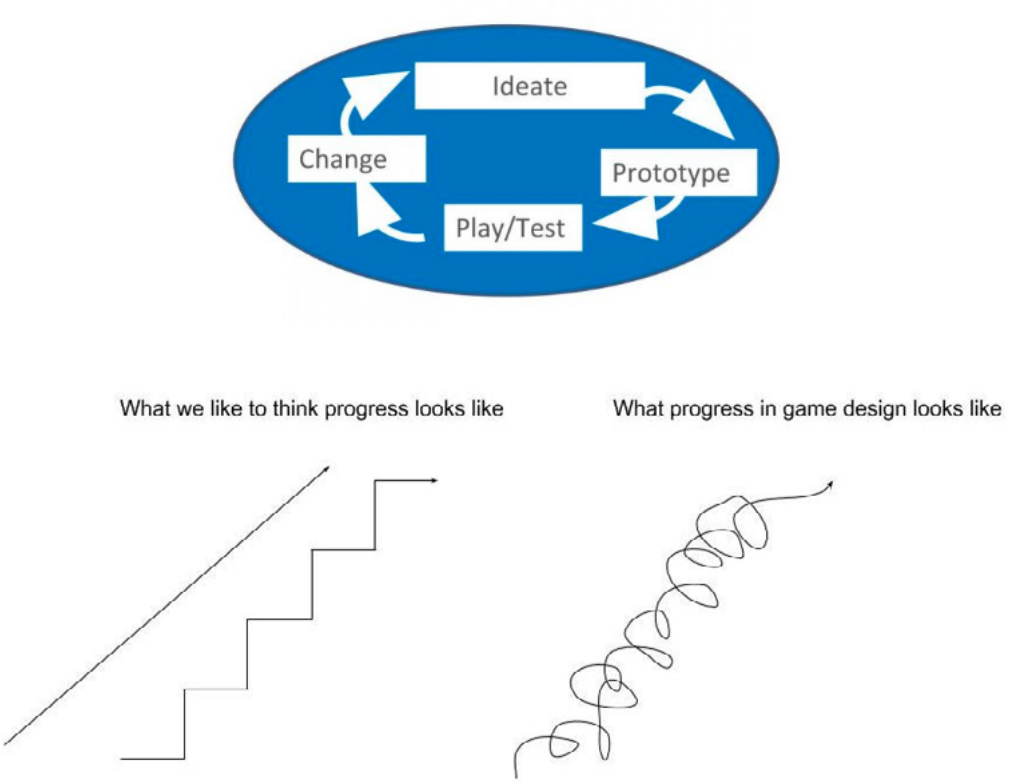
43 See https://www.nzcer.org.nz/blogs/bron-stuckey-rethinking-who-and-what-makes-game-educational

but not limited to the development of digital skills and capabilities. However, the idea of students making games (a constructionist approach) has for decades played second fiddle to the more dominant idea that students could learn something from playing games (an instructionist approach).

As we have argued elsewhere, one of the reasons game design can be so powerful for learning is that it is genuinely hard to do.[44] While there are many ways to "fail" as a player within a game (see Section 2), there are vastly more ways to fail as a game designer. According to students and teachers we have interviewed and observed, it is through facing and overcoming these challenges that some of the richest learning can occur.

At the heart of game design lies an iterative design process. No game can be devised and created by mapping out a plan from start to finish. All game designs start with an idea, or several ideas, that must be prototyped, tested, changed, retested, tweaked, and refined through many cycles of play testing. Game designer Tracy Fullerton (2014) calls this a "playcentric" approach.[45] It is easy to convey a visual sense of what this process involves (Figure 3) but is much harder to do. In game design—both digital and non-digital—plans frequently change, and new directions unexpectedly emerge.

FIGURE 3 **Visual depictions of the iterative game design process**




GBL pedagogies share many parallels with the process of game design, and, in this sense, GBL is simply game design writ large. In the same way a game designer is trying to design an engaging and satisfying experience for a player, teachers are trying to design engaging, satisfying, and meaningful learning

44 See https://www.nzcer.org.nz/blogs/game-design-hard-thats-why-your-students-should-do-it
45 See https://www.nzcer.org.nz/blogs/game-design-object-lesson-seeking-and-receiving-feedback

experiences for their students. When teachers are experimenting with GBL, they must also be prepared to navigate the challenges, opportunities, and direction changes that emerge from a play-centric process. For some teachers, this fits well with their existing pedagogical tendencies, while for others it takes some getting used to.

> With gaming I have found that … you can't plan too far ahead, because you don't know what's going to happen. (Hayley, Years 5–6 teacher)

## Other published examples of GBL in New Zealand classrooms

Additional accounts of diverse GBL practices in New Zealand schools and classrooms have become increasingly easier to find and access. Like the vignettes shared in this chapter, other published accounts demonstrate the breadth of ways that games and game design can be woven into learning and teaching, to meet a variety of learning purposes. These accounts are recommended as useful further reading for teachers seeking examples that may relate to their specific *contexts.* Recent examples include contributions to a *Set: Research Information for Teachers* Special Issue on learning through play and games by Malmstrom (2018), Silcock and Mackenzie (2018), Christie (2018), and Lemon & Durham (2018), and a series of teacher accounts of GBL practice in the March 2019 issue of *Interface* magazine (Adams, 2019).

# 4.

# How does GBL benefit learners?

In Sections 4 and 5 we look at two ways teachers and students thought learners benefited from GBL. The first way was through the effect that GBL pedagogies had on the classroom learning environment, and some of the collective and individual benefits that flowed from that. In terms of how this related to the curriculum, teachers often talked about this in terms of development of key competencies and other cross-cutting and transferable capabilities. The second way, discussed in Section 5, was in relation to learning subject or disciplinary knowledge.[46]

## Engagement and motivation

Teachers said GBL was an effective way to get learners more engaged and motivated to participate in learning activities, particularly learners who normally struggled to engage with or enjoy classroom learning. Teachers often mentioned specific learners with learning, behavioural, or social inclusion challenges, or students they described as "quirky". Primary and intermediate teachers frequently talked about the engagement benefits of GBL in relation to literacy and numeracy, particularly for boys who were less engaged with these aspects of learning.

46 The distinction between these two kinds of learning benefits is somewhat arbitrary, and mainly serves to organise the data for reporting.

Adam, a Years 5/6 teacher, brought in his *Dungeons and Dragons* (D&D) player handbooks thinking that it might engage a group of boys who usually struggled to engage with writing.

