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A waste of time? Or an effective learning tool? - Assessing the effectiveness of a digital games-based learning approach in music education

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I hereby declare that to the best of my knowledge, the content of this thesis is my own work.

I have not submitted this thesis for any degree or other purposes.

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Abstract

This research is a multiple case study on four participants who had access to the game *Rocksmith 2014 remastered* for sixty days. Following the sixty-day period, a post-test was conducted. The participants were assessed by two guitar experts and then interviewed by the researcher to understand if *Rocksmith* was an effective way to learn how to play the guitar. At the time of the interview, these participants were aged between 25 and 28 years and had varying levels of experience playing the guitar and video games. The findings suggested that as a learning tool, *Rocksmith* can teach certain guitar playing skills. These include (but are not limited to): teaching technical skills (such as knowing how to hold the guitar, correct and efficient left and right-hand technique, tremolo picking, sliding, and moving across the fretboard efficiently). Despite this, the interviews revealed that the participants did learn about other aspects of guitar playing, such as being able to play hammer-ons and pull-offs. In their interviews, the participants expressed a belief that *Rocksmith* is a useful tool for learning. Still, they also said that it was hard to find the motivation to continue playing. While they described their experience of playing *Rocksmith* as enjoyable and immersive, they also expressed having little motivation to continue playing. The study further tried to assess whether the skill of being able to read guitar tablature was transferable outside of the game. The findings revealed that this was inconclusive and that further study needed to be conducted.

Acknowledgements

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Contents

1. INTRODUCTION

Four participants with varied musical and videogame playing experience participated in this multiple-case study. For at least a sixty-day period, these participants had access to *Rocksmith Remastered 2014* (a videogame that requires the player to play music and arcade games with a real electric guitar, not a controller shaped *like* an electric guitar).

My interest in researching this videogame emerged after hosting a videogame evening at the university that I attended. These evenings involved playing music videogames and, conversations on the effectiveness, possibility, and potential to integrate videogames in music learning environments. On one of these evenings, I watched a close friend pick up an electric guitar to try out one of *Rocksmith's* arcade games – *String Skip Saloon* (see Figure 1). The learning aim of this game was to be able to distinguish between the six different strings on the guitar. In the game, the player must pluck the correct string before cowboys reach the end of the bar, the game is over once a cowboy reaches the end of the bar. I watched my friend play the game with skilled hands and focused eyes; she beat the already existing high score in the game. By the time she finished playing a single round, she had revealed that she never played an electric guitar, but she did have quite extensive experience playing videogames.

Figure 1. String Skip Saloon.

This single observation led me to wonder whether *Rocksmith* could teach a person how to play the guitar. And if this was the case, I also wondered what sort of person would be best suited to playing *Rocksmith* – would this person have extensive videogame playing experience? Or would they be a beginner or intermediate level guitarist with *some* experience playing videogames? Alternatively, would it be more effective for a person with little experience playing videogames and the guitar? In the summer of my first semester, I read *Real-Time Research: Experiments in Improvisational Game Scholarship* (Squire, Zimmerman, & Dikkers, 2010). The authors conducted research on the attendees at the annual 2009 Games+Learning+Society Conference. In the chapter titled *All I Really Needed To Know I Learned By Playing Games* (Bixler, Cady, Ohmberger, Maryellen Huang, Joosten, & Karakus, 2010) the researchers used a similar frame of questioning when investigating the mindsets, identities, and backgrounds of the attendees at this conference. As the name of the conference suggests, the attendees included researchers, educators, and game designers. The authors investigated the relationship between the attendees' professional identity and the games that they favoured.

In James Paul Gee's (2007) book *What Videogames have to Teach us about Learning and Literacy,* I came across the idea that videogames open up new modes of literacy. In the introduction, he established his background as a linguist with a special interest in learning, language, and literacy. He argued that when engaging with a text, it is possible to read it in different ways. Using the Bible as an example, he stated that a person could read the Bible as a self-help guide or as historical literature. Ultimately, people can read the same text and engage in it, in a range of different ways. People can also choose different ways to frame a single text by aligning themselves with other groups. But what is not possible is the ability to read or think outside of a single group. Citing Wittgenstein, Gee makes clear that there are no "private languages" or "private minds" (Gee, 2007, p. 6). Despite this, Gee articulates that videogames are a unique medium in that they help challenge how a person reads and experiences a text. When a person moves around in a digital three-dimensional world, they assume a character that is possibly both similar to and different from their own.

In this study, I attempted to understand the relationship between an individual's musical learning identity and the modality of using videogames when learning how to play the guitar. I also tried to ascertain how effective *Rocksmith* was in teaching a person how to play the guitar. The LITERATURE REVIEW explains the mechanics of the *Rocksmith* game, its playing modes, design, and considers current music education research on it. Later in this section, I use a *Game Verses Player* (Juul, 2003; Tondello, Wehbe, Orji, Ribeiro, & Nacke, 2017) approach by first examining the features of a game and then describing the multi-faceted experience of playing a videogame.

The METHODOLOGY chapter explains the initial survey questionnaire, post-test assessment design, and the interview protocol. The RESULTS AND ANALYSIS chapter include two parts: first, the participants' performance scores in the post-test assessment, and second, the participants' evaluations and reflections on their experience of playing the

Rocksmith game. In the conclusion, I state the limitations of this research study, list avenues for further research and explain the significance of this study.

2. LITERATURE REVIEW

The literature on the effectiveness of videogames in music education contexts is scarce but growing. However, the literature on videogames in broader educational contexts is vast. In the following literature review, I will first give a context of *Rocksmith*, and then consider the the limited existing research on *Rocksmith*. Following this, I will broadly examine the research literature on videogames in education, focusing on its applications in music education. I will apply the framework of the *Game and Player* (Juul, 2003; Tondello et al., 2017) by first considering the game and the aspects that constitute a game, and then I will describe the player's roles, identities, and the experiences common to playing games.

Rocksmith (Ubisoft San Fransisco, 2012) is a game produced by Ubisoft in 2011 and remastered in 2014. The remastered version was used in this study. Before *Rocksmith,* (Ubisoft San Fransisco, 2012), *Guitar Hero* (Ubisoft Leamington, 2005) and *Rock Band* (Harmonix & Pi Studio, 2008) were music games that had great commercial success (Dozal, 2016). These games required the use of plastic electronic controllers which imitated the instruments typically found in a popular music ensembles (drums, guitar, and keyboard). Figure 2 illustrates one guitar controller – it contains a fretboard, but no strings. *Rocksmith* emerged as a result of market dissatisfaction with these games because they were limited to such a plastic controller and not a "real" instrument (Schroeder & Farelly, 2012).

Unlike its predecessors, *Rocksmith* (Ubisoft Leamington, 2005) requires the use of a real electric guitar and a "real tone cable" (a USB cable that connects to the standard quarter-inch jack of most electric guitars and includes a built-in audio MIDI interface). This game is also compatible with bass guitar and acoustic guitar (through the use of a computer microphone picking up the sounds). The *Rocksmith* 2014 version is compatible with a wide range of different platforms including Microsoft Windows, PlayStation 3, PlayStation 4, Xbox 360, Xbox One, Macintosh, and recently iOS (only available in Canada at the time of writing).

Figure 2. Rock Band Electric Guitar, (Alphathon, 2010)

Rocksmith has five playing modes, which are as follow:

2.1 Guitarcade

As the word implies (or more specifically, the compound words *guitar* and *arcade*), this playing mode includes a library of eleven mini-games, inspired by traditional arcade games from the 1980s. Each game contains specific learning goals. This section will focus on six games from the *Guitaracade* library. These games have been specifically chosen because they will be mentioned in the following chapters.

2.1.1 Gone Whalin'.

The aim of this game is to develop dynamics and muting. At the start of the game, a character of a man resting on a whale's blowhole appears, and the player can manipulate this character by strumming or muting the strings. When a lot of noise is made, the whale shoots out water from its blowhole, and the character ascends. When the strings are muted, the character descends. Throughout the game, the player must dodge islands or birds, and the game is immediately over when the player collides into one of the two objects. Alternatively, The player earns points when the character collects bananas.

Figure 3. Gone Whalin

2.1.2 String Skip Saloon

As illustrated in Figure 1, the aim of this game is to be able to differentiate the six different strings on the guitar. The different colours represent the different six strings (and this colour scheme continually occurs throughout other *Guitarcade* games and also in the song mode). Throughout the game, cowboys try to escape to the other side of the bar. To stop this from happening, the player must pluck the corresponding string which shoots the cowboy. Should a cowboy escape to the bar, the game is immediately over.

2.1.3 Hurtlin' Hurdles

This game aims to develop tremolo technique. As the term implies, the player must manipulate a character that runs on a racecourse. "Jumping" over a hurdle involves muting the string. Periodically, the character changes string (this is indicated by the change of lane and colour), playing a tremolo on a different string.

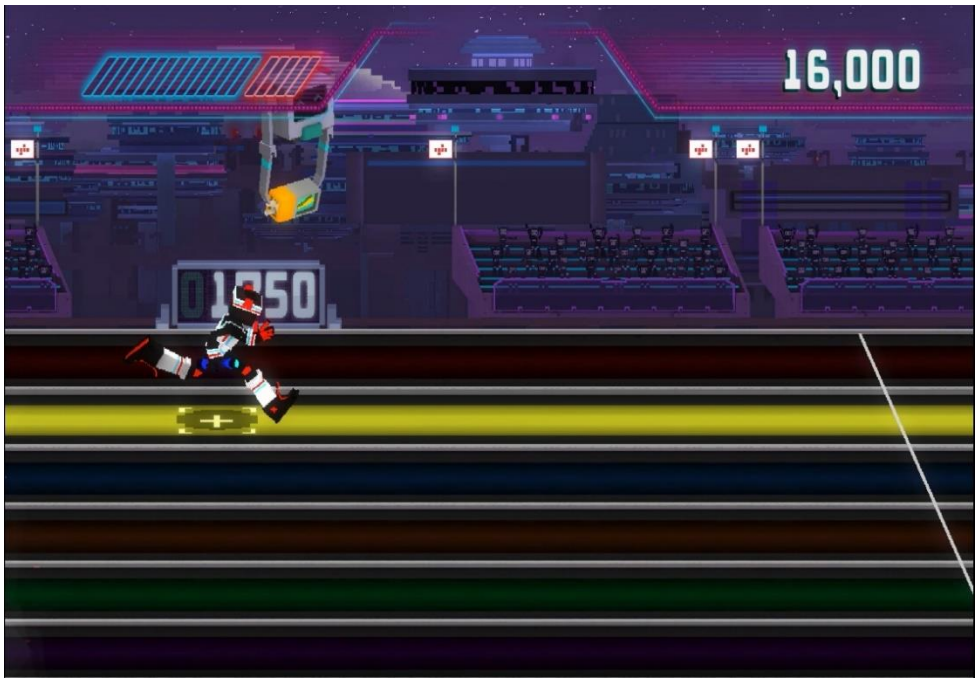


Figure 4. Hurtling Hurdles.

2.1.4 Slide Ninja

As implied by the name, the aim of this game is to develop pitch sliding. The player manipulates a character on the screen by sliding from fret to fret. The frets are indicated by the numbers which loom above the pagodas. Periodically, a message on the screen displays the words “switch strings” with an indication (based on the previously mentioned colour code) for which new string to switch to.

Figure 5. Slide Ninja

2.1.5 Return of the Castle Chordead

The aim of this game is to become fluent with reading power chords. At the start of the game, the player is given an introduction, and they are informed that various monsters know the “power of chords”. These zombie-like creatures move around the player and with time they move closer. Each creature has a power chord that looms over its head, and if the player successfully plays the correct power chord, then it is shot and dies.

Figure 6. Return of the Castle-Chordead

2.1.6 Scale Warriors

As implied by the name, this game aims to develop fluency and familiarly with a variety of different scales on the guitar. On the screen, six different coloured lines are shown, representing the strings of the guitar. In *Scale Warriors,* four frets show at a time. When the note flashes (a square box on a specific string and fret), the player must play it, which in turn moves a character to that position, enabling the character to defeat the "bad guys" that appear on the string. The pattern of notes belong to the pentatonic major, pentatonic minor, aeolian mode, and ionian mode.

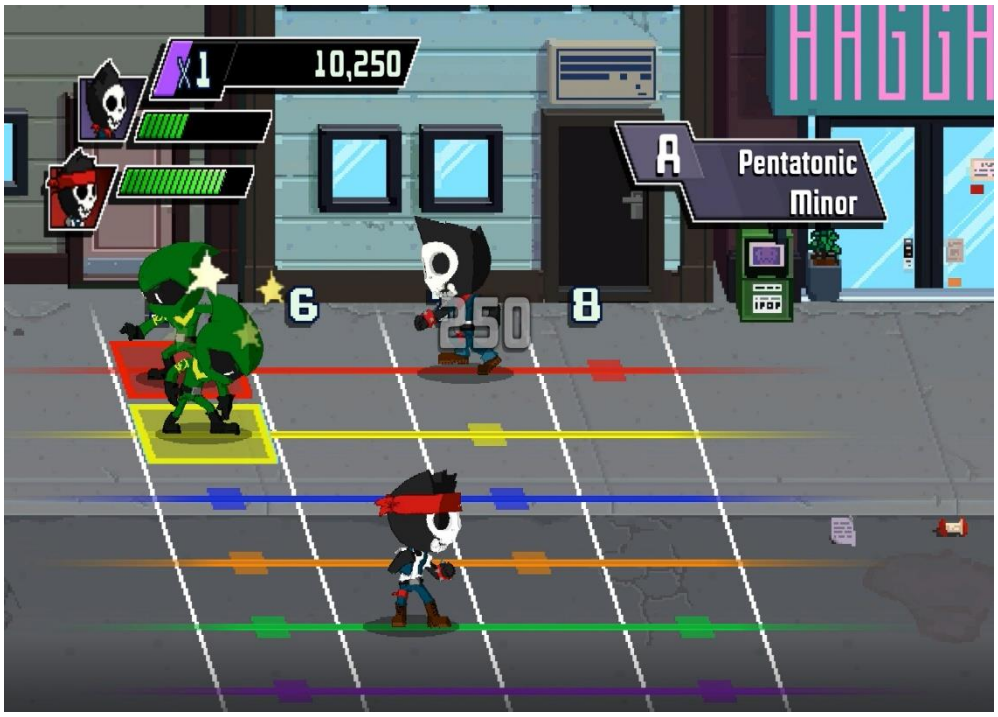


Figure 7. Scale Warriors

2.2 Song Mode

This is *Rocksmith's* primary playing mode. It contains an extensive song library that the player can choose and play. Additional songs may be purchased from the *Rocksmith* STEAM library. In the game, the player interacts with a moving musical notation which resembles guitar tablature. In traditional guitar tablature, there are six lines which represent the six

strings of the guitar. The lowest line represents the lowest "E" string, and the numbers represent the frets. *Rocksmith's* digital notation is different to guitar tablature as it mirrors the strings of the player's guitar. In otherwords, if a person learned how to play the guitar using *Rocksmith* with no previous experience or education, then this person may be confused to later discover that conventional guitar tablature is not mirrored but upside-down.

Shultz described this as a "driving mode" (Shultz, 2008 p. 182), and driving is an apt way to describe the experience of playing a song in *Rocksmith.* When driving, a driver can determine how far away an object is by looking at its size as the driver moves toward the object, the size of the object increases. Likewise, in *Rocksmith*, notes are represented by coloured rectangles (objects that are colour-coded according to the strings). These rectangles move closer and gradually increase in size, allowing the player to anticipate when to play the next note. The player is required to play the directed note when it locks into the closer rectangle, as can be seen in Figure 8.

In the earlier levels, the player is required to play no more than two or three different pitches, often on the first beat of each bar. As the level of difficulty increases, the note density increases (both in pitch range and rhythmic complexity) (O'Meara, 2016) and other techniques such as slides, pull-offs, and hammer-ons are included. The level of difficulty increases for all the songs in the song library, and this feature is known as "dynamic difficulty" (Ubisoft San Fransisco, 2012). In other words, if an experienced player were to select a song that she was unfamiliar with, she would not be starting from the lowest (sight reading) level as it is anticipated that the reading skills are transferable to learning new songs (this will be further discussed on pages 22-25). However, if the sight reading level was changed manually by the player, then the game's inbuilt capacity to adapt to the player's skill is overridden, and the level of difficulty remains fixed.

At the end of each song, two scores are displayed on the screen: the accuracy score, and the mastery score. Accuracy refers to the percentage of notes played correctly (at the correct pitch and note timing). The mastery score considers two aspects: the level of difficulty *and* the accuracy score. Or to put it into the player's perspective, when a player plays a song at a low level of difficulty, the player plays only a fraction of the full song. What is meant by this is not that sections of the song (the verse, chorus, instrumental solo, and bridge) are omitted, instead, the song exists as a structural whole, but the note density is lower. At the highest level of difficulty (100%), the player plays the full song, and at the lower level, the player plays only a part of the whole song. The levelling-up process in *Rocksmith* happens gradually. When the default "dynamic difficulty" mode is on in *Rocksmith*, the level of difficulty changes and adapts according to the player's ability to play the songs. In other words, if the player struggles, then the game reverts to an easier level (a version of the same song), and if the player plays with a high level of accuracy, then the game reverts to a higher level (closer-to-complete version of the same song). If the player plays *Rocksmith* in this setting, then a mastery score reflects the difficulty level and the accuracy score.

Figure 8. Song mode

A "riff-repeater" option is also featured in the song mode, allowing the player to isolate particular passages by practising them repeatedly and at a slower tempo. *Rocksmith* also features a multiplayer mode, where two players can play at the same time. However, unlike other games, such as *Guitar Hero Live*, (FreeStyleGames, 2015) it is not possible to play *Rocksmith* online. The two players must be in the same room in order to successfully engage in the multiplayer mode.

2.3 Video Tutorial Mode

This mode is a non-game playing mode with forty-nine instructional videos that teach guitar technique (for example harmonics, sliding, and hammer-ons) and maintenance (for example, replacing a string and tuning). "Special Topic" videos cover playing the guitar outside of the game, alternative tunings, and guitar equipment basics.

2.4 Amplifier and Tone Designer

The tone designer allows the player to adjust and try out different sounds and effects that can be generated by the virtual amplifier.

2.5 Jam Session Mode

In this mode, the player can freely improvise with a virtual ensemble. The player can play with different tempos, instruments and tonalities.

2.6 Other Research on *Rocksmith*

Ubisoft purports that it is possible to "learn the guitar for sixty days" using *Rocksmith* with an hour of practice a day. This is known as the "Sixty-day challenge" (Ubisoft Entertainment, 2014). The Ubisoft website claims that private independent research has previously been conducted to test the validity of this claim (Ubisoft Entertainment, 2014), but this research is not locatable. It is possible that this research is unpublished and not peer reviewed. This being the case, the veracity of Ubisoft's claim is unknown.

Jiménez (2016) tested this claim through his autoethnographic research. Following the advice of Ubisoft (2014), the researcher played the game for an hour a day, for five days a week. The author reported that he was a novice at playing the guitar. However, he had some experience playing music rhythm games such as *Guitar Hero* (Ubisoft Leamington, 2005) and *Rock Band* (Harmonix & Pi Studio, 2008).

Jiménez made field notes after each playing session in which he observed the following aspects of his experience: what he learned, his feelings (feeling tired, frustrated, or motivated), the increasing levels of difficulty, real-time, delayed and corrective feedback, as well as the level of agency provided in the game. Jiménez also acknowledged the limitations of *Rocksmith*, noting that after the sixty days, he was unable to read sheet music (a skill that

is not required for most electric guitarists, or popular musicians) (Green, 2001, 2008), nor play a song independently (without the assistance of *Rocksmith*). Finally, he still struggled with playing particular kinds of chords (barre chords).

O'Meara's (2016) criticism of *Rocksmith* was from a ludomusicological perspective, and his playing experience contrasted with Jiménez's (2016). O'Meara appeared to have a higher level of prior musical literacy than Jiménez. When he analysed how difficulty increased through the levels, he observed that rhythms became increasingly dense in the later levels. He labelled this phenomenon as "embedded rhythms". According to O'Meara, these embedded rhythms posed particular challenges. He noticed that when he learned a rhythm (in the earlier levels), it was difficult to "un-hear" the same rhythm in the later levels. He illustrated this in several transcriptions in Figure 9.

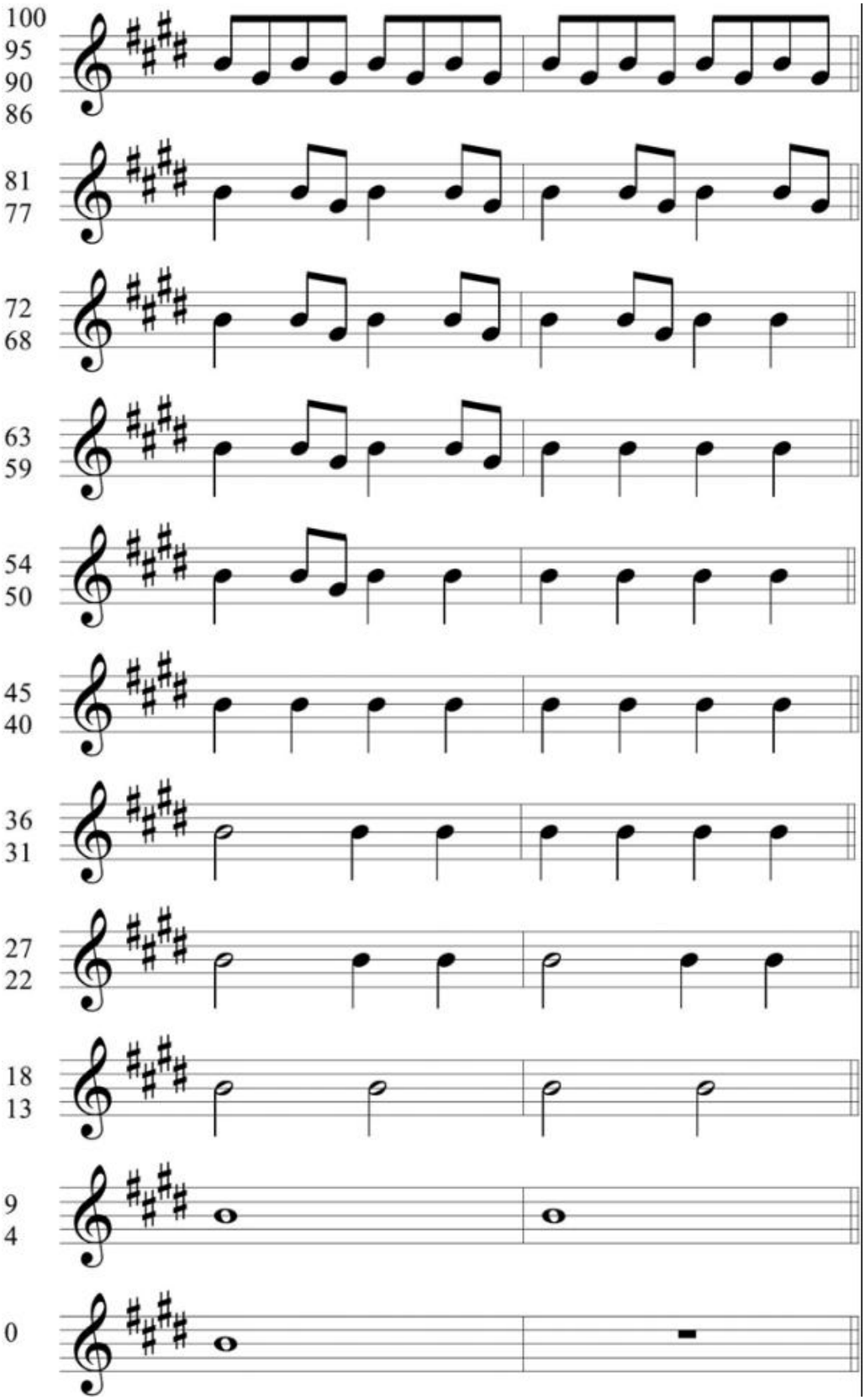


Figure 9. A transcription of the increasing rhythmic complexity through the *Rocksmith* levels in the *XX Islands* outro (O'Meara, 2016, p. 241). Reproduced with permission from the author.

Scaffolding by way of increasing rhythmic and harmonic density aligns with standard music education practice. For example, the easy piano version of James Humberstone's (2012) piece titled *Music from their worlds* contains the central melodic idea and is less rhythmically dense (as it only has crotchets in the left-hand accompaniment). In the complete version, the harmonic and rhythmic density is greater (Humberstone, 2015).

In O'Meara's (2016) transcriptions, he observed that upbeat notes (often the fourth beat) were omitted in the lower levels and included in the higher levels, giving the player time to shift to the next position. He described these rhythmic changes in greater detail. For example, between level 77 to 81 (see Figure 9), the rhythm in the XX *Islands* outro includes a simple and consistent pattern: a crotchet followed by two quavers. Between levels 88 to 100, this rhythm becomes four crochets. The rhythm thus changes from a long note followed by two shorts, then to four consistent short notes. While O'Meara described the gradual levelling-up process in *Rocksmith,* it was unclear if he played the game in its default state (dynamic difficulty). More specifically, it was unclear if he played the same song over and over, thereby allowing *Rocksmith* to increase the level of difficulty in its default state gradually. Or, if he instead, manually altered the level of the song on each different playing. Alternatively, if O'Meara hadn't focused very intently on a small selection of songs, and instead chosen other songs in the *Rocksmith* song library at random, would he have had the same challenges related to unhearing a rhythm? O'Meara also reported the inverse effect: he observed that being familiar with a particular song *before* playing *Rocksmith* made him predisposed to a specific listening of the song. His informal observations of other YouTube performers playing *Rocksmith* showed that they too had similar experiences.

Converse to O'Meara's (2016) experience, Jiménez (2016) described playing in the master mode – a level offered to players who reach 100% mastery in a song. In this mode of playing, the notes gradually fade out, and with more proficiency (on the part of the player),

the notes disappear entirely. Jiménez noticed that in the master mode, he "was already relying on *listening* to the sounds that the guitar was making, rather than the screen as (he) played the sections of a song (he) felt comfortable with" (Jiménez, 2016, p. 331). O'Meara (2016) clarified that in the master mode, the player relies on memory as the moving on-screen notation gradually fades then disappears. The existence of a master mode, where memory is developed and consolidated is logical (Hallam, 1997; Vuvan & Hughes, 2019). The activity of reading guitar tablature requires the player to have some level of aural memory. Standard guitar tablature does not include markings which indicate how long or short a note should be played, nor does it show the metre of a given song.

Graham and Schofield (2018) conducted two experimental studies on *Rocksmith.* The first experiment was conducted with the aim to evaluate the effectiveness of *Rocksmith* as a learning tool. In thirty minutes, the participants (n=8) were given several structured tasks which involved setting up the game, playing a song from the song mode library, and then playing a recommended challenge. Following this, the participants were given a post-test which allowed them to evaluate their learning experience. Based on the results, the participants seemed to respond positively to the game, expressing a want to continue playing. In the second experiment (n=4), the researchers acknowledged that thirty minutes was a limited length of time to evaluate the participants' learning. To further understand how the participants learned and progressed, the researchers implemented three testing sections over a 15 week period. The results showed that over time, the participants believed that their guitar-playing abilities had improved. The authors acknowledged another interesting finding, while the participants thought that *Rocksmith* could be utilised as a learning tool, they viewed *Rocksmith* as less of a learning tool and more of a game.

Research by Harve et al. (2018), which was conducted concurrently with this study investigated the experience of pre-service music teachers who played *Rocksmith* over one year. Data was collected through group interviews, participant observation, and self-reports. After closely analysing the data, the authors posited four positions from which participants engaged with the game, namely the musician, technician, gamer, and teacher. The authors clarified that they did not intend to typecast individuals (or groups of individuals). Instead, they strived to articulate various positions held by the participants in the study.

Many of the participants in this study expressed excitement that this game could motivate younger students to practice and play a musical instrument. The participants commented positively on how the game visually showed progress. They also likened the experience of a riff-repeater to their own experience as students practising music and undertaking lessons. In terms of negative experience, many participants expressed dissatisfaction with the in-game latency[1], frequently needing to tune the guitar, and the inaccessibility in pricing for the extra downloadable content. These contrasting experiences raise pivotal questions related to who the ideal audience is for the game: gamers interested in playing the guitar? Or guitar novices? Or guitarists who wish to increase their skills?

2.7 Ubisoft's Advice on how to play the game and Online Support

Ubisoft's website includes advice on how to best tackle their "sixty-day challenge" (Ubisoft Entertainment, 2014). As previously mentioned, Ubisoft recommends it to be undertaken with an hour of gameplay every day. Further directions on *how* best to play the game were not specified and left up to the player. Despite this, the game does recommend songs, missions, and games to the player to guide them through the experience. Player agency is a key feature in standard game design (Gee, 2003; Rigby & Ryan, 2011) and is a high

[1] Latency can be defined as a delay in the user's action and the onscreen response.

priority in *Rocksmith.* In a typical playing session, the player is presented with *several* missions to choose from, but the player does not need to play through the missions in order to progress through the game.