> I thought [the D&D books] would be a cool context for them to write about, you know, this has pictures of monsters, they have stats in them, you can imagine how they'd fight together, so they love it basically. That has been the single best decision I think I've made this year, and I don't say that lightly because they hooked on it really hard for at least a term and a half. (Adam)

After much pleading by the students, Adam ran a D&D game for them.

> They learned a surprising amount of the rules. For kids that I don't think would describe themselves as liking to read for fun, reading a [text-heavy] book like this, that's a big deal. (Adam)

The students went on to design and play with their own D&D characters, and write about it.

> That measurably raised their writing level by—thinking of one particular boy—a full curriculum level, over the course of about two terms, because he was suddenly actually willing to write and didn't just sit there complaining that he didn't have any ideas. (Adam)

## Cohesion, collaboration, and inclusion

Beyond just engagement, many teachers described their classes becoming more cohesive, collaborative, and inclusive. Teachers often expressed this in terms of collective or group-level benefits. One teacher described one of his main goals with GBL as being about "creating a shared experience" for learners—something that might provoke, unsettle, or challenge them, which they all went through together, and which could be discussed, unpacked, and reflected on as a common experience.

Diana-Grace discussed game design as a form of "learning in public", meaning different ideas, knowledge, opinions, and plans could be talked about openly, and worked out together. She also tried to model this with her co-teacher, to show students that it was OK for them to talk about their half-formed ideas, be open to a different suggestion or idea, and be prepared to change tack if a better idea or strategy presented itself through the group's collective processing.

> When I talked to parents explicitly about this [idea of learning in public] ... they said 'I can see that, and I'm so grateful because my child is doing that [now]. They used to not do stuff until it was perfect." (Diana-Grace)

In game-designing classrooms, everyone struggled at one point or another, and the collaborative experience of trying to design games gave students a newfound appreciation of one another's struggles, as well as one another's strengths.

> [Game design] brought them together in a way that other curriculums just do not do. Parents would come up to me and say "I can't believe this particular cohort how well they've got on, how they've really looked out for each other, that students have not felt left out." There's just been this cohesiveness about them. (Diana-Grace)

> Particularly in the last few months with us doing more [game] activities I have seen a shift in friendships, as in meeting and getting on with new people. Working with different people has been beneficial for them, and we have got new relationships forming and supporting each other. (Imogen)

Teachers and students noted the benefits of students working through their own disagreements and differences of opinion.

> The teacher has to be able to cope with conflict in the classroom and not want to solve it. You must start noticing what the students are saying, and also to reassure them that actually it's OK to be disagreeing. (Diana-Grace)

> I guess it is pushing the boundaries of what collaboration means, it isn't just working in a group, or being in a group, it is actually like *doing stuff* in the group, and I think that is what we achieved. Some really cool things happened, like challenging [each other's] ideas, and different people taking leadership roles, that healthy debate, and it was just complete student agency. (Leanne)

Teachers also gave various examples of GBL supporting the inclusion of students with particular learning or social challenges. Teachers intentionally designed learning opportunities in ways they thought would achieve this, drawing on their prior knowledge of inclusive practices and universal design for learning, as well as experimenting and noticing how those students responded to GBL opportunities and how this helped to draw out their strengths or support their learning goals.

> We have this kid with us for just over a term and he has got next to no English and so we were trying to find out ways that we could connect with him. He loves chess and only a couple of other kids in the class knew how to play. So [the other students] would initially earn a reward for playing chess with him, so the boys all started learning to play chess and now they absolutely love it, and it is such a good way to connect with this kid. (Imogen)

> I have had a student [with special learning needs] and I guess that I am always sort of looking at, am I engaging everybody in some way? And so I always think if I have got her engaged and these other people who are quite up there in terms of their thinking, then I have kind of hit everybody's needs. She was very engaged in the bit about being part of a group, and for her that is a goal. So she might not have contributed to a lot of the [collaborative game] ideas but she was part of a group, she was play testing the games, and that was all really important skills for her to work on. (Leanne)

> I have an autistic student and she doesn't like having social contact, so I was really concerned when I did the first games week. I knew she wouldn't want to play anything so I … but she loves rules, she is very particular, she loves enforcing. So she became the ruling force and the judge which was really good because it forced the other kids to be really nice to her. And then what I found was we played one particular game where they all had to write a fact about themselves that people didn't know, and then we sat in a circle and she would draw them out and read them and then we would take it in turns and we would each have to guess who it was. We played that once and then she said "Can I go?" I was like "Of course you can."

## Revealing students' strengths and interests

Teachers gave many examples of how GBL afforded opportunities for them to see particular strengths, interests, and capabilities in students, that wouldn't otherwise have been visible.

> [Name of student] is a unique kind of student to manage in terms of his behaviour. He always complains "This is hard sir, this is hard", but once you give them the basics and they start doing this [digital game design] stuff they really surprise themselves. I thought he would not amount to anything, but you put him in front of a computer, tell him what to do, oh he will finish it. He is impressive. (Jesse, secondary teacher)

> One thing that I was really surprised with, so they were trying all these tank games and stuff and sometimes [the students] don't articulate what they mean very well. They talked about, very elaborately, about how they worked together and how there's this team work and if you don't work together, you let your team down. (Nick, Years 5–6 teacher)

In some cases, a group, or the whole class, was grappling with an open-ended problem, or had hit an impasse in their game design, and a student unexpectedly stepped up to offer an idea or way forward. Sometimes that student was, in other ways, struggling with some aspect of their learning. Diana-Grace offered an account of how shifting her approach to "focus on the system, not the gap" yielded noticeable benefits for some learners.

At Diana-Grace's school, there had been a big focus on addressing the achievement gap for students who were consistently below the (then) national standard, and what kind of "interventions" those students might need. After a year of trying different things, nothing seemed to be working with the target students[47] in her class.

> So I thought instead of looking at the gap, I'd look at the system of learning. Game design very much is around the system. [The thing to focus on is] what is going on in here, what are all the interrelations [in this system]?
>
> In other words, rather than focusing intently on the student who was underperforming in reading and writing in relation to the standards, she paid attention to what else those students were doing when the whole class was engaged in game design. Seeing things from a system perspective enabled her to see "different things about students", and to give the target students different kinds of feedback.
>
> An example was a particular student. I said [to him] "Did you notice that in this group you were really disruptive and you weren't happy, and did you notice when you went to that other group you actually saved the day?" It was around game design and basically [the group] couldn't actually finish the game, and he just jumped in and he just nailed it. This particular group were all above the standard, and they could see that he was worth his weight in gold. He started getting this sense of success, and then [the solution was] coming with really fast feedback for him. He would be writing and you'd have to give him feedback that night or the following morning, [and that] actually raised his writing.