Like many video games, online technical support is provided in a Frequently Asked Questions (FAQs) section of their website as well as in other online communities (Ubisoft San Fransisco, 2020). *Rocksmith's* online support covers a great range of topics such as latency, white noise, instrument, and operating system compatibility. The extra hardware (*Rocksmith's* patented USB to quarter-inch jack cable, the *Real Tone Cable*) has meant that the *Rocksmith* gaming experience is not without technical issues. Curiously, this has opened up other online learning spaces where players provide technical support to each other. A wide variety of online discussion forums cover different topics such as the pedagogical limitations of *Rocksmith,* a player's personal experience completing missions and mastering songs, and a player's unique game playing style. Like many video games, screen capture recordings and game walkthroughs exist on YouTube, allowing players to share their gameplaying experience with others, as well as the opportunity to document their journey through the sixty-day challenge.

The existence of such open spaces acknowledges that online communities and learning exists *outside* of the *Rocksmith* game. This social phenomenon is not uncommon in video gaming (Gee, 2007; Gee & Hayes, 2012; Steinkuehler, 2006; Steinkuehler & Gee, 2005). Gee (2007) labels this phenomenon "affinity spaces".

2.8 Defining "Game"

In his book *Homo Ludens: a Study of the Play-Element in Culture,* Huizinga (1955) theorized that games existed in a special environment known as the "magic circle" (p. 10).

Playing, according to Huizinga, was defined by several givens which have been listed as follows:

- Rituals that carry special meaning – in other words, kicking a ball into a goal outside of the game state does not possess special meaning. However, in a game of soccer, this means earning a point.
- Roleplaying. The player assumes a role and is not herself. Instead, she is a potion maker, wizard, goalkeeper, etc.
- An experience that is immersive and absorbing to the players involved.
- The existence of win and lose states.
- Non-seriousness. The stakes in a game and the consequences for losing or winning in a game are not high or detrimental to the player outside of the game-space
- No material gains or profit. The word "play" is contrasted against professional activity (or work)
- The formation of special groups joined by secrecy. In other words, only the members of the group understand the rules, rituals, and meaning in the game space.

Huizinga stated that the magic circle is a space that is entirely separate from reality. Paradoxically, Huizinga also acknowledged that it is difficult to establish the exact boundaries between play and reality because rituals exist in everyday life. From a legal hearing in a courtroom to an entertainer telling jokes in an arena; all of these are special environments that are secret and separate to the outside world. These spaces contain players with roles and rituals with special meaning.

French sociologist Roger Caillois (1961) extended Huizinga's theory of the magic circle by defining play. Playing, according to Huizinga, was inclusive of any activity that happened inside of the magic circle. Unlike Huizinga, Caillois (1961) differentiated the words *play*

(paidia), and *game (ludus).* Play (or paidia), refers to any activity that is free, improvisatory, and unstructured: dribbling a ball, testing the thickness of different brushes, or playing scales in different rhythms are all examples of play. Game is the opposite of play as it refers to any structured activity, governed by rules and containing win and loss states: playing a game of basketball, painting a picture, or performing a piece of pre-prepared music for a live audience are activities which illustrate more gameful states. Caillois posited that play and game exist on a continuum and that all human activity exists somewhere on this continuum.

Caillois further extended Huizinga's theory by stating that players enter the magic circle voluntarily (Caillois, 2001). In Caillois' book, Huizinga's idea of non-seriousness is re-articulated as "unproductive" (Caillois, 2001, p.10), which means that any material gains or status in the game environment (or the magic circle) stops existing outside of the game environment. In other words, owning a lot of properties in a game of *Monopoly* (Magie & Darrow, 1935) does not translate to owning a lot of properties in the realm of reality. Like Huizinga, Caillois identifies the game space as an entity that is separate from everyday life. He extended Huizinga's definition by labelling this particular phenomenon as "Make-Believe" (Caillois, 2001, p.10), and he described this to be a "second reality" as well as "a free unreality, as against real-life" (Caillois, 2001, p.10).

Caillois furthered Huizinga's theory of play by identifying four different types of games:

- Agon: Games centred around competition (common in sports, and many multiplayer video games)
- Alea: Games of chance. These can include games with dice or cards
- Ilinx (Greek for whirlpool, or vertigo): Games that alter perception, this can include drinking games or children's rumble and tumble games that involve spinning or hanging up-side-down

- Mimicry: Games where an alternative reality is accepted, where roleplaying exists

Suits (1978) was another philosopher with a strong interest in games. He wrote that "Playing a game is a voluntary attempt to overcome unnecessary obstacles" (p. 41). For example, if in a game of golf, the aim is to get the ball into the hole, this in itself should be an easy feat. The player could pick the ball up and place it inside the hole. Unnecessary obstacles exist in the way of rules (such as only being able to make contact with the ball using a club), boundaries (only being able to play within specific parameters), and competition (playing against an opponent). Adopting an acceptance of these rules (or unnecessary obstacles) means possessing what Suits called a "lusory attitude" (p. 129). This lusory attitude could be further described as a state of mind, a mindset, or a psychological state. When a player adopts a lusory attitude, then the player helps to facilitate further gameplay. In his text, Suits did not explicitly cite Caillois, but a particular aspect of Caillois' theory re-appeared in Suits' theory of the lusory attitude. Like Caillois, Suits believed that when a player enters a game, they do so voluntarily, without force or coercion. Suits' actual definition of the term game (or ludus) did not directly define the word. Instead, he focused on defining the activity of *playing* a game (Salen & Zimmerman, 2003).

Salen & Zimmerman (2003) succinctly defined games as "a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome" (p, 11). Their theory extended the theories of the above (Caillois, 1961; Huizinga, 1955; Suits, 2005) and was further informed by definitions by other philosophers, designers, and historians interested in games, ludology, and game studies (Abt, 1970; Avedon, 1971; Costikyan, 2002; Crawford, 1984; Parlett, 1991).

The definitions above apply to all games, digital and non-digital, although Caillois and Huizinga wrote literature in a time when digital games did not exist. The following section will attempt to define and distinguish digital games from non-digital games.

2.9 Defining and Distinguishing Video Games

Videogames are games that exist through digital media. This definition includes games for specialised handheld gaming devices (such as the Nintendo Switch), specialised gaming machines (used in arcades), consoles (such as the Playstation, Xbox, and Nintendo), or games which are compatible with desktop or mobile devices (such as the tablet and mobile phone). A significant amount of literature on the topic of defining video games exists in the field of game studies (Arjoranta, 2019; Bergonse, 2017; Bogost, 2009; Esposito, 2005; Salen & Zimmerman, 2003).

Esposito's (2005) definition is:

> A videogame is a game which we play thanks to an audiovisual apparatus and which can be based on a story

Similarly, Bergonse (2017) defines video games as:

> A mode of interaction between a player, a machine with an electronic visual display, and possibly other players, that is mediated by a meaningful fictional context, and sustained by an emotional attachment between the player and the outcomes of her actions within this fictional context (p. 253).

Both definitions include the following aspects: playing as an activity and the manipulation of hardware. In Esposito's definition, the hardware is articulated as an "audiovisual apparatus", while in Bergonse's definition, he phrases this as "a machine with

an electronic visual display". Esposito's (2005) definition includes narrative as a component in videogames, while Bergonse focuses on the player(s) and the experience of playing.

Terkinbas & Zimmermann (2003) attempted to define videogames by describing them. The authors identified four traits of video games, but in their definition, they clarified that these traits were not mutually exclusive to digital games. More precisely, the authors argued that non-digital games and lived experiences could contain these four traits. The four traits are:

2.9.1 "Immediate but Narrow Interactivity" (Terkinbas & Zimmerman, 2003, p. 3).

Immediate feedback through the use of points, sounds, signs, and penalties are given to the player immediately after a specific action (desirable or non-desirable) is performed. For example, in a platformer, if a player happens to fall off a platform, they might lose a life and need to start over. This sort of feedback is immediate. Narrow interactivity refers to the limited actions that a player has throughout a game. Going back to the example of a platformer, the player could move left, right, fall downwards, and jump. In total, the player's movement is limited to four actions. Despite this, the player is still capable of developing their unique playing style in a game.

2.9.2 "Information Manipulation" (Terkinbas & Zimmerman, 2003, p. 3).

Before playing a game of chess, the players must understand all the rules. However, in a digital game, it is not necessary to understand all the rules before playing. When playing a video game, it is possible to give out such information (rules and mechanics) gradually. For example, in the independent platformer game known as *Thomas was Alone* (Bithell, 2014), the player is introduced to a single rectangle named Thomas. The player also takes on this rectangle's persona and manipulates Thomas by moving him sideways (left and right). The rules start to become more complicated at a later level when the player discovers that Thomas

can jump. As the player progresses through the game, another game mechanic is unveiled: with enough initial velocity, Thomas can jump long distances. This information is not given to the player through a set of written or verbal instructions but through other forms of media – sound, progression (or lack thereof) in the game, clues in the narrator's storytelling, and the loss of life. This example illustrates the gradual disclosing of information and how information is manipulated and communicated to the player – both aspects are prominent in videogames.

2.9.3 "Automated Complex Systems" (Terkinbas & Zimmerman, 2003, p. 3).

In a game of Scrabble (Butts, 1938), each player receives seven tiles at the start of the game, and each tile contains a single letter. The player must arrange the tiles to form a word and places this word onto the gameboard. Several factors determine the player's score (in a single turn): the word, the characters used, and where the player placed the word on the gameboard. In the digital version of the same game, certain parts of the game are automated. Rather than physically taking a letter tile from a bag, the computer instantly replaces the tiles for a player. Scorekeeping is also automatic, saving the player from needing to add up the points at the end of every turn. In this example, these systems are by no means complex, but they are automated. In more complicated games, automated systems have an advantage. For instance, in the dollhouse simulation game known as *The Sims*, (Wright, 2014) a player can create individuals (known as a Sim), choosing details (facial features, hair colour and style, build, sex, clothing, life goals, and personality traits). The player can also create a family house and detail it according to their preferences. Automated systems exist in the game through the night and day cycle, the aging of a Sim, the wear and tear of in-house appliances (that the Sim must fix), and the death of a Sim. In a non-digital doll-house game, it would not be possible to automate such systems.

2.9.4 "Networked Communications" (Terkinbas & Zimmerman, 2003, p. 3).

In a board game or a team-based sport, communication is limited to players who are in close proximity to one another. In a digital game, communication and playing can happen over greater distances. Using the same example, in a game of Scrabble (Butts, 1938), the players must be in the same room to be able to play this game. In the digital version, distance is no barrier.

Arjoranta (2019) and Bogost (2009) took a critical and philosophical approach when defining video games. In his attempt to define video games, Bogost provided context that allayed some of the great debates and issues in the field of game studies. These include Ludology (the study of game mechanics) versus Narratology (the study of narrative) and the more recent development of the game versus player debate (Juul, 2003). Bogost also acknowledged that the field of game studies (as the term implies), is inclusive of non-digital games, but there has been a greater focus and interest on digital games. In the end, Bogost stated that the question "what is a videogame?" is fundamentally an ontological one. After dissecting the components of video games (players, code, hardware, narrative, aesthetics, and mechanics), he concluded that "Videogames are a mess. A mess we don't need to keep trying to clean up, if it were even possible to do so" (Bogost, 2009, para. 88).

Arjoranta (2019) critically reviewed Bergonse's (2017) attempt to define video games, arguing that an essentialist approach to defining video games is not ideal. Instead, Arjornata used the analogy of mathematical axioms and argued that videogame definitions ought to be understood and accepted as axioms – statements or truisms that are first to be accepted as starting points, allowing dialogue and discourse to happen later. The following section focuses on digital games by describing and distinguishing the different types of video games and how academic research has categorised video games in the current market.

2.10 The Types of Video Games

Many different categorisations of videogames currently exist. Videogames can be categorised by compatibility with operating systems (Macintosh, Android, iOS, Windows), compatibility with game consoles (Nintendo, PlayStation, Xbox – and the many iterations of the same consoles, such as the Wii U, Nintendo Switch, Xbox One), and compatibility with other devices (mobile (phone and tablet) games and desktop games). Like other forms of media (such as film and television), videogames are also classified by age and maturity suitability.

Further categorisations of games are centred on genre. Ernest Adams (2010) identified nine game genres: action games, strategy games, roleplaying games (RPGs), sports games, vehicle simulations, construction management simulations (CMS), Adventure games, Artificial Life and Puzzle Games, and Online Gaming. He stated that smaller sub-categorisations for these games exist. For example, action games are video games that require the player to interact with the game in real-time. Unlike *Solitaire* (Cherry, 1990) *Angry Birds* (Rovio Entertainment Oyj, 2009), or many puzzle games (that allow players to take their time), in an action game, the player must make decisions and take action quickly to progress through the game. The sub-genres of action games include music rhythm games, platformers, shooters, and fighting games.

In other work, Adams (2009) identified five dimensions to help describe and define the different categorisations of games, and these include mechanic, setting, audience, theme, and purpose. He further argued that the mechanics are a stronger determiner of the game's genre than setting or aesthetic (Adams, 2009). For example, if the setting for a shooter-game is a virtual medieval world, then this is still fundamentally a shooter-game, not a roleplaying game. When describing the purpose as a dimension, Adams described two kinds of games: commercial entertainment games and serious games. Aligned with such games are other

terms: *Gamification* and *Serious Games*. The following section will look more closely at these areas.

2.10.1 Digital Game-Based Learning (DGBL)

DGBL was a term coined by Prensky (2001a), and it refers to learning through digital games. The author did not define or identify any specific kinds of games. In effect, this term may apply to commercial entertainment games and educational games. These categorizations will be further defined below.

2.10.2 Serious Games

Serious Games was a term coined by Abt (1970) and refers to games made with serious outcomes (or outcomes not related to entertainment). Educational games such as *Where in the world is Carmen San Diego?* (Broderbund, 1985) and *Mathletics* (3P Learning, 2020) are examples of serious games. Entertainment games, as the term implies, are the opposite of serious games. Examples of entertainment games include *Counter-Strike* (Valve & Hidden Path Entertainment, 2012), *Mario Kart* (Nintendo EPD, 2019), and the *Life is Strange* series (Dontnod Entertainment, 2015).

2.10.3 Gamification

The term *Gamification* started to circulate in 2009 (Deterding, Dixon, Khaled, & Nacke, 2011). It refers to the placement of game mechanics (such as badges, points, leaderboards, progress bars, narrative, and avatars) into non-game-related contexts. Gamification typically exists in contexts related to health and fitness, education, and the workplace (Deterding et al., 2011; Kapp, 2012; S. Walz & Deterding, 2014; Werbach & Hunter, 2012). Gamifying something does not make it a game.

The music training application *Scales Blitzer*, designed by piano teacher Samantha Coates (2017), is a gamified smartphone and tablet application intended to motivate (younger) music students to play scales. When a student plays scales, the teacher can validate this by awarding the student points. When a student acquires a high level of experience, the student can tour around the (virtual) world playing scales. Students can design their avatar, and their progress is shown on a leaderboard, adding a competitive element to the experience. In this example, the designer used game mechanics of points, leaderboards, customization, and a narrative to motivate the student to play scales. Fundamentally, it did not make the activity of playing scales a game, but it made it game-like.

2.11 Issues with the Terminology

The terms gamification, serious games, and entertainment games are not without problems because commercial video games made for entertainment purposes have been used in serious contexts. For example, the game *Civilisation III* (Meier, 2001) was designed and marketed for entertainment purposes but has been used to teach history, geography, and world trade (Squire, 2006). Additionally, the line that separates *game* from *gamification* is not always so straightforward. For example, the mobile health and fitness application *Zombies, Run!* (Six to Start, 2012) is marketed as a game. In the "game", the player situates themselves in a (make-believe) environment where a zombie apocalypse exists. To survive, the player must run and collect items. At particular points of the game, the narrator tells the player to "run faster" (Six to Start, 2012). This instruction is accompanied by the sound of zombies breathing. This sound becomes louder, indicating that the zombies are closer. If the player fails to run fast enough, the items in the player's inventory disappear. Each mission weaves a story which is delivered to the player episodically. *Zombies, Run!* is marketed as a

game, not an application. However, in teaching texts and contexts, *Zombies, Run!* is used as an example of gamification (Kapp, 2012).

The outcome of this game is ambiguous: Is the whole point of the game to run away from zombies? Unlock missions? Or to make the seemingly arduous task of exercising fun? These questions prompt another: Is this a game, or is this gamification (of running)?

2.11.1 A Critical View of Gamification

Game designer and theorist Ian Bogost took a critical view of gamification. In his provocative chapter titled *Why Gamification is Bullshit* (Bogost, 2014), he wrote that gamification "is primarily a practice of marketers and consultants who seek to construct and then exploit an opportunity for benefit" (p, 65). To illustrate this, he used the example of the *Deloitte Learning Academy* (DLA). The DLA awarded training employees with badges and placed such badges on a leaderboard showing the achievement of employees. The intention behind this was to motivate the employees to work effectively. Bogost argued that the employees in training were not intrinsically motivated to work. Instead, they were coerced into working effectively. In previous work, Bogost coined the term *exploitationware* (Bogost, 2011c), suggesting that this term should be used synonymously with the word gamification. Bogost reasoned that the term exploitationware captured the intentions of gamification proponents.

At first glance, it would seem that Bogost was critical of gamification for enterprise, especially since the first part of his chapter criticized gamification in that context. Naturally, this does prompt questions about gamification's effectiveness in other contexts (such as healthcare and education). Using another example, relevant to education and training, Bogost illustrated the misunderstanding of the word gamification by describing *Vim Adventures* (Linder, 2020) – a game with a *Legend of Zelda* (Shigeru & Tezuka, 2019) aesthetic. The

pedagogical aim of this game is to learn the keyboard shortcuts in the Vim text editor. To put it in context, in a conference that Bogost attended, he noticed that a presenter used the word *gamification* to describe Vim's Adventures. Bogost disagreed and argued that Vim's Adventures was an example of a game, not gamification. Perhaps a more fitting label to Vim's Adventures is the term serious game, but Bogost also disagreed with this term. In other work (Bogost, 2010), he argued that entertainment games could (and effectively do) teach serious outcomes. He preferred the term *persuasive games* (Bogost, 2010), not as a synonym to serious games but as a way to challenge the distinction between entertainment games and serious games.

Through his chapter *Why Gamification is Bullshit* (Bogost, 2014), Bogost further criticized certain rudimentary aspects of gamification. He analysed the mechanic of instant-feedback and questioned whether this was a mechanic that was truly exclusive to videogames. He illustrated this by describing his experience using a text editor, acknowledging that he received instant feedback after pressing specific keys on his keyboard as the corresponding characters appeared (instantly) on his screen. Additionally, misspelling a word led to another type of instant feedback: a zig-zagged red underline. Bogost questioned whether this made typing a game, or even gamification. In the end, he deemed that the word *gamification* was unnecessary.

In line with this argument is the view that gamification exists in everyday life. Humans gamify mundane (yet necessary) experiences to escape boredom. In a study conducted by Sansone, Weir, Harper, & Morgan (1992), the findings revealed that when a person must complete a menial and uninteresting task, strategies are applied to increase the level of interest in the task. These strategies also assist the person in continuing the task on a long-term basis. By this logic, gamification is an intrinsic part of being human.

Jane McGonigal, like Bogost, is a game designer and researcher, and many of her games feature serious outcomes. She also took a critical view of the term gamification. Her game *SupeBetter* (McGonigal, 2012) (a game centred on wellbeing) has been widely researched in the field of health (Roepke et al., 2015; Worthen-Chaudhari, Logan, McGonigal, Yeates, & Mysiw, 2015; Worthen-Chaudhari et al., 2017). At first glance, gamification would seem to be a fitting way to categorise the *SuperBetter* application.

SuperBetter is a browser-based application also available on Android and iOS mobile devices. When a person plays *SuperBetter,* they do not assume a make-believe world because the *SuperBetter* world exists in reality. The player can customize their own experience by creating a quest or choosing from the range of already existing quests. One of the already existing quests involves improving one's sleep quality. Should the player choose this quest, small tasks are assigned to achieve this goal, an example of this includes assuming the role of a sleep scientist by researching what constitutes sound sleep. If the player completes the quest, the player may click the lightning-shaped button to be rewarded with points for mental resilience. The player may also share their success with their friends through social media. This application uses the game elements of quests, levels, points, and social sharing to help the player achieve their health and wellbeing goals.

SuperBetter applies game mechanics (as listed in the previous paragraph) into a non-game related context (health and wellbeing). It is, therefore, a fitting example of gamification. Despite this, McGonigal did not identify with the term. Instead, McGonigal preferred the term "Alternate Reality Games," defining such games as "games you play in your real-life" (McGonigal, 2012, p. 120). Ultimately, it appears that *SuperBetter* is, in fact, a gamified health and wellbeing application, but McGonigal chose to affix other words to describe the games that she designed.

Naturally, this prompts the following questions: Why was McGonigal so opposed to the term gamification? And what does the term gamification mean to McGonigal? In an interview conducted by Bruce Fieler (2012), McGonigal said: “I don’t do ‘gamification,’ and I’m not prepared to stand up and say I think it works”. She elaborated on this idea further by saying: “I don’t think anybody should make games to try to motivate somebody to do something they don’t want to do. If the game is not about a goal you’re intrinsically motivated by, it won’t work” (Fieler, 2012, para. 12). McGonigal’s disagreement with the term gamification seems to go back to Bogost's previous point: gamification coerces an individual into participating, and it does not support or assist them in reaching their goals. Her preference for the term “alternate reality games” puts forward the view that “gamification” is a simple, abstracted, and overly reductionistic approach to game thinking and design. Preferring to use the term alternative reality games implies that there is more to game-design than just adding badges, points, and leaderboards to existing activity.

2.11.2 Attempts to Disambiguate the Differences Between Serious Games and Gamification

In an attempt to clarify the definitions of serious games and gamification, Kapp (2012) referred to all serious games as gamification. He wrote that “serious games are a sub-set of the meta-concept of gamification” (Kapp, 2012, p. 18). In other words, gamification was an umbrella term for other terms such as serious games. However, in later work (Kapp, Blair, & Mesch, 2014), he contradicted this. He stated that the terms gamification and serious games were differentiated because according to Kapp, games are a “self-contained unit” with a clearly defined “game space” (p. 56). Unlike gamification, games contain win-states, beginnings, and ends. Conversely, gamification involves embedding game elements into everyday life – in the gamification world, there is no start or end. Walz and Deterding (2014) acknowledged that “gamification” is such a pervasive term that it has more recently become

an umbrella term used to describe anything game-related – this includes serious games and gameful-design.

Despite this, Walz and Deterding (2014) attempted to offer clarity to the term gamification by identifying a framework. In this framework, the authors distinguished two movements: the "ludification of culture" (p. 7) and the "cultivation of ludus" (p.7). The authors also identified four different types of gameful experiences which have been listed below. Musical examples have also been included to clarify and show how this framework applies to the field of music education.

- Serious games as "full-fledged games" (p. 7) also labelled as "ludic wholes" (p. 7) with serious (or non-entertainment) outcomes. Skill and drill games, such as *Staff Wars* (The Music Interactive, 2017) (a music notation game where the aim is to "shoot" the moving note head by pressing on the correct note letter before it reaches the far left side of the screen) is an example of this (see Figure 11).
- "Serious Toys" (p. 7) also labelled as "paidiac wholes" (p. 7) or as "toys designed for non-entertainment purposes" (p.7). Examples of music video games that stimulate play include applications such as *Isle of Tune* and *Groovy Music*, which were designed to teach primary school-aged children to produce loops. In these applications, the player places objects in a virtual world environment, which in turn creates musical loops (for example, in *Isle of Tune*, the player can put cars into his/her virtual environment). This type of interaction is playful since it provides the student with an unstructured activity that is, by nature, free, not containing rules, rewards, penalties, or win and loss states.
- "Playful" (p. 7) design as experiences or "non-toy objects" (p. 7) designed to instigate playful (paidia) experiences – the piano stairs in Stockholm (which have since been installed in other cities on a global level) are an example of this. In a busy train

station, the stairs were modified to appear like a piano. When a person stepped on a stair, a pitch sounded; this, in effect, demonstrates a level of playfulness (or paidia) in the experience of using stairs.

- Gamification (also labelled as “gameful design”) (p. 7) as game elements applied to non-game or “serious” contexts. At present, gamified applications related to music education exist with aims to motivate students to practice. Designers try to achieve this by making the typically less inspiring parts of music learning fun and engaging (pages 48-52 and 57-60 explores this further). For example, *Tonara* is an application that allows students to log their practice time, communicate with their teacher, complete assignments, earn points, and set practice goals.

Figure 10 illustrates the four above mentioned points.

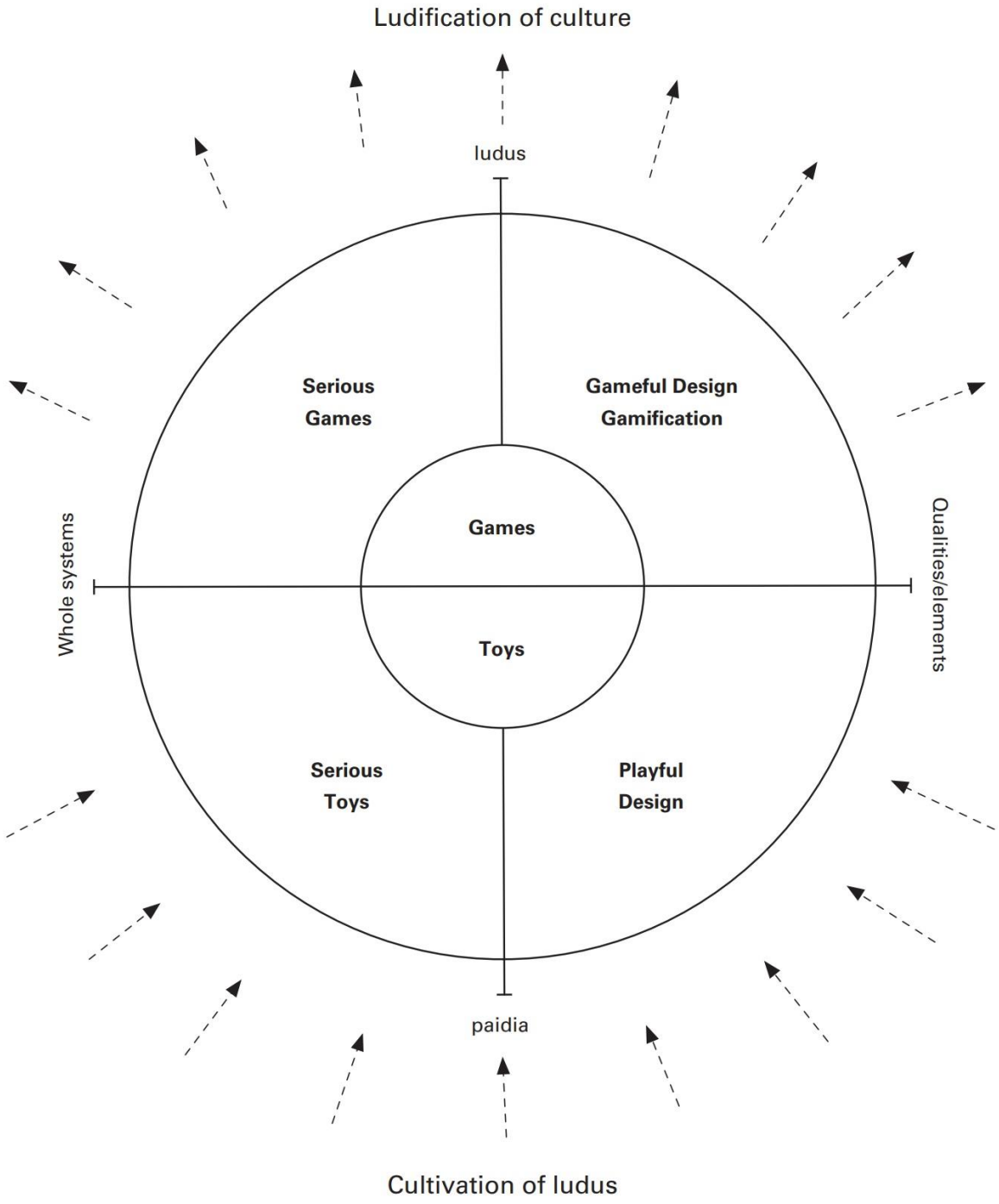


Figure 10. "Framework for Game thinking and Design" (Walz & Deterding, 2012, p. 8). Reproduced with permission from the authors.