## Did all learners engage with GBL?

Teachers mentioned occasional examples of students who were less keen to engage with games or game design, or questioned when they would be doing "real" learning. Teachers typically had two response strategies. The first was to engage these students in a conversation to challenge their perception that GBL was not really learning.

> No one ever said "I'm sick of playing games" but sometimes you'd get a student who's quite concerned … "When are we going to do real work?" The question we immediately ask them is "What's that?" You turn it back around on them, and without fail they eventually realise that actually they're learning more than they realise, once they kind of verbalise it. (Adam, Years 5–6 teacher)

The second strategy was to allow those students to choose another learning activity.

## Students' perspectives

Across all the contexts we studied, several themes recurred across students' comments about what they learned from GBL.[48]

### Learning about themselves and others, and being part of a group

Students talked about things they had learned about themselves or their peers, including individuals' strengths and interests that had contributed to the overall success (or challenges) of a group. In

47 Those who were below the national standard at the time.

48 Our previously published case studies provide student perspectives on learning in specific GBL contexts. This includes Year 13 history students' reflections on what they learned through a complex role-play game (Bolstad, 2017), and Years 5–6 students on what they learned from playing, designing, and talking about games as part of an inquiry that spanned more than a term (Bolstad, 2018).

collaborative game-designing classes, students talked about managing creative differences, using mistakes as opportunities to improve, and having to work through their own group dynamics and disagreements.

> You have to learn to listen to other people's opinions. Not everyone likes what you like. You have to trust them on their ideas. (Years 5–6 students)

In several primary and intermediate classes, teachers and students told us how students often came to realise they needed to mix up their groups to include more diversity, to achieve better collaborative outcomes.

> I learnt that I can work better with lots of other people than just my friends. Because with my friends we just make up really simple fairy board games. But with this game it's quite fun and it's good for both genders. (Year 6 student)

## Learning to appreciate what goes into making the games they play

Through attempting to make their own games, students often gained a deeper appreciation of what goes into the design of the games they play and enjoy.

> It gives you respect for already-existing games. How much code they need. What looks easy might be hard to play and harder to code. (Years 7–8 students)

> When you look at a game it looks simple, and I think, "I want to make a game like that", but it's way more complicated than you think. (Year 11 student)

In many cases, students were not able to complete a game to the level of quality and sophistication they had imagined, but were still proud of the knowledge and skills they had gained in the process.

## Learning to take feedback, persist, and solve problems

Asking peers to play test their game prototypes or give feedback on concepts was sometimes eye-opening for student game designers. It helped them to recognise how their own assumptions about how their game would work weren't obvious to someone trying to play the game for the first time.

> [The trickiest bit was] making the rules, because everything had to balance out and it all had to go together … It got really complicated. We simplified the game a bit and thought about how everyone else would learn it, not just us. [How did you know how to do that?] Well we had play tested some other people's games, and only them who had originally made it knew how to play it, and it was extremely complicated to learn. In the end we thought, if it was really hard for us to learn, we should make our game easier for others. (Year 6 students)

> Students had to get used to not getting things right the first time.

> You don't really know how to do character creation. You could think, "This is a good idea", but it probably wouldn't work, so you had to keep going and going until you found something that did work. (Year 6 students)

In game design, it was important to be "persistent" and "resilient".

> I think it changes our mindsets. (Years 5–6 student)

## Games and game design as analogies for life

Finally, learners shared various insights about games and/or game design as analogies for learning and life.

> Life is like a game. When you're a baby, you only have a little bit of code and can only do a few things. As you get older, you get more code. (Years 7–8 students)

> I think it's funny in these [role-play] games, people when they have a lot of power rise up, they are the ones yelling and getting involved because they feel the most powerful. Just to let people know they are important, that they have the power to veto things. So in that sense it is realistic! (Year 13 history student)

> She [student leading our game design group] was like our boss, and we were her workers, but she was like a good boss. (Year 6 students)

# 5.

# Can games help students learn subject knowledge?

The GBL examples we saw touched on almost every learning area, including health and PE, science, technology (especially digital technology), social sciences, te reo Māori, English, mathematics, and the arts.[49] Collectively, teachers described many ways in which specific instances of GBL supported specific subject or disciplinary learning, but this was always integrated with other cross-cutting learning goals.

> The fitness game [we designed as a class]—well there was just so many things in that, and the thing is, it's not compartmentalised learning and I think that that's really important. So yeah there was definitely links to the PE and health curriculum but there was also links to other aspects [of the curriculum] as well, and lots of key competency-based stuff. (Years 3–4 teacher)

> A game is linking in all aspects of the curriculum … it's getting kids to communicate, it's teaching them about sharing by having to use the key competencies of thinking, participating, managing self, they have to wait their turn, they've got to be creative in the way that they think about what they're doing and use strategies, and you've got numeracy games, you've got oral language skills, so without even trying it's bringing in all of those different elements. (Years 5–6 teacher)

In general, teachers believed that games could be most effective in supporting subject or content learning when game play (or game design) was woven into a well-thought-out pedagogical process that helped students to make explicit connections with subject knowledge. Most teachers didn't think games were always the answer, or that they could replace all other modes of learning and teaching. Instead, their GBL pedagogies involved supporting students, through dialogue, to make explicit connections with particular knowledge concepts that they might be learning, or had previously learned.

49 Other published accounts of New Zealand GBL practice further illustrate specific curriculum-linked and subject-based contexts (for example, see, Adams, 2019; Christie, 2018; Lemon & Durham, 2018).

Andrew and Michael, who used games in their senior secondary history classrooms, thought it was important to recognise the limitations of games as a tool for teaching history (see Bolstad, 2017).

The primary purpose for the live action role-playing games they used was not to teach history content, but to give students a more complex and interesting way to reflect on historical content knowledge they had already read or studied, or to introduce situations and contexts that could pique students' interest to learn more about an aspect of history that they might encounter for the first time via a game. They hoped complex role-play could help to develop students' "history empathy"; that is, their ability to look beyond their own modern world views and assumptions to consider how people from the past may have thought or felt.

> A common assumption of young people is that people in the past acted differently because they weren't as smart as we are today. (Michael)

They also wanted students to develop ways of thinking about, and making sense of, complex conflict, to prepare them for "pragmatic and idealistic participation in society".