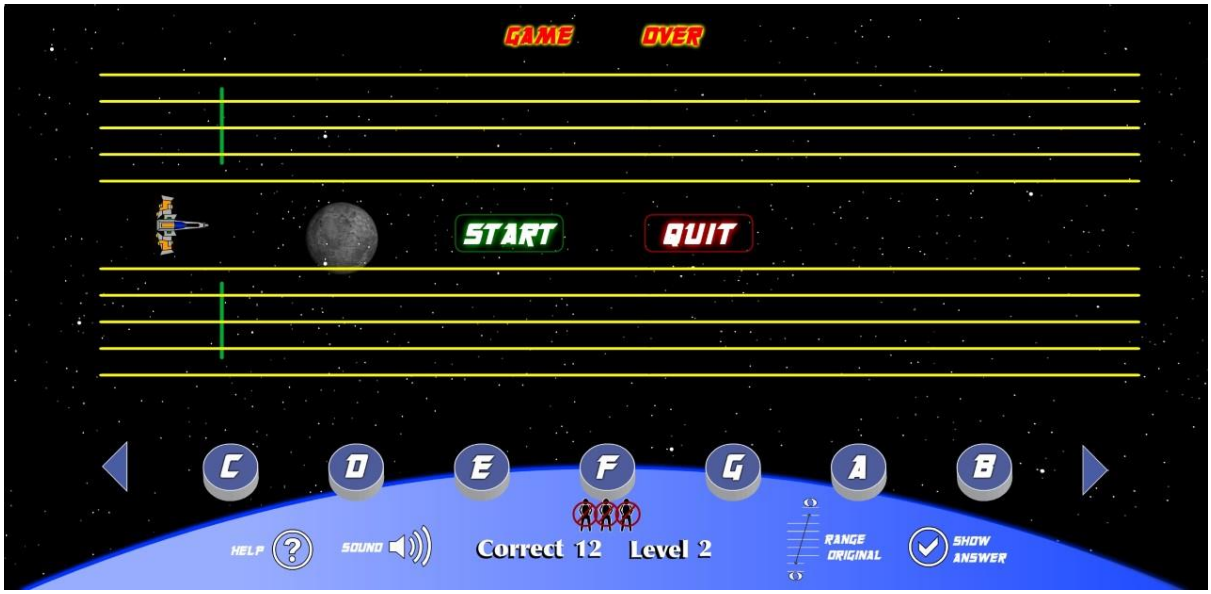


Figure 11. Staff Wars game

In previous work (Ly, 2017), I have situated these terms (gamification, DGBL, entertainment games, and serious games) on a continuum, arguing that at one end of the continuum, a "serious" space (reality) exists (see Figure 12). On the other side of the continuum, a player is fully "contained" in Huizinga's idea of the magic circle. Next to the serious reality space, the following terms exist in this order: gamification, serious games, and entertainment games traversing the continuum.

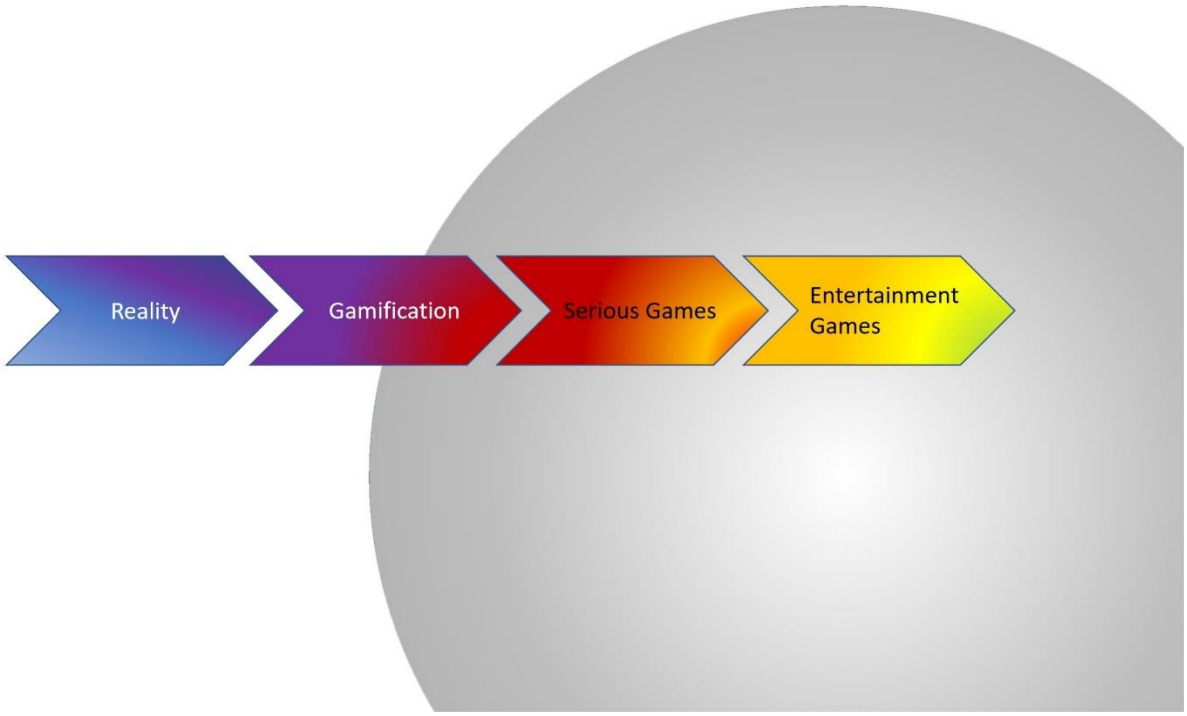


Figure 12. The continuum between reality and the magic circle (Ly, 2017)

2.12 How Music Games are Categorised

Williams (2012a) established an alternative framework that applied exclusively to music games. He posited that two binaries exist in opposition to one another: digital games/non-digital games and games/non-games. Such games and experiences can exist in four different combinations which have been illustrated in Table 1.

Table 1

Williams' Framework Categorising Musical Digital and Non-digital Games

	Non-Digital	**Digital**
Non-game	Immersive learning, traditional lessons	Exploratory sound-making apps
Game	"Real-life" musical game	*Rock Band, SingSmash*

Williams' (2012a) framework is similar to Walz and Deterding's (2014) framework (see Figure 10), acknowledging the playful (paidia) versus gameful (ludus) elements of design and experience. However, unlike Walz and Deterding, Williams differentiated the digital or virtual experience with a non-digital one. Both non-digital and digital examples exist in Walz and Deterding's framework on gameful experiences. Williams (2012a) also acknowledged a "reality state" that is a totally "serious" non-game state.

Hein (2014) organised music digital games under three distinct categories:

1. Drill-and-skill
2. Rhythm Games
3. Music Toys

His categorisations are similar to Deterding's model mentioned above, acknowledging the existence of serious toys (music toys) and serious games (drill-and-skill). He also put forward that drill-and-skill games augment the learner's experience and offer a better solution to traditional modes of feedback. Unlike previous technologies that involve completing worksheets and handing them to a teacher to mark, drill-and-skill applications related to music theory give students immediate auditory feedback.

In his chapter, Hein (2014) organised rhythm games more distinctly under three subcategories:

1. *Dance games.* Examples include *Dance, Dance Revolution* (Konami, 2019), *Just Dance* (Ubisoft, 2009), *Dance Central* (Harmonix, 2010a). As the term implies, these dance games involve the player moving in time and in accordance to the onscreen indications of where to place their feet, or in the case of *Just Dance* and *Dance Central*, the screen shows a character dancing, and the player is to mirror this character's gestures. The infrared camera is capable of picking up the player's

movements and assessing how accurate their movements are. Real-time feedback is provided to the player, allowing them to understand whether or not they have moved in time with the music.

2. *Instrument Simulation Games.* Examples of such games include *Guitar Hero* (Ubisoft Leamington, 2005) and *Rock Band* (Harmonix & Pi Studio, 2008). As mentioned, these games feature controllers in the shape of musical instruments (e.g., keyboards, drums, and guitar) and require the player to push certain buttons in time with the moving-onscreen graphic notation.
3. *Singing Games*. *SingStar* (London Studio, 2017), *Just Sing* (INiS, 2016) – these games involve singing into a microphone connected to a console. When playing the game, the player chooses a song from the song library and sings along with the full track. A MIDI-like musical notation appears across the screen, and the player receives real-time feedback when they sing into the microphone. This feedback exists in the form of points and computer-generated comments.
4. *More Abstract Games*. *FreQuency* (Harmonix, 2002), *Fantasia: Music Evolved* (Harmonix, 2014) – these games involve interacting and manipulating sound through movement. For example, in the game *FreQuency*, the player travels on a virtual rollercoaster-like octagonal tunnel, collecting points by hitting buttons that correspond to the beats.

2.13 Why Gamify Education? Why use Games?

2.13.1 Motivation

As mentioned, the majority of the literature on gamification focuses on its use and application in the area of business and enterprise (Burke, 2014; Werbach & Hunter, 2012; Zichermann & Linder, 2013). The interest in gamifying education and DGBL exists based on

the evidence that a high number of primary and secondary school-aged students spend their time playing video games. In a study conducted on American youth, between the ages of eight and eighteen, the findings revealed that such individuals consumed 10.45 hours of media a day, compressed into 7’38 hours a day due to multitasking. Of that 7.38 hours of screen time, 0’57 (close to an hour) of it was spent playing video games on console and handheld devices (this amount did not include computer games) (Rideout, Foehr, & Roberts, 2010)

The experience of playing a video game is a highly immersive one (Rigby & Ryan, 2011). Harnessing such immersive qualities to engage students and inform curriculum design is an area of interest to educators, game designers, and researchers alike (Kapp, 2012; Sheldon, 2011; Squire, 2011). School-aged students are not always interested in schoolwork. There are many reasons for student disengagement, and some of these reasons include not wanting to be associated with intellectual stereotypes (Bradbury, 2016), digital distraction (De Castella, Byrne, & Covington, 2013), and failure anxiety (Alkhazaleh, 2016; De Castella et al., 2013).

Gamification systems and DGBL exist as solutions to promote student engagement by motivating students to undertake activities related to their schoolwork (such as musical practice, reading, coding, or completing skill and drill activities) (Birch, 2013; Hwang, 2014; Ibanez, Di-Serio, & Delgado-Kloos, 2014). To put it succinctly, DGBL solutions and gamification systems use what is familiar and engaging to school-aged students (games) in an environment that is not always engaging (school).

2.13.2 Intrinsic and Extrinsic Motivation

Ryan & Deci (2000) posited that two types of motivation exist: motivation that is intrinsic and motivation that is extrinsic. Intrinsic motivation comes from within, or more

specifically, it can be defined as the drive to pursue an activity purely on its own terms. Wanting to read a book about video games because of curiosity and interest in the topic demonstrates intrinsic motivation. Conversely, extrinsic motivation refers to motivation that exists outside the activity: working long hours in a tedious job for money is an example of extrinsic motivation since the motivation to pursue the activity is not in the job, but rather on the extrinsic reward (money). Before Ryan and Deci (2000), behaviourists such as Skinner (1974) believed that all motivation was extrinsic. Ryan and Deci (2000) acknowledged that intrinsic and extrinsic motivation are not mutually exclusive, that no binary or dichotomy exists. Instead, the authors put forward that these types of motivation are spectral. It is, therefore, possible to experience intrinsic and extrinsic motivation at the same time.

A musical example of a single reward that might summon elements of intrinsic and extrinsic motivation could be as follows: if a child was learning how to play the clarinet, she might find certain parts of this experience to be less enjoyable than others (for example, playing scales daily). Being offered new reeds in exchange for playing scales on a regular basis is a reward that focuses on the original activity (which, in this example, is playing the clarinet). To acknowledge that intrinsic and extrinsic motivation can co-exist, Ryan and Deci (2000) situate these motivations on a continuum with a-motivation on one end of the pole, extrinsic motivation in the middle, and intrinsic motivation at the opposite end of the same pole as shown in Figure 13.

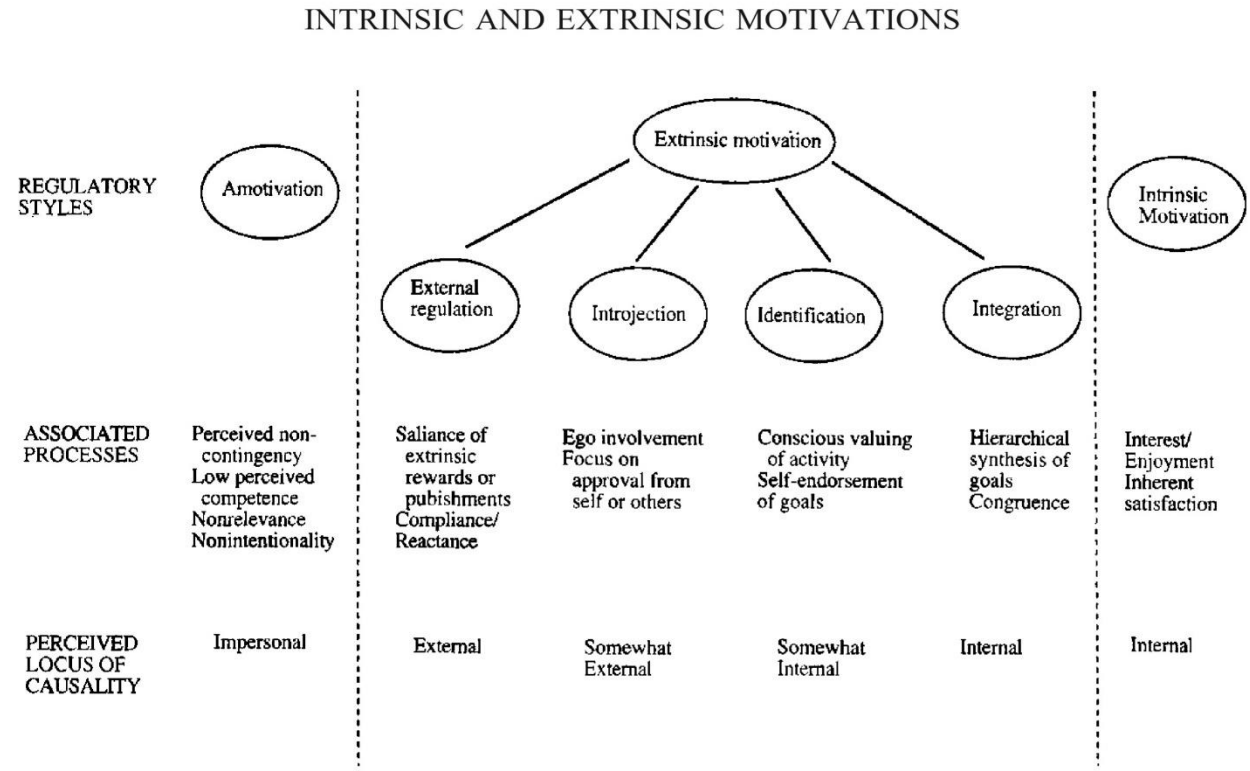


Figure 13. Taxonomy of Human Motivation (Ryan & Deci, 2000, p. 61). Reproduced with permission from the authors.

2.13.3 Intrinsic Motivation, Choice and Agency in Games

In later work (Rigby & Ryan, 2011), Ryan collaborated with Scott Rigby and applied the theory of intrinsic motivation to video games. According to the authors, in a game, "the reward is integrated into the activity, rather than dangled outside of it" (p. 147). The authors also acknowledged that inside of the game space, the player is typically presented with several choices: this is called *player agency*. Whether it means declining or accepting a quest, or choosing to play the game with another player, playing is a voluntary experience. The player enters the game space on their terms, without being forced or coerced. In this example, the player's motivation could be described as more intrinsic than extrinsic.

The authors compared choice and agency when playing video games to traditional schooling. In their comparison, they state that unlike games, the rewards available in

schooling do not always encourage intrinsic motivation. Passing an exam or earning a gold star means earning a reward outside of the experience. Moreover, choice in traditional schooling is largely absent: students typically have little choice over what learning activities they can undertake (Ryan & Rigby, 2011).

Ryan and Deci (2000) further acknowledged that extrinsic rewards could diminish intrinsic motivation if an individual was (or is) already interested in the task at hand. However, where intrinsic motivation does not already exist, extrinsic rewards can increase (or establish) intrinsic motivation.

Critics of gamification argued that gamification rewards players with virtual extrinsic rewards. These aspects of gamification are known as "pointification" (Blohm & Leimeister, 2013; Seaborn & Fels, 2015). In effect, this leads to motivation that is short-lived and extrinsic. In a longitudinal study conducted on undergraduate level social studies students, this claim was tested and supported (Hanus & Fox, 2015). Conversely, proponents of gamification state that it involves more than adding points, badges, and leaderboards into non-game related activity (Hunter & Werbach, 2012; Kapp, 2012). In this thesis, I refer to *Rocksmith* as a digital *game* which fits under the category of DGBL. While some aspects of the *Rocksmith* experience could be described as *gamification,* as an experience, it begins and ends within a clearly defined space (the digital game space). *Rocksmith* does not "continue" into the realm of reality. To clarify, although it is possible to play the guitar outside of the *Rocksmith* game, it is not possible to continue playing *Rocksmith* outside of the game.

Still, other questions remain: why are well-designed video games highly effective in holding a player's attention? Why are students intrinsically motivated to play videogames? How do game designers engineer an experience that is highly absorbing and captivating to

the players involved? The following section will attempt to answer these questions by focusing on the experience of playing a videogame.

2.13.4 Active Learning and Designed Spaces

Gee (2007) argued that learning through a video game meant being an active participant in a virtual world. This mode of learning is explicitly active because the player assumes another identity in a virtual environment. When moving through a virtual world, the player must make choices based on the powers, limitations, and restraints imposed on their virtual world character and environment. For example, in the game *Rollercoaster Tycoon* (Sawyer, 1999), the aim is to construct a theme park with rollercoasters. Naturally, theme parks have limits in budget and space. Theme parks also involve other issues, such as needing to provide adequate restrooms for patrons. In this game, the player assumes the role of both a rollercoaster engineer and manager. The player oversees the needs of patrons while addressing issues related to space and budget. The player also must make decisions based on the virtual identity that they assumed. According to Gee, learning in games is very different from learning in school. In the traditional classroom, learning about skills (such as management, keeping to a budget, and engineering) is a passive experience, typically gained through reading textbooks or through consuming other forms of media (such as instructional videos, teacher instruction, and worksheets). But in a game, the student *is* the manager and engineer.

2.13.5 Affinity Spaces

Affinity spaces was another term coined by James Paul Gee (2007), and it refers to the (mostly) online communities established around a common interest. These spaces are accessible and open to anybody with an email address and access to an internet connection. In later work, Gee and Hayes (2012) collaborated to describe and identify sixteen characteristics

of an affinity space. The authors contrasted affinity spaces against the traditional classroom and noted many differences. One of the differences included the fact that affinity spaces allow for open and democratic participation. Tied in with this aspect of democracy is the fact that age, sex, location, experience, ethnicity, and culture are elements that are (usually) unseen or irrelevant when interacting in the affinity space. Participation in these spaces is voluntary, and members do not need to participate in an activity to retain their membership in the space. Additionally, members who participate in these spaces act both as consumers and producers of information. In the traditional classroom, this does not usually happen because the teacher directs the learning and acts as an authority.

2.13.6 Attitudes and Mindsets - The Gamic Attitude

The idea of a mindset, or a psychological state that occurs when playing a game, is a useful one. As mentioned, Suits defined the "lusory attitude" (Suits, 2005, p. 10) as an acceptance of rules to facilitate further gameplay. McGonigal (2015) developed this idea by using the term "gameful mindset" (p. 182). In her definition, a player has a gameful mindset when she accepts challenges, experiences positive emotions, even while knowing full well that failure and loss are highly likely. She contrasted the gameful world to reality, stating that negative experiences such as loss and defeat have more significant consequences in the realm of reality. McGonigal acknowledges that anxiety and depression happen in the realm of reality. But in the context of a game, or in the magic circle, players are immune to receiving such negative experiences. With the help of colleagues, McGonigal devised *the Gameful Strengths Inventory* (GSI) (McGonigal, 2015, p. 403) to measure the traits and benefits that arise from playing videogames (optimism, social connection, hope, strength, self-efficacy, creativity, and determination).

The effects of game playing and the mindsets held while game playing was further explored by Juul (2013), who argued that games give players a safe environment to fail, and more importantly, that players learn through failure. What is significant is that players accept and expect that defeat will happen many times throughout a game. And despite this, the player is still motivated to continue playing the game.

When comparing the gameful world to the serious world of education, it is clear that failure is a very different experience to a student in a classroom receiving a mark under 50% (or any "fail" grade) than to a player whose lemmings have just fallen off a cliff in a game. Failure and its effects on students is a topic that has attracted a wide range of research in the field of education (Alkhazaleh, 2016; De Castella et al., 2013; Lavigne, 2014). Interventions and strategies involving game thinking include using videogames to teach skills and to help stimulate conversation on serious topics (Lacasa, Méndez, & Martínez, 2008; Short, 2012; Squire, 2006, 2011; Squire, Giovanetto, Devane, & Durga, 2005). Other interventions include designing games and gamification systems to modify behaviour (Birch & Woodruff, 2017; Raymer, 2011).

Educational interventions have also involved using game-design thinking to inform curriculum design. These interventions encourage failure in a safe and supportive game-like environment. Tekinbas (2011) designed *Quest to Learn* – a charter school in New York, where the whole experience of schooling is an augmented reality game. Sheldon (2011) theorised that games rewarded the player for trying, but the traditional classroom does not. According to Sheldon, in a typical tertiary-level course, students theoretically start with an "A". Over the semester, after submitting an assignment, if the student does not perform to the standard required, they have a lower chance of maintaining that "A". Should the student perform abysmally in a major assessment, then their chance of receiving a higher grade becomes impossible since they cannot redeem their mark. Sheldon argued that the reward

systems in videogames oppose the traditional school model. Unlike schooling, players start with “0” (or an “F”), and players receive high “grades” for trying.

2.13.7 Grit, Self-Efficacy & Growth Mindset

The previous section explored mindset and failure in the context of playing a videogame. This section will explore how this aligns with theories in the field of educational psychology.

Playing a game is an experience laden with failure, defeat, and difficult challenges. In spite of this, players continue playing, feeling more and more determined to win. *Grit* is an apt way to describe this type of determination, and Angela Lee Duckworth (2016) (who coined the term) described grit as a personality trait. A person with a high level of grit bears strength, resilience, and perseverance in a task. This perseverance continues despite the obstacles, difficulties, or challenges that they may face. Grit is closely related to the theory of self-efficacy (Bandura, 1997) – an individual’s belief in their ability to perform a task.

Videogames offer players immediate feedback through timed challenges and a scaffolded levelling up system with specific goals. Such an experience rewards players with experience points (XP), badges, unlocked levels, powers, and objects which facilitate (and assist) more gameplay. These sorts of rewards are a powerful form of feedback, to the extent that an individual can then easily deduce their ability to complete and perform a task. Players often exhibit confidence and a desire to continue playing a game, welcoming the challenge, rather than seeing the task as a threat (see McGonigal, 2015).

Related to self-efficacy is *growth mindset* (Dweck, 2017). When a person has a growth mindset, they believe that intelligence (or skill in a particular area) can grow, but if a person has a *fixed mindset*, then they believe in the opposite of this – that intelligence is fixed. McGonigal (2015) highlights similar mindset theories related to gaming, contrasting a

"challenge mindset" (being open to new, unfamiliar tasks as growth opportunities) with a "threat mindset" (which, as the term implies, refers to seeing a new task as a threat). Presently, it is unclear whether games can help with teaching growth or challenge mindset. Still, research by Lee, Heeter, Magerko, & Medler (2012) revealed that over time, gamers with a growth mindset outperformed gamers with a fixed mindset, verifying the idea that gamers carry different mindsets into the activity of playing videogames. However, this does not establish that games can *teach* a growth mindset, nor does it prove that games create environments that support growth and a challenge mindset. O'Rourke, Haimovitz, Ballweber, Dweck, and Popovic (2015) argued that while serious games for education have improved student engagement, these games were not all designed in the same way. The authors proposed a framework known as the "Brain Points Incentive Structure" (p. 3347), which rewards behaviours associated with a growth mindset.

2.13.8 Flow

Flow was a term coined by Mihaly Csikszentmihalyi (1990), and it describes a state of being. Flow happens when a person is so engrossed in an activity that they lose track of time. The positive emotions associated with playing a videogame can be attributed to flow. Well-designed videogames engage a player and put them into a state of flow (Gascon, Doherty, & Liu, 2015; Williams, 2012a).

Csikszentmihalyi (1990) described flow as an "optimal state" (p. 1). He advocated for increasing flow-experiences in everyday activity, stressing that it is important to wellbeing. Since flow essentially describes a state of being, it is not easy to measure and understand exactly why and when it happens. Despite this, Csikszentmihalyi (1990) theorized that flow exists under several conditions. One of these conditions includes having a particular personality, known as an "autotelic personality" (p. 83). When a person has an autotelic

personality, they are less likely to experience boredom, and they are more likely to pursue an activity purely for its own sake. Flow intersects with the previously mentioned theory of intrinsic motivation (Ryan & Deci, 2000) because when a person pursues an activity purely for its own sake, they are intrinsically motivated.

The autotelic personality is a theory that describes an internal state, or more precisely, a personality type that is more susceptible to experiencing flow. Converse to this is the theory that an environment could be engineered, adapted, and modified to engender flow. Csikszentmihalyi theorised that flow happens when an activity is not too easy (that it is boring) and not too hard (that it brings about feelings of anxiety). Figure 14 illustrates this idea, situating the flow-state between boredom and anxiety.

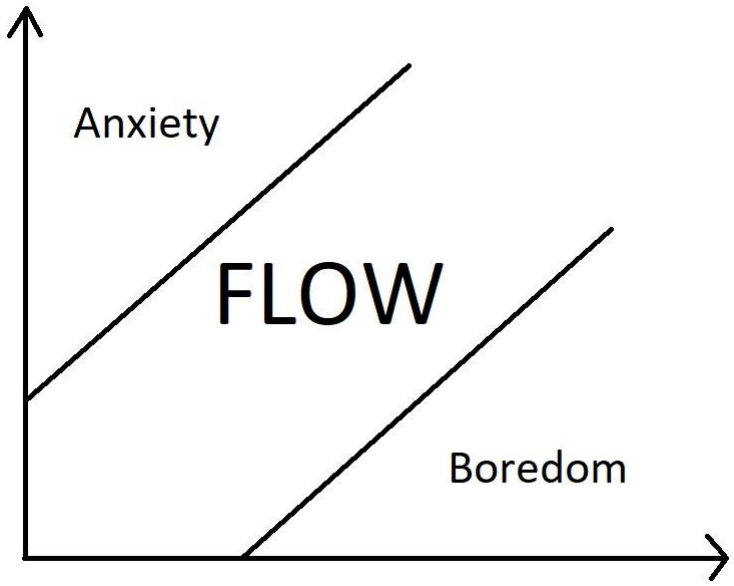


Figure 14. Flow Illustrated as the State Between Boredom and Anxiety, adapted from Csikszentmihalyi (1977).

2.13.9 Flow and its application to Music Education and Videogames

Flow is an experience common when playing videogames (Chou et al., 2013; Klasen et al., 2011; Sanjamsai & Phukao, 2018). Flow also exists in activity related to music-making. Research has verified that flow happens in musical performance (de Manzano,

Theorell, Harmat, & Ullén, 2010), music composition (Macdonald, Byrne, & Carlton, 2006), and improvisation (Parncutt & McPherson, 2002).

Even in music education research not directly centred on flow, flow is still mentioned as an area worthy of further study. Hein (2013) and Williams (2012a) advocated for a flow-centric view and approach to music education. Hein's development of the rhythmic drum application (for mobile iOS devices) known as *Drum Loop*,[2] allows students with no previous musical training or experience to program drumbeats by placing shapes onto a circular loop. Although Hein did not explicitly test whether this application facilitated flow, he speculated that it could induce its users into a flow state, especially since the mechanics contained in his software were by nature less "gameful" (or ludus) and more "playful" (or paidia). When using the application, the user could tinker with the beats while receiving instant feedback, which helps them experience a flow-state (Hein, 2013). In the *Drum Loop* application developed by Hein, he speculated that instant feedback, along with the lack of rewards (points or badges) or win and lose states, meant that the user couldn't experience failure. According to Hein, this should help to facilitate flow. Like Hein, Williams (2012) did not explicitly attempt to measure the level of flow in the participants of his study. However, Williams' (2012) development of the mobile iOS application and game *SingSmash* had similar aims, primarily because he wanted to build a game that would teach musical skills while facilitating a flow-state in its users. Like Hein's *Drum Loop* application, *SingSmash* gave the player immediate feedback – if the player sang the correct pitch, then the paddles on the bottom of the screen would light up and repel against the moving ball.

In her ethnographic research, Green (2008) observed school-aged students playing along with music recordings. She noted that in this activity, they appeared to be a flow-like

[2] This has been updated as a browser-based application and is now known as *Groove Pizza* (NYU Music Experience Design Lab, 2020)

state. Cassidy & Paisley (2013) had similar findings. In a single case study, the participant (a 14-year-old male with some previous experience and training playing the guitar) played *Rock Band 3* (Harmonix, 2010b) for several hours. Although the authors did not explicitly attempt to measure flow in their participant, the audiovisual recordings revealed that he appeared to be in a flow-like state when he played it, especially since his eyes rarely diverted from the screen.

Although flow is an experience common to music-making and videogame playing, it would be naïve to assume that all activities related to these two pursuits engendered flow (or even a flow-like state). In fact, there is research that verifies that flow does not always happen in the realm of music education or video gaming.