> I think it's about preparing students to be able to participate in society with at least some information about the deep complexity of the world that they live in, that "right" and "wrong" are very difficult ideas, that you can't just take a stand, you need to take a stand appreciating that [it] comes at a cost, or it comes at a compromise. (Andrew)

Mistakes they thought a novice teacher might make in attempting to use games in history classes included:

- using games to try to teach content, rather than to teach complexity
- not being conscious of, and unpacking, complex issues or tensions (including ethical issues) that could arise as part of the gameplay
- not taking into account who was playing the game, or considering students' readiness or sensitivities that might be triggered when playing games that intersected with real-world issues that might personally affect students in the game.

The literature on the use of games for developing empathy and perspective-taking capabilities aligns with views expressed by Andrew and Michael. Farber and Schrier (2017) recently reviewed the limits and strengths of digital games for development of these kinds of capabilities. They highlight the important role of the teacher, and the curricular context, that frames the use of any particular game, and recommend professional development for educators on discussion, reflection, and perspective-taking strategies to precede and follow gameplay. Other literature about the use of games in history teaching contexts is also discussed in the full case study of Andrew and Michael's classroom practices (see Bolstad, 2017).

## What do students say?

Interestingly, learners said they *did* learn various kinds of factual knowledge (as well as various skills and capabilities) from playing games—often when talking about their recreational gaming activities outside school. The fact that young people may learn some kinds of factual or disciplinary knowledge through their out-of-school gaming highlights the importance of creating space to talk with students about these experiences. Many of the game-using and game-curious teachers in our research did this as part of their practice, and were sometimes surprised to find out what learners knew, or *thought* they knew, from playing games. Table 2 summarises some of the benefits of inviting learners to talk about what they know, and what they have learned, from games and gaming outside school.

TABLE 2 **Educational reasons for asking young people about their out-of-school experiences with games**

**To facilitate rich conversations about "learning"**

Many of the vignettes in Chapter 3 have shown how conversations about students' game knowledge and experiences can be leveraged into deeper conversations about learning.

**To support students' factual and conceptual knowledge development**

Young people may have learned things from games that are highly germane to a topic, context, or concept they are learning in class. Knowing this means teachers can build on what students already know. Additionally, learners may have picked up factual misconceptions from games that could be discussed and addressed in a learning setting.

**To build students' capacity for critical literacy**

The capacity to critically analyse games is important because games, like all texts, shape our thoughts and actions in a variety of ways that are not always immediately apparent. Critical literacy can provide students with the capabilities and dispositions needed to question how and why particular games have been constructed and the impact of these choices for the player. Critical literacy provides students with the capacity to play games in ways that meet their own needs, or to modify games or create new ones that better reflect their own values, beliefs, and views of the world (see McDowall, 2017).

**To engage with young people's identities as "gamers" and connect with youth culture**

Finally, as many teachers in our study noted, games are part of the fabric of their students' lives. They found, as we did, that students were often very keen to talk about their gaming. In some cases, being given permission to talk openly about something that was often marginalised or dismissed by the adults around them gave learners the feeling that their knowledge and perspectives were valued.

## What about "educational games"?

Our goal in the Games for Learning project was to focus on the whole learning context surrounding game-based practices, foregrounding the experiences and perspectives of learners and teachers, rather than foregrounding "the games" per se. Unlike some studies, our approach was agnostic about what types of games and GBL we would study. From this perspective, any kinds of games and game-based practices could be "educational games", depending on how they are used, and what learners gain (see also Farber & Schrier, 2017; Rowan & Beavis, 2017).

However, it should be acknowledged that there exists a large class of games, both digital and non-digital, that have been designed or republished *specifically* for use in educational settings, to support particular disciplinary or subject-knowledge learning. These games are typically marketed to schools (and to the general public) as "learning games", "educational games", or sometimes "serious games". What kinds of learning opportunities do these games offer, and are they the most useful place for educators to look?

Yet again, the picture is complex. Focusing just on digital games, Mizuko Ito (2008) describes three distinctive genres of software which emerged in the 1980s and 1990s under the umbrella of "learning games":

- **Academic games** tended to focus on curricular content rather than innovative game play, and were marketed to parents as a tool for achievement. (Examples: *Math Blaster, Reader Rabbit)*
- **Entertainment games** often involved open-ended and exploratory environments, and were marketed to the "progressive and permissive parent" who saw inherent value in children's fun and imagination exploring. (Examples: *Pajama Sam, Where in the World is Carmen Sandiego?)*
- **Construction games** put children into the role of creators and authors of the digital content they were "playing" with, and were marketed as a stance towards technology based on "technological empowerment" (Examples: *Sim City, Microworlds, Minecraft)*

Ito notes that these genres, and the ideas they represent, have "much deeper historical roots" and "draw from longstanding discourses in education" (p. 113) that present different ideas about what kinds of learning are important. Of the New Zealand teachers we interviewed and case studied, the way most used games (or game design) in their practice aligned most closely with a progressive and/or constructionist/constructivist perspective. They tended to favour games that were more open-ended and could be used for flexible learning purposes, or (in the case of some game-designing classrooms) were most interested in digital platforms that made it possible for students to be the builders and creators of digital games.

Teachers were critical of some of the content-specific or "educational" games they had seen other teachers using, or games that were "labelled" as subject-knowledge games, but which they felt provided a more shallow learning experience than the kind of games they favoured.

> There are many, many maths games that are very basic low level skills but they won't teach you anything like these [complex board games and role playing games] do. (Secondary teacher)

Perspectives like these are common amongst GBL practitioners and leading educational game designers, who know enough about "good games" to be critical of games that don't measure up to the level of depth and quality they would seek out for their own practice.

However, throughout the Games for Learning project, many teachers asked us variations of these questions:

- Where can I find good games for [name of learning area or topic]?
- Can you recommend any games about [subject matter]?
- What are some good games for [students at the ages I teach]?

The short answer to these questions is that there are a lot of great games out there, and, for almost every topic, learning area, or subject matter, there are many relevant games that *could* fit the bill in each case—including commercial entertainment games *and* games designed specifically for use in educational contexts. However, the problem of how to find, evaluate, and plan for the use of any particular games emerges as one of the key challenges for game-curious educators. This challenge is also recognised by game designers and creators who would love to see their games used in formal learning settings, including for specific disciplinary and subject-learning purposes. Potential solutions for this challenge are discussed further in Section 6.

# 6.
# Challenges for implementing GBL

The New Zealand teachers we interviewed were often curious to see how their individual experiences connected with other teachers' practices. International literature suggests that behind every "game-using" or "gameful" teacher there's a journey of pedagogical experimentation to unpack (Beavis et al., 2017; K. Bell, 2018; Farber, 2017; Fishman et al., 2014; Hourdequin et al., 2018; Prestridge, 2017; Takeuchi & Vaala, 2014) This section discusses some of the common challenges for teachers implementing GBL, and potential strategies and solutions for overcoming these challenges.