In a study conducted by Wrigley & Emmerson (2013), the Flow State Scale-2 (FSS-2) was administered to tertiary level undergraduate performers (n=236). The vast majority of the participants in this study reported feeling a low-level of flow during their music performance. However, the authors noted that the FSS-2 was distributed after a formal music examination, a serious high-stakes situation that was not typically conducive to flow.

Wagner's (2016) research involved interviewing piano students (aged 9-11) who reported a weekly total of seven or more hours playing videogames. Many of the participants described being in the flow-state when playing videogames but not when practising the piano. Despite this, the author noticed that the students she interviewed continued to pursue their piano studies. When the researcher probed further by asking why this was the case, she discovered that the students perceived piano playing as an important activity that existed in a serious, real-world context. Contrastingly, the students viewed game playing as an activity that was the opposite of that. It is no surprise then that the participants also reported a greater amount of time playing videogames than playing the piano.

2.13.10 Flow vs Frustration

In terms of videogame design, the assumption that well-designed videogames immerse players and place them in a state of flow is a popular theory (Rigby & Ryan, 2011; Wagner, 2016; Williams, 2012a). And as mentioned, there is evidence that verifies that video games facilitate flow (Chou et al., 2013; Klasen et al., 2011; Sanjamsai & Phukao, 2018). While Hunter & Werbach (2012) supported this idea (that flow exists in well-designed videogames), the authors also acknowledged that *frustration* is an emotion common to videogame playing. Although frustration is an emotion outside of the flow-state, the authors put forward that frustration is a powerful emotion that can motivate the player to *continue* playing. Hunter and Werbach (2012) and Bogost (2015) illustrated this by using the mobile action game *Flappy Bird* (Nguyen, 2013) as an example. When playing *Flappy Bird*, the player must manipulate a bird through 99 obstacles (which are green pipes). If the bird happens to hit one of the 99 pipes, then the game is over, and the player must start again. This game is hard to complete and is known to engender a highly frustrating playing experience. Despite the level of frustration that a player may feel, it only fueled motivation to continue playing.

Gilleade & Dix (2004) researched how frustration could be fostered and managed in the design of adaptive videogames (adaptive videogames, as the term implies, adapt according to the player's level of experience and in-game competence). This mechanic is relevant to *Rocksmith* as *Rocksmith's* dynamic difficulty setting in the song mode setting is an example of an adaptive videogame.

Huang, Liao, Chiu, & Teng (2017) investigated the relationship between frustration and loyalty in videogame players (n=558). The results revealed a positive effect between frustration and participation in team-oriented tasks for novices. Conversely, the authors noted

that frustration in more skilled and experienced players negatively affected their involvement in team-oriented tasks.

Mills, Milyavskaya, Mettler, Heath, & Derevensky (2018) researched the link between frustration and the time that university students spent playing videogames. The authors identified and applied the dualistic model for passion (DMP). According to this model, passion can exist in a healthy and harmonious way, or in an obsessive and problematic way – the authors labelled the latter as "obsessive passion" (OP) (Mills et al., 2018, p. 461). For an individual with a passion, two states emerge, needs satisfaction (NS), and needs frustration (NF). The authors observed that in terms of gaming, a link between NF and OP exists. The authors also acknowledged inverse of this phenomenon: when players had a low level of OP, a negative association with NF occurred, which led to lower lengths of gameplay time.

In the music education field, practice is a topic that has attracted a high amount of research. There is research which investigates motivation and music practice (Evans & Bonneville-Roussy, 2016; Renwick & McPherson, 2002; Valenzuela, Codina, & Pestana, 2018), the role of parents in music practice (Davidson, 2010), and the existence of flow in music practice (Araújo & Hein, 2019; Valenzuela et al., 2018). Despite this, it appears that there is a dearth of literature that explores the relationship between frustration and practice time. In a research study led by Valenzuela, Codina, & Pestana (2018), the authors observed the self-reported experience of conservatoire-level performance music students. The authors noted that autonomous motivation (also known as intrinsic motivation) correlated with experiencing flow-like states during music practice. The authors described frustration and boredom as the opposite of flow. However, the authors did not investigate whether frustration functioned as a motivational drive to *continue* music practice. To date, there appears to be a scarce amount of literature that deals with the relationship between frustration and music practice.

2.14 Understanding Player Demographics, Motivations & Personalities

Over the last three decades, player motivation and player demography is a widely researched area. Richard Bartle (1996) was a designer and researcher of Multi-User Dungeon Games (MUDs). MUDs were one of the first multiplayer online games. Usually text-based, MUDs are set in a fantasy world, and as the term implies, playing a MUD involved interacting in real-time, with multiple players through instant messaging. In his analysis of the interactions between players, Bartle posited that there were four player types:

- The achiever: Players who play the game to progress through it
- The socialiser: Players who use the game to socialise with other players
- The explorer: Players who play the game to explore the game environment
- The killer: Players whose motivations are tied in with "killing" characters in the game or destroying the game environment (Bartle, 1996)

These player types and motivations are not mutually exclusive. It is possible to play a game under two different motivations. For example, when playing a MUD, a player can play to achieve and socialise, or to explore and kill. A person's player type can also change over the course of a game, or when playing other games.

Other game scholars and designers continued to develop this theory. Erwin S. Andreasen and Brandon A. Downey developed the *Bartle Test of Gamer Psychology* (2000) to identify an individual's player type. This test features a questionnaire with questions related to digital game playing habits and styles. In later research, González Mariño, Gallegos, & Camacho-Cruz (2018) identified issues with the questionnaire, describing the limits of only having two choices for every question. The authors redesigned the Bartle Test of Gamer Psychology by modifying the questions and using Likert scales to measure and identify a player type more accurately. Bartle's theory, then, has been useful to the development of videogame design

(Salen & Zichermann, 2011), and more specifically, to informing and designing game-based learning environments (Konert, Göbel, & Steinmetz, 2013). Following the popularisation of MUDs, other genres of videogames have entered the market. Although Bartle's theory is the most popular of player typologies and is still seen as relevant by current designers (Salen & Zimmerman, 2011), other models and paradigms also exist. For example, Fullerton (2008) identified ten player types in her book *Game Design Workshop: A Playcentric Approach to Creating Innovative Games*: the competitor, explorer, collector, achiever, joker, artist, director, storyteller, performer, and craftsman

Player demography is another area that has been widely researched over the past thirty years. Research reveals that gender is an important variable in the selection and preference of videogame genres (Bonanno & Kommers, 2005). Females more commonly play casual games and simulations, while males favour immersive action games with social and competitive elements (Hartmann & Klimmt, 2017; Lucas & Sherry, 2004; McClure & Mears, 1984). Another area that has been explored in research is the link between personality and videogame playing styles. Frameworks such as The Big Five Personality Traits have been applied to investigate the link between game-playing styles and game mechanics (Bean, 2014; Ferro, Walz, & Greuter, 2013; Nagle, Wolf, & Riener, 2016).

Neuroscientist Susan Greenfield (2003, 2013) takes a critical view of modern technologies, and this is inclusive of videogames. In her work (Greenfield, 2013, 2014) she argues that videogames cause neurological damage to the developing brain, but there is limited peer-reviewed research that clarifies that these views are substantive. The existence of different game categorisations, player demographics, player motivations, and player personalities demonstrates that the experience of playing videogames is diverse. It is naïve to assume that all videogames are immersive or enjoyed by a younger school-aged audience. It is also too simplistic to assume that all videogames are the same (Squire & Steinkuehler,

2017), that all players experience ill-effects, ranging from dependence or obesity to addiction, or that all players play games to escape reality (Rigby & Ryan, 2011).

The different categorisations of videogame genres and the diversity in player demographics raise essential questions in music education research: Who plays music videogames – musicians, non-musicians, younger school-aged children, males, or females? Are the skills gained from playing music videogames transferable to other musical contexts? The following few sections will attempt to explore how the research literature has dealt with such questions.

2.14.1 Informal Music Learning, Class, and Cultural Capital

Green (2002) researched how popular musicians learn, and in later work, she developed a pedagogy and applied it to the classroom (Green, 2008). This approach was known as *informal learning.* Later research observed that informal learning occurred in online spaces such as YouTube (Cayari, 2015; Waldron, 2012) and digital games (Matijević & Topolovčan, 2019). Despite Green's advocacy for informal learning (Green, 2002, 2008), cultural attitudes around the superiority, legitimacy, and timelessness, of western art music continue to exist in today's cultural landscape (Green, 2003; Walker, 2007). Contrastingly, popular music is seen as ephemeral, unsophisticated, and lacking in substance. Schooling perpetuates these attitudes and puts forward particular cultural assumptions and expectations related to success in formal music education (Bull, 2019; Green, 2003). The idea of digital games intersecting with informal learning raises several highly pertinent questions: Do digital games have a place in music education, or even *formal* music education? Can DGBL be culturally accepted as a legitimate way to learn and apply in formal music practice?

On a more fundamental level, two opposing ideas are presented, one being that games are "unproductive" (Caillois, 2001, p. 5) and an "occasion of pure waste" (Caillois, 2001, p. 5),

another being that games have the potential to teach, engage, motivate, and foster confidence in disengaged students (Ferguson & Olson, 2013; Hwang, 2014; Williams, 2012a). As mentioned, a wide range of research supports the effectiveness digital game-based learning (Black & Reich, 2012; Gee, 2007; Halverson, 2012; Steinkuehler & Oh, 2012), but research that examines the cultural views around the legitimacy of game-based learning is lacking (Bourgonjon, Valcke, Soetaert, de Wever, & Schellens, 2011).

2.14.2 Transferability of Skill in Music DGBL

To date, there is a limited range of literature that attempts to explore whether the skills gained from music videogames are transferable to other musical contexts (outside of the game playing environment). Research has affirmed that action videogames assist and improve an individual's spatial cognition, that is, their ability to process information related to objects in their real-world or virtual environment (Nouchi et al., 2013; Spence & Feng, 2010). The need to focus intensely on a single spot on a screen for long periods while ignoring other onscreen information requires a high level of visual-spatial processing. Action videogames can help develop this (Karle, Watter, & Shedden, 2010; Nouchi et al., 2013; Spence & Feng, 2010). At present, action videogames are used in serious, real-world contexts, such as the in the training of endoscopic surgeons (Shane, Pettitt, Morgenthal, & Smith, 2008; van Dongen, Verleisdonk, Schijven, & Broeders, 2011), and assisting children with visual processing conditions such as amblyopia and dyslexia (Franceschini et al., 2013; Green & Bavelier, 2012).

Upon considering the transferability of skill in action videogames, the previous question remains: are the skills played in music videogames transferable in *other* musical contexts? This question is especially relevant since music rhythm videogames fall under the

broad category of *action* games. A limited range of published research has attempted to answer this question. This section attempts to examine the existing pool of research.

Arsenault (2008) argued that *Guitar Hero* (Ubisoft Leamington, 2005) is unlike playing the guitar and that the skills gained from *Guitar Hero* are unlikely to transfer over to any other activity, or more specifically, to playing the guitar. Contrastingly, Cassidy, and Paisley (2017), Peppler, Downton, Lindsay, and Hay (2011), and Roesner, Paisley, and Cassidy (2016) supported the use of games like *Guitar Hero* in the music classroom. These authors argued that such games could teach musicianship skills, increase student engagement, make music education more accessible and appealing to new students, and open up the way for more formal music learning practices.

Several pilot studies have attempted to measure the transferability and effectiveness of music games outside of the ludic context. Williams' (2012b) research of the game *SingSmash* (a singing and ear-training game aimed at primary school-aged children, designed and developed by the author) tested two groups, a control group, and an experimental group. The control group received access to ABRSM's *Aural Trainer* (The Associated Board of the Royal Schools of Music (Publishing) Limited, 2019) application, while the experimental group received access to the *Aural Trainer* application as well as *SingSmash* (Williams, 2012c). A pre and post-test was implemented, which included thirty items intended to measure the participants' aural and musicianship skills. The results revealed some evidence that *SingSmash* led to improved scores in ear-training and aural skills. The same participants also expressed that they were engaged, describing the experience as "fun" (p. 35). The results further showed that the participants in the experimental group spent more time using the *SingSmash* application and less time using the *Aural Trainer* application.

Jenson, Castell, Muehrer, and Droumeva (2016) similarly conducted a pilot study, designed to assess the transferability of skill in several different music videogames (*Guitar Hero* (Ubisoft Leamington, 2005), *Rock Band* (Harmonix & Pi Studio, 2008), *Sing Party* (FreeStyleGames, 2013), *Wii Music* (Nintendo EPD Group No. 2, 2008), *Rocksmith* (Ubisoft San Fransisco, 2012), and an assortment of iPad rhythm games. The participants (n=55) who took part in this study were high school level students involved in a DGBL music program that lasted for eight weeks, with each gameplay session lasting for thirty-five minutes. Although the games all belonged to the same genres (action videogames and music videogames), the results revealed that these games were truly diverse and different, each game bearing a different kind of learning potential and containing different mechanics, outcomes and aims. For example, the group who played *Wii Music* showed improved scores in the rhythm and pitch section of the post-test, while the group playing *Sing Party* showed most improvement in the aural pitch section in the post-test but slightly less improvement in the written pitch section.

Peppler, Downton, Lindsay, and Hay (2011) attempted to study the music game *Rock Band* (Harmonix & Pi Studio, 2008) in an afterschool program. The results of this study revealed that such music videogames functioned as a *gateway* into formal music learning. Another interesting finding in the study was that high levels of *Rock Band* playing correlated with higher scores in the traditional music assessments that were administered following the nine-month period of the study. However, the authors noted the limits of this study, stating that a control group and a pre-test would have helped to confirm this finding. The authors also acknowledged the difficulty (in fact, the impossibility) of obtaining such experimental conditions in an informal learning environment.

Paney (2014) used the game *Karaoke Revolution Presents: American Idol Encore* (2007) on PlayStation 2 to test the transferability of skill in pitch recognition. The

participants (non-musician university students) played this game by singing the same song (a song of their choosing from a song library of 37 songs) as many times as possible in a ten-minute session. The results revealed that the participant's ability to match pitch improved following the session.

Pasinski, McAuler, and Snyder (2016) attempted to measure the transferability of musical skill across three different groups (n=45): high-level musicians with a lot of experience and training (n=15), video gamers (n=15) (who had a high level of experience playing music videogames) and a control group (n=15) (a group with little or no experience playing music or videogames). Throughout the study, participants from each group played *Rock Band 2*, which helped establish a "baseline" in videogame playing ability. The participants needed to have achieved 80% or higher in the "hard setting" mode to be allowed to take part in the study.