## Knowing where to start when you don't know much about games

The teachers in our study had diverse starting points.[50] Some teachers self-identified as "gamers" and were able to lean in to their own game knowledge and insights when planning their GBL pedagogies. Other teachers didn't have a particular interest or expertise in games, at least to begin with, but recognised it was something their students were very engaged with.

> I'm new to it. I played games but I don't understand where the learning comes in other than, you know, really superficial. (Years 5–6 teacher)

Some even admitted they disliked playing games. However, some teachers saw their own lack of gaming knowledge as an advantage, because it left more space for the students to be the experts.

> Actually it's very important for me—not to be an expert [on games and gaming]. If I was an "expert", I would have pretended I wasn't! (Years 7–8 teacher)

> There are things the students know more than I [do] ... whenever I give them the chance [to show what they know] they are more engaged in learning, when they see that 'Alright I have taught my teacher to do this.' (Secondary design teacher)

More important than teachers' starting knowledge about games was their openness towards exploring games and trying things out. Game-novice teachers found that, once they started thinking and learning

50 We documented teachers' different starting points and motivations to engage in GBL in a blog series entitled "What motivates game-using teachers?" See https://www.nzcer.org.nz/blogs/what-motivates-game-using-teachers-episode-1 and others in the series.

more about games (including through the strategies in the box below), there was no shortage of opportunities to keep learning more.

> Once you start [with a games focus] … you see it everywhere—it opens up a whole new way of thinking. (Years 5–6 teacher)

As Rowan (2017, p. 204) observed among Australian game-using teachers, the most important thing was "their commitment to experiment, to develop, to collaborate and to play as they developed their own skill base and confidence". The key message for novices is "the more you do it, the more you get a sense of what's possible" (Beavis, cited in Rowan, 2017, p. 204). Game-using teachers in our project thought it was also useful for teachers to expand their own knowledge by finding and playing games that they found engaging, or looking into games that they knew their students liked.

> I think definitely finding some games that you can enjoy yourself so that you can unpack them … I've found a couple of games which I've played and tried to look at it from that perspective and "Why do I enjoy this so much?" (Teacher, Years 3–4)

Some teachers went further by trying to design games themselves.

> It was pivotal for me in [understanding] how complex and challenging making a game is. If I could say anything, [it would be that] if you're going to teach kids how to do gaming, always make one yourself. Which is challenging [but] that's what you're asking kids to do. (Teacher, Years 5–6)

TABLE 3 **Strategies for getting started with games**

- Ask learners to share what they know about games.
- Pair up with a game-knowledgeable colleague.
- Seek out workshops and conferences about GBL to learn from more experienced practitioners.
- Meet and connect with game designers.
- Read New Zealand-based practice stories about GBL.51
- Read books about GBL, and search for free and accessible online content, including online articles, blogs, podcasts, and YouTube channels.
- Use online communities and social media to post questions about games, and seek advice and recommendations from peers and colleagues.
- Make time to find and play games, or even try designing a simple game.

## Finding relevant games and GBL resources

Other common challenges are knowing where to look for "good" games, having time to evaluate their fit for purpose, and planning how they will fit into a teaching and learning strategy.

> As a teacher you don't know exactly what games are best. (Primary teacher)

This "discovery problem" is shared by teachers internationally (Takeuchi & Vaala, 2014) particularly where curriculum is flexible and resources are not centrally prescribed, and is not unique to games. It applies to all kinds of resources—including traditional resources like books, and newer digital resources. The discovery challenge can be frustrating for teachers, who want to find best-fitted resources for their purposes, as efficiently as they can. It is also frustrating from the perspectives of resource creators and curators, who want to see teachers finding and using resources they have invested in creating.

51 Sources include magazines and journals such as *Interface* (for example, see Adams, 2019), *Education Gazette,* and a special issue of *Set: Research Information for Teachers* (Volume 3, 2018).

Resource creators and curators may seek to overcome the discovery challenge through strategies such as:

- designing resources to specifically align with particular curriculum goals or assessment standards
- providing support materials that show how a given resource *can* be aligned to fit particular educational goals or standards
- collating sets of related resources in one easy-to-find place
- providing case studies of good practice
- advertising and promoting resources to teachers and schools.

These strategies have also been used to support teachers to find and use games in education. Some "educational game" producers curate their digital games to be easily searchable by topic, curriculum area, or learner age / year level. Depending on the producer, games may be free to play or behind a paywall, platform-specific, or web-based. Other curated sites have been created by educators or advocates for game-based learning (e.g., ChangeGamer[52]). These sites may be agnostic about game type (e.g., paid or free, digital, or non-digital), and provide independent educator perspectives. Such sites can provide high-quality recommendations from expert GBL practitioners, but can be difficult to sustain and maintain over time if the labour required to maintain them is done by volunteers.

Most of the curated and searchable sites and indexes for learning games and GBL we know of are based outside New Zealand.[53] In today's digital environment, resource suggestions can come from anywhere, including from teachers' own internet searching. However, recommendations from peers and colleagues working in similar contexts are often especially valuable, and our experience suggests this is one of the most important ways non-gaming teachers pick up ideas for games and ways of using them in the classroom.

New Zealand teachers value resources that provide support in the form of links to research, pedagogical information, and exemplars (McDowall & Berg, 2018). Research shows the importance of recognising and scaffolding teachers' agency in determining the best ways to use particular resources to meet their needs, and build their "pedagogical design capacity".[54]

Over the course of the Games for Learning project, teachers often suggested they would benefit from a curated "one-stop-shop" of games resource suggestions, based on their use and relevance to New Zealand schools and kura,[55] and alignment to New Zealand curriculum, supported by case studies of game-use in practice, and a forum where teachers can come for advice and discussion about GBL practice.

52 http://www.changegamer.ca/

53 There are, however, New Zealand game producers and distributors, whose games are discoverable if you know where to look.

54 Beyer and Davis (2012) define pedagogical design capacity as teachers' ability to "use personal and curricular resources in designing instruction for students" (p. 386). Curriculum materials that promote the development of pedagogical design capacity are ones that intentionally support teachers' learning.