Following this, all participants took the following tests: The Big Five Inventory, which attempted to measure and compare different personality traits of the three different groups, as well as the Profile of Music Perception Skills (PROMS) task – a test which aimed to assess musical skills and aptitudes, and can be administered to both non-musicians and musicians. The findings indicated that two groups (trained musicians and music video gamers) scored significantly higher than the controls in the three components of the PROMS test, namely melody, tuning, and tempo. There was no significance between the three groups in the rhythm part of the PROMS test.

As mentioned, the literature on the effectiveness of digital games in music education is a small but growing field. There has been some limited research which investigates how effective *Rocksmith* is as a learning tool (Graham & Schofield, 2018; Havre et al., 2018;

Jiménez, 2016; O'Meara, 2016). In effect, this research aims to build and add to this field.

The next chapter describes the methodology in detail.

3. METHODOLOGY

3.1 Multiple Case-Study

This research is a multiple-case study with a post-test that used both qualitative and quantitative methods of assessment (Yin, 2000). The participants were four young adults aged between 25 and 28 at the time of interview. As mentioned, Ubisoft (2014) claims that through *Rocksmith*, it is possible to learn the guitar in sixty days and this study aimed to test the validity of such a claim as well as to answer the following related research questions:

- How did players emotionally experience playing *Rocksmith* – did they feel immersion when playing the game, or satisfaction, or frustration?
- How did the participants play *Rocksmith*? Was the majority of the game-play time spent in the song mode, jam session mode, or *Guitarcade*?
- What were the participants' goal(s) when playing the game?
- How much time did the participant spend playing *Rocksmith*?

While case studies are a qualitative research method, specific quantitative methods were used in the assessment that followed the playing period. The post-test was an assessment of the participants' guitar playing ability.

3.2 Sampling and Participant Recruitment

Social videogame evenings served as the primary source of recruitment. Announcements at pre-service teacher technology exhibitions and pre-service education classes also served as another method of recruitment. Participants were selected after completing a questionnaire (see Appendix A) on *SurveyMonkey* (2015), which indicated the following:

- The level of training the participant had in playing the guitar (electric or acoustic)
    - Whether the participant had any formal training playing the guitar

    - Whether the participant had any informal experience playing the guitar
    - How many years the participant had been playing the electric or acoustic guitar (if applicable)
- The familiarity the participant had with action games – to ascertain this, popular action videogames on the current commercial games market were listed (see Appendix A)
- The participant's experience with playing action games (if applicable)
- The length of time that the participant spent playing action games on a weekly basis (if applicable)

The questionnaire was designed to place the potential participants into the following six groups:

1. Participants with a low (or no) level of action video game experience and a low level (or no) level of guitar playing experience and training
2. Participants with a low (or no) level of action video game experience and a moderate level of playing guitar playing experience and/or training
3. Participants with a low (or no) level of action videogame experience and a high level of guitar playing experience and/or training
4. Participants with a moderate or high level of action videogame playing experience and a low (or no) level of guitar playing experience
5. Participants with a moderate or high level of action videogame playing experience and a moderate level of guitar playing experience
6. Participants with a moderate or high level of action videogame playing experience and a high level of guitar playing experience

Advanced guitarists or guitarists with a high level of training and game playing experience were not included in this study. The reason for this was that it would have been difficult to ascertain how much skill an advanced guitarist had gained from playing *Rocksmith,* especially since this study did not include pre-tests. The eventual four participants accepted into the study were categorised as representing the first, second, and fourth groups in the list above.

3.3 Sixty Day Challenge

After completing the initial questionnaire, participants were given a *Real Tone Cable* (a cable required for playing *Rocksmith*), credit to buy the game from *Steam* (a videogame digital distribution platform), and an electric guitar (if required). Despite Ubisoft's recommendation to play for an hour a day, over sixty days (Ubisoft Entertainment, 2014), the participants could choose the duration and frequency of each game-play session. The reason for this was to emulate the experience of playing a videogame in a real-world environment. Although it is typical in (formal) music education settings for a teacher to recommend a certain frequency and duration in practice time (such as an hour a day for five days in a week), in the videogame playing world, participation is wholly elective.

3.4 Assessment Design & Context

Following the sixty-day period, participants were assessed on their guitar playing ability in the game and outside the game. Participant assessment was divided into three sections, and assessment guidelines have been included in the appendix (see appendix E). The assessment was also recorded through screen capture to note the players' scores and playing ability.

3.4.1 Assessors

The assessors were undergraduate students who majored in guitar performance at a conservatory level. They were familiar with playing the electric guitar and had experience playing in contemporary music styles. The same assessors had teaching experience in a variety of different contexts (this included private one-to-one tuition and pre-service teacher training in primary and secondary level schooling).

3.4.2 Assessment Design

The rubric that forms part of the assessment (see Appendix D) was designed with the help of the two guitar assessors. Standardised music education examination boards such as the *Australian Music Examination Board (AMEB), Rockschool, St Cecelia School of Music, The Associated Board of the Royal School of Music (ABRSM),* and *Trinity Guildhall London's (TGL) Rock and Pop syllabus* influenced and informed the assessment design and rubric in this study. In these examinations, candidates are assessed on their ability to perform technical exercises, repertoire, and other supporting tests.

In the *Rocksmith* game, the player plays along with songs (*repertoire*), and plays *Guitarcade* games, highlighting the need for the *Rocksmith* assessment to be adapted to include the experience of playing a videogame. The next section will explore how the examinations boards influenced the assessment and rubric design for this research project.

The AMEB is a popular music examination board in Australia (Australian Music Examinations Board, 2020), offering standardised examinations for a wide range of traditional western instruments and voice. At present (2020), the Contemporary Popular Music (CPM) syllabus is included in the AMEB manual of syllabuses. However, this syllabus will be withdrawn from the year 2021 because AMEB has partnered with Rockschool (Australian Music Examinations Board, 2020). AMEB typically assesses the following:

technique (scales, arpeggios, and technical exercises), pieces/repertoire (usually of different styles and genres), and other general tests that include aural/ear-training, sight-reading, and general knowledge. Despite the different components of the exam, clearly defined rubrics that numerically break down where the student excels or needs development do not exist. In a typical exam, the examiner does not assign a mark in every section but will leave comments. At the end of each examination, the student is awarded an overall score (A Honours, B Credit, C Pass, or D fail) (Australian Music Examinations Board, 2018).

The ABRSM (2019), St. Cecilia Music School (2020), Trinity Guildhall London (Trinity Guildhall London, 2020), and Rockschool (RSL, 2020b) (which is also hosted by the AMEB in Australia) are other exam boards that feature a similar exam format. As mentioned, such exam boards assess a variety of musical skills that include technique, performing varied repertoire(s), sight-reading, general knowledge, improvisation, and aural/ear training tests. These boards have had a long history of hosting exams for traditional western instruments featuring repertoire, reading tests, and technical exercises that support formal traditional western art music practices. However, in recent years, such exam boards have revised their syllabi to be inclusive of popular music genres. At present, TGL (2020) host a Rock and Pop syllabus. ABRSM (2019) and AMEB (2020) host the Rockschool exams (RSL, 2020b) and St. Cecilia School of Music (2018) host exams for contemporary styles, such as contemporary guitar and modern piano. Rockschool also features band exams where candidates can be assessed on their ability to play together in an ensemble.

Unlike the AMEB, the other listed music examination boards numerally breakdown each component of an exam (RSL, 2020a; St. Cecilia School of Music, 2018; The Associated Board of the Royal Schools of Music, 2018; Trinity College London, 2017). This breakdown contains an already existing rubric available to the public, allowing the candidate to prepare and understand the examination requirements ahead of time. The assessment designed for this

study aimed to emulate the structure above. The *Guitarcade* and song mode section included a 1-5 Likert scale for a variety of guitar technique and performance outcomes. Similarly, the sight-reading section included a rubric with band descriptors ranging from 1-10. The marking sheets had space for the assessors to write comments on the participants' guitar technique and game-playing. The assessors were also provided with a rubric that explained how to distribute marks (see Appendix E).

The participants did not receive a rubric or breakdown of marks ahead of time. Before commencing the study, it was made clear to the participants that the assessment was not a formal "test" but a way for the researcher to understand if the *Rocksmith* game was a useful learning tool.

As mentioned, *Rocksmith's* dominant play modes are the *Guitarcade* and the song mode. These two modes resemble the technical and repertoire component of a formal summative music assessment. The *Guitarcade* section was the first part of the *Rocksmith* assessment. In this section, this assessment aimed to measure the participants' technical skills related to guitar playing.

Effective technique facilitates effective playing, having a high level of technical control means having the tools to meet the technical demands and challenges of playing an instrument. It is logical to assume that the sound that a guitarist produces should indicate their level of technical proficiency. However, in the *Rocksmith Guitarcade* games, many of the sounds are distorted. Many *Guitarcade* games feature 8-bit sounds from arcade games popular during the 1980s (O'Meara, 2016). For example, in the previously mentioned game *Gone Whalin',* when a player strums the strings of her guitar, water erupts from a whale's blowhole and pushes a little character upwards, creating a "whoosh" sound, consistent with the sound of air escaping from a balloon. As the player progresses through the game, they can

collect bananas, prompting a high pitched 8-bit digital sound. Hence there is a discrepancy between the player's sound on the electric guitar and the sounds produced in the *Guitarcade* games. It is difficult to assess a participant's technique from a sonic or musical perspective. Only the physical aspects of playing could be successfully assessed and measured in the first section of the *Rocksmith* assessment.

In a standard exam hosted by many of the boards mentioned above, the candidate is required to play several contrasting pieces. This requirement emphasises the importance of playing a varied repertoire and different styles of music. *Rocksmith's* extensive song library (and extra downloadable content) contains a wide variety of songs. Two different songs were included as part of the assessment to show variety.

As mentioned, the assessment for this study was modelled and informed by the already existing assessment design criteria and rubrics of the following boards: *Rockschool* and *TGL Rock and Pop*. In their assessment for solo instruments, these boards require the candidate to play along with a backing track, thereby emulating the experience of playing with a full rock or pop ensemble (RSL, 2020a; Trinity College London, 2017). In *Rocksmith*, a similar skill is required as the player plays with a pre-recorded song in the game's song mode.

In a *Rockschool* exam, marks are allocated for basic, rudimentary skills (RSL, 2020b). One such skill is being able to play with a consistent pulse. In Trinity's *Rock and Pop* exam, a similar outcome is contained in the assessment criteria. The candidate at the first-grade level is expected to "Perform with general continuity and a sense of pulse" (Trinity College London, 2020, p. 10). Later, at the second-grade level, the candidate is required to "Perform with generally secure rhythm and a sense of pulse" (Trinity College London, 2020, p. 10).

In *Rocksmith*'s song mode, this is difficult to assess because the song moves on. The game does not stop or wait for the player to play the correct pitch. The reason for this is that in the earlier levels, the player is not "needed" as the song still sounds whole without the player's contributions. The same can be said of a typical *Rockschool* exam since the candidate plays along with a backing track (which also does not stop for the candidate) and is pushed to keep in time or play with a consistent pulse. However, it should be noted that in the context of a *Rockschool* exam, a candidate is required to play with a pre-recorded backing track that eliminates their part (like a minus-one score). It would be easier to *hear* inconsistencies or inaccuracies (whether they were melodic or rhythmic) in a *Rockschool* exam, than in a *Rocksmith* gameplay session. It is also harder to sound unmusical in a game of *Rocksmith* than it is in a *Rockschool* exam because the backing track is significantly louder than the player's part.

As mentioned, in *Rocksmith*'s song mode, corrective feedback is provided to the player. This feedback tells the player if they missed the note, played on the wrong fret, or played too early. The feedback is easy to see but difficult to hear. When the player plays a wrong note or strikes it out of time, this error is shown visually but not made obvious sonically (other than the player hearing their own playing and having the ability to perceive that it was incorrect).

Despite the difficulty in measuring the participants' ability to play in time, this skill was still included in the *Rocksmith* assessment design. Several factors came into consideration when forming this decision. First, being able to play with a consistent pulse is a rudimentary musical skill. Second, although it is difficult to hear and assess whether the participant played in time with the music, it is still possible to see this visually. In the *Rocksmith* assessment, the assessors measured the participants' ability to keep in time by watching the onscreen action and listening to the pre-recorded song. They also watched the

participant play the song. Third, being able to play consistently with a sense of pulse is something that the *Rocksmith* program should be able to measure by providing a score for, but this is not always the case. Issues related to the program not being able to register the note is an issue common to playing *Rocksmith* (Graham & Schofield, 2018; Havre et al., 2018).

After reviewing gameplay footage on YouTube and reading online articles, it was clear that a high number of gamers who played *Rocksmith* reported issues with latency, tuning, and the game's inability to pick up on certain notes. Later, in published research conducted by Havre, Väkevä, Christophersen and Haugland (2018) similar complaints were made by many of the participants who took part in playing *Rocksmith* over a year. The inclusion of human assessors to judge a participant's ability to play with a consistent pulse intended to account for in-game latency issues. In other words, assessors were expected to notice if the game had communicated that the participant was incorrect when they weren't, and then to report and account for this in their assessment feedback, and vice versa.

In music exams, marks are awarded when the candidate demonstrates the level of technical proficiency and musicianship required for the grade. What specifically constitutes an effective technique has been a highly contentious topic (Bosi, 2018; Offermann, 2019). The *Rockschool* (RSL, 2020a) exam syllabus states that the candidate is required to "demonstrate technical ability on the instrument through responding to set technical demands" (p. 34). These technical demands and expectations increase in difficulty through an exam candidate's progression through the grades. Effective guitar technique may involve having ease and facility when moving through strings and frets, holding the instrument correctly, and having a hand position that is relaxed and free of tension. These are all aspects specific to guitar technique but not usually contained in the rubrics of a typical music examination board syllabus (RSL, 2020a; St. Cecilia School of Music, 2018; Trinity College London, 2020). To address this, I attempted to identify and list several essential elements

relevant to guitar technique (see Appendix E). This list was derived through the communication that I had with the assessors.

With the exception of sight-reading, the other tests which occur in a typical music examination (such as general knowledge, improvisation and aural/ear-training) were largely irrelevant to the assessment component in this study. As mentioned, *Rocksmith* features a "driving mode" (Shultz, 2008, p. 182) moving notation that resembles guitar tablature. In the sight-reading section of the assessment, participants were assessed on their ability to sight-read guitar tablature outside of the game. Like many examination boards, the rubrics allocate marks according to how accurately the candidate reads the excerpt provided to them in the exam. The descriptors in the highest band indicate that all, or the majority of the except was played correctly (both rhythmically and melodically). Conversely, the descriptors in the lowest bands indicate a non-attempt