55 This would include, but not be limited to, games produced and designed in New Zealand. A large proportion of games created by New Zealand's small game design industry are aimed at global entertainment markets, but there are also developers and small studios developing games that reflect Aotearoa New Zealand cultural, social, and environmental contexts, and some that aim to create games suitable for children, or for use in an educational context. At present, there isn't a curated index of New Zealand–produced games that could be suitable for educational use, but the New Zealand developer community is small and close–knit, and the idea of developing such an index has been discussed. In terms of non-digital games, there are all sorts of New Zealand options if you know where to find them, such as the Ministry of Education's Game of Awesome, a card trading game developed by Zealandia, and many other games developed by various NGOs, independent designers, and companies.

TABLE 4 **Strategies to find and evaluate games**

- Board game cafés, meetups, gaming clubs, and conferences are increasingly popular around New Zealand. Aficionados can provide expert recommendations for games that might not be well-known by non-gamers, and there are New Zealand-based lending services for board games that do special arrangements for schools.56
- Explore online curated games recommendation sites for educators, such as ChangeGamer, an international educator-curated site that promotes the use of digital games "to explore important topics such as energy, climate change, natural disasters, the environment, economics, politics, history, science, and philosophy."[57]
- Suggestions in the previous strategy box also apply here.

## Budgetary, technical, and logistical constraints

The "discovery" challenge for teachers also includes assessing game resources for their suitability within the budgetary, technical, or logistical constraints of their school or classroom. For example, how useful is a digital game if your students can't access it on the devices they have, or it isn't affordable? Does every student in the class need individual access to the game for it to be useful for learning and teaching, or will it work if different students are taking turns? If computers and devices are limited, can a game work as a "station" in a rotation of learning activities in a busy classroom? Does students' access to taking turns playing the game need extra teacher monitoring and management? Is it a game that can be played in groups, and how many players can play at a time? How long does it take to play, and how does that fit with the length of a class or lesson?

Teachers in the Games for Learning project tended to find ways to work around technical or logistical constraints, making the most of games that they could access, and selecting games that "worked" for the social and physical environment of their classroom. In various classrooms, this might mean projecting a game up on a big screen so that the whole class could participate or share in making player decisions, bringing in a game console from home so that students could access particular kinds of games, or sending students off to search for digital games they could play in the classroom that met certain criteria provided by the teacher (e.g., they must be free to play, and collaborative).

Given the added layer of challenges that can be involved in bringing digital games into classrooms, it is perhaps not surprising that so many of the cases and examples of game use and game design in our project were of the non-digital variety. Some games may simply require less "translation" to work easily in the physical and social environment of a classroom. For example, tabletop games are designed specifically for play by groups of people in close physical proximity to one another. The social interactions and exchanges that occur around the gameplay are part of what makes them work so well in a social setting. Teachers can easily observe and listen to what's happening, join in the conversation to scaffold learning, or ask a pertinent question.

In contrast, many digital games are designed for someone to play on their own, or with other people who are at a distance. There are also some digital games that are specifically designed to be played by two or more people physically located near each other.[58] However, we think there is an opportunity for more digital games to be designed specifically to work in group settings, such as a classroom, and utilising the

56 For example, http://boardgamerentals.co.nz/

57 See http://www.changegamer.ca/. Other curated game recommendation lists and sites include http://www.ithrivegames.org/, and www.literarysafari.com/armmewithgames

58 A couple of examples we often showed teachers to change their views on what a digital game can be include *Bounden,* a game where two players dance together while holding on to a mobile phone (http://playbounden.com/), and *Space Team,* a co-operative game for phones and tablets (https://spaceteam.ca/). A widely used educational "quiz game", *Kahoot,* is another example.

affordances that come with a group of people being together, in the same time and place, who can have interesting social and learning interactions during gameplay.[59] Cook, Dow, and Hammer (2017) highlight two areas to focus on in the design of technologies for interaction in the classroom: by providing methods for emphasising group success over individual achievement, and by preserving the spirit of the experience which is, by nature, a shared experience.

## What if your colleagues question what you're doing?

Some teachers talked about feeling the need to be able to justify what they—or their students—were doing with games; for example, if colleagues or senior leaders questioned them.

> I am always thinking how would I justify it, what am I going to do if the principal walks in and we are doing this, you know? How do I say, well here is my lesson plan, this is what we are learning and [to the principal] it looks like carnage. (Teacher)

> This school is not necessarily open to games. Some of my students complain to me that they are being banned or the internet access taken off because they were caught playing games by their teachers. (Teacher)

> The teachers would say to me at morning tea, "They were playing games in my classroom, is that actually okay? They are online playing games." I said, "Yeah they are okay, they are on Scratch." [The teachers are] just checking because they don't know. On the surface [it looks to those teachers as though] they are mucking around. (Teacher)

A few game-using teachers confessed to niggling doubts or questions that came up in their own minds from time to time. These included whether they were getting "carried away" with games at the expense of learning, or focusing too much on fun and engagement without being able to "prove" that this would ultimately pay off for students' learning in the long term.

> Another thing [that I worry about] is what am I actually teaching these kids? I really don't know until they graduate after four years and pick up something at the tertiary level. Or maybe one day if I bump into them and they thank me, and then that is the only time I can say that I have done a good job. So the anxiety is always there. But in saying that, that anxiety is actually the fuel for me to keep on learning and searching and researching. (Teacher)

Some teachers in our project talked about "closing the curtains and doing it anyway", particularly when they felt like there wasn't anyone else in their school who was interested in the same kinds of practices.

Other teachers didn't feel worried or doubtful about their game-based practice. They felt well supported by their senior leaders, or were themselves in senior positions, and didn't see any need to justify themselves or their teaching practice.

> To be honest I don't really care [if peers don't see the value of games for learning]. If I want to do it and think it's good for my kids, I'll do it. Regardless of any stigma that's involved. I know the skills I want them to get, and how I get them there is up to me. I never feel like I have to justify it, because I can. I know why I'm doing it, otherwise I wouldn't be doing it. (Teacher)

Many of the teachers in our project were largely operating independently in their GBL. However, one of our case studies discusses the benefits of a syndicate-wide approach (Bolstad, 2018).

59 One example is *Stranded*, developed in a project by the Finnish National Board of Education. The premise of the game is that players are stranded on an island after a shipwreck and they must collaborate to survive. Although the game takes place on the screen, the collaboration and communication happen exclusively outside the game (see http://strandedgame.net).

TABLE 5 **Strategies for engaging colleagues and senior leaders in GBL**

- Share resources, readings, case studies, and other GBL-related knowledge with colleagues.
- Talk to colleagues about your pedagogical purposes, curriculum goals, and the learning outcomes you have observed in your students through GBL.
- Give staff time and opportunities to play games and discuss their potential learning benefits.
- Run a GBL workshop for colleagues and help them plan a GBL approach with your support.
- Invite colleagues to talk with students about their learning during/after GBL, or invite students to teach games to teachers.

## Time

The final challenge for GBL practice is time—fitting it in amongst all the other time constraints and commitments of a busy classroom or school.

> If I had a hesitation around it, it would be the time it takes. (Teacher)

Games that involve complex strategies, steep learning curves, or where repeated play opportunities allow for deeper experiences can take time. Giving students opportunities to explore lots of different games also takes time. Teachers found creative ways to work around time constraints, including cramming other content learning early on to leave space for some extended GBL (or vice versa), working out ways to have GBL as a rotation activity amongst other learning activities, or carving out time and space in co-curricular activities.

> [The] stuff we set up in gaming camp and gaming club, that's much more difficult [to set up in a subject class] when you've got X amount of content. So you can either take a hit [on curriculum content] early on and focus [interactive learning] for the rest of the year, or you can try and make [game-based learning] work in small groups … in the past that is what I had done in my science classes. I had three kids that were in [the game *Pandemic]*. I just rotated it. They had a game going … it took an hour and the other two were doing research. That meant that I could spend time with them explaining. That's not ideal, we try and move away from that [in the gaming camp]. (Secondary science teacher)

Game design proved to be another process that took longer than teachers and students thought it might. Allowing time for conversation and discussion about what students experienced during and after a game (or after trying to design a game) is one of the most important aspects of GBL practice. The ideas and connections that can emerge from such conversations tend to be rich, open-ended, and diverse.

Finally, following emergent opportunities that arise from GBL takes time. Describing what happened in Australian GBL classrooms, Rowan and Prestridge (2017) borrow Steven Johnson's notion of "the adjacent possible" to describe the new ideas and opportunities that arise during GBL. Their findings in the Serious Play project have strong parallels to our own findings. They observed that

> Openness to experimentation, uncertainty and risk taking allowed students … to access a whole range of adjacent possible, many of which began with simple links built between students and their outside lives, and blossomed into links between students and each other. (p. 217)

They also commented that "time, effort, and a leap of faith … may be required to start on the kind of journeys undertaken by our project teachers" (p. 217).

TABLE 6 **Top tips from game-using teachers**

In 2015, we asked game-using teachers what advice they would most like to share with other teachers. Here are eight of their top tips.

1. Be open to the possibilities of using games for learning.
2. Discuss games and gaming with your students.
3. You don't need to be a gamer yourself, and you don't need to know everything about games.
4. You do need to be clear about your purposes for using games for learning.
5. Think deeply about how games can contribute to your curriculum.
6. Be curious. Think about when to step back and let students take the lead, and when to step in with a productive question.
7. Don't be afraid to try different kinds of games in the classroom, and see what happens.
8. It can't hurt to play a few games yourself!

See the original blog post to find out how game-using teachers used these tips in their own practice: https://www.nzcer.org.nz/blogs/advice-game-using-teachers

# 7.
# Strengthening GBL in Aotearoa

Our system-level recommendations for strengthening GBL in Aotearoa New Zealand include:

Building teachers' pedagogical capabilities in GBL, through:

- PLD that builds teachers' confidence and capabilities to integrate GBL into school-based curriculum and pedagogy
- communities of practice that encourage teachers to explore, innovate, and share ideas around GBL
- networking and collaboration opportunities between educators, students, and game designers and the game design industry, with an emphasis on collaboration, co-creation, and mutual learning.

Supporting equity, inclusion, and wellbeing for all learners through:

- resources and PLD that demonstrates how GBL can meet inclusive practice goals through intentional pedagogical and curriculum design[60]
- targeted support to ensure equity of access and equity of opportunity for high-quality GBL for all young New Zealanders
- resources and PLD that support diversity and cultural learning through games.

Strengthening development and discoverability of GBL resources relevant for Aotearoa:

- curation and profiling of GBL resources that link with *The New Zealand Curriculum* and *Te Marautanga o Aotearoa,* supported by reviews and case studies from teachers and students
- investment in GBL resources, including games and teachers support materials, that:
  - reflect Aotearoa New Zealand and its unique cultural, historical, social, and natural environments
  - are flexible, adaptable, and build teachers' pedagogical design capability
  - emphasise the development of key competencies and other transferable capabilities, and complex cross-disciplinary themes and concepts.

Reducing barriers to access:

- identifying ways to reduce costs for schools to access and use high-quality GBL resources. Possibilities might include strengthening game lending systems for schools, or bulk purchasing arrangements.

60 See https://www.inclusive.tki.org.nz/

## A caveat about "domesticating" games

While there has been international interest and investment in the idea of games as a tool for assessment, or the need for stronger assessment data to "prove" the learning benefits of games, these arguments carry some risk of a "domestication" mindset , where the wild and potent edges of GBL get chipped off in order to make them fit into the existing school structures, systems, and beliefs about learning and what counts as learning, and in the process, lose "the very features of gaming that appear to offer so much to schools in the first place" (Rowan & Beavis, 2017, p. 173). The Australian teachers the researchers worked with over 2 years in the Serious Play project consistently rejected the idea that their ability to work with games would be enhanced through a particular formal framework or model for assessing GBL.

While we don't dismiss assessment questions, or the research that has been undertaken in this field—which does indicate possibilities where assessment and GBL can integrate well—this topic cannot be adequately addressed in this report. Instead, we offer a perspective from leading American GBL researchers who have already traversed much of the same terrain.

> This grand vision of the integration of gaming culture with school culture will require a tremendous effort on the part of all involved—schools, parents, academics, government agencies, non-profit agencies, gaming professionals, and others. Providing access for all students to the kind of playful, investigative, collaborative and well-supported education that we envision … will necessarily depend on school culture and gaming culture coming to a respectful, mutual understanding and comfortable integration. (Klopfer, Osterweil, & Salen, 2009, p. 43)

# 8.
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# Appendix: Methodology

When we began the project, we found a substantive amount of international research and theory about games and learning. However, it was difficult to piece together a clear picture of the range or impact of practices involving the use of games in/for learning and teaching across New Zealand, although we did identify a scattering of research,[61] news stories, and anecdotes. The Games for Learning project aimed to fill some of the gaps in New Zealand research with qualitative data. Over 2 years, we convened two group workshops, visited 14 schools, and interviewed 21 teachers and more than 150 students.[62] In some schools, we visited several times to observe GBL activities happening in classrooms. To frame the school-based data collection and analysis, we retrieved and reviewed an extensive range of international literature on game-based learning, and attended several key conferences about game design, gaming culture, and games in education.[63]

Figure 4 gives an overview of the project, including key research activities, outputs, and community-building dimensions.

## Design-based research

The Games for Learning project utilised aspects of design-based research (DBR) (Barab & Squire, 2004; Shah, Ensminger, & Thier, 2015). Design-based research recognises the inherent complexity of teaching and learning, and takes a clear stance on the question of how to link theory with practice. Namely, it seeks to "[inform] immediate practice while simultaneously continuing to develop theoretical understandings in the field of education" (Shah et al., 2015, p. 158). DBR typically involves an intermingling of researchers and practitioners, resulting "in the co-construction of knowledge" providing "multiple benefits for both practitioners and scholars (Shah et al., 2015, p. 158).

61 This included tertiary educators researching their own experiments with game-based approaches to teaching ethics (Oldfield, McKnight, Goundar, Stewart, & Slessor, 2014), geography (Gaillard & McSherry, 2014), ICT education (Bahiss, Cunningham, & Smith, 2010) and research into the design of videogames for children with ADD/ADHD (Baghaei, Casey, de Vivar, & Harris, 2012).

62 One limitation of the project is that it only involved English-medium schools. We hope that future work will add insights about the role and potential of tākaro and kēmu in Māori-medium contexts.

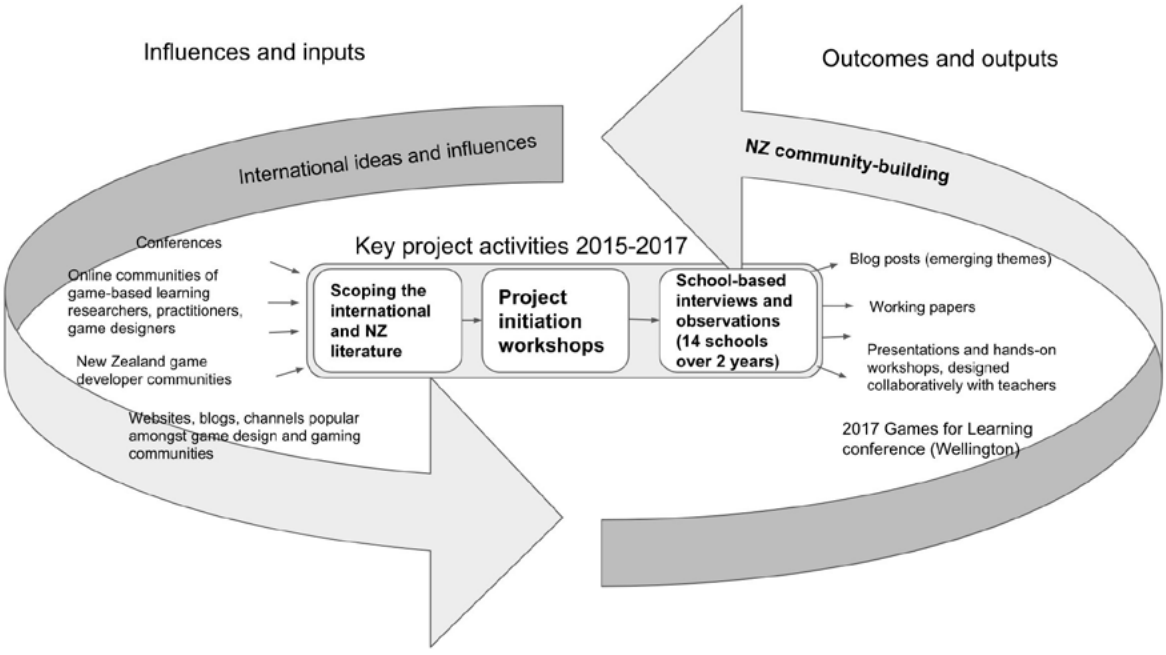
63 Including the 2015 Games for Change Festival (NYC), AUT's 2015 Creative Gaming symposium and 2016 Play, Interactivity and Games symposium (Auckland), the 2016 Education in Games Summit (Melbourne), and PAXMelbourne.

## Building a community of practice

Throughout the project, we also took steps to build and strengthen an active New Zealand community of interest around games for learning. The community-building aspect of the project proved to be generative in three important ways. First, the initial networks that began to form around the project helped to attract teachers who were keen to contribute to the research, giving early input into the project's scope and direction, and, in some cases, access to their schools and classrooms for research. Secondly, because we were sharing emerging findings from the project as it evolved,[64] we created opportunities for other "game-curious" educators to network and exchange ideas and practices with us, and with each other. Third, we were able to forge active networks with a growing global "tribe"[65] of researchers and practitioners of GBL. Utilising these networks, we could look at how New Zealand GBL practices were similar to or different from trends in other parts of the world, and keep up to date with cutting-edge literature in this field.

The 2017 NZCER Games for Learning conference[66] was another facet of the community-building agenda. The many face-to-face and online networking opportunities over the course of the project generated many ways to keep discussing and exchanging ideas, questions, insights, practices, and reading recommendations with other game-interested teachers, researchers, and game developers. This helped us to keep testing our interpretations of the data gathered in schools, and explore different ways of sharing and communicating our research findings.

FIGURE 4 **Overview of the project activities, influences, inputs, outcomes, and outputs**




64 This was done through games for learning blog (www.nzcer.org.nz/blogs/games-for-learning) and working papers (http://www.nzcer.org.nz/research/games-learning), as well as through breakfast talks, webinars, conference presentations, weekend meetups, and workshops.

65 This is an informal name used within the community to refer to its membership. Farber (2017) provides a detailed description of the origins and membership of "The Tribe", an affinity group that connects extensively both online and offline to share ideas, practices, and research, provide friendship and support, and mentor emerging game-based learning educators.

66 See www.gamesforlearning.nz

## Research visits to schools

As an exploratory project, we sought to include a mixture of primary and secondary schools, and schools located in a range of different communities. However, the schools we visited were not intended to be a representative sample. Research visits were organised with schools and teachers who volunteered to be part of the project, with some selections made on the basis of travel costs and ease of access to schools for multiple return visits. Most of the schools involved in the project were located in either Wellington or Auckland, and the schools where the most return visits took place were mainly in Wellington.

In 2015, we undertook research visits to nine schools (four in Wellington, four in Auckland, and one in Palmerston North). In most schools, we interviewed between one and three game-using teachers, and at least two focus groups of students. During 2016, we visited an additional five schools to interview teachers and students (four in Wellington, one in Christchurch). A final school case study was undertaken in Wellington in late 2017. Four of the Wellington schools were visited multiple times for more in-depth case studies.

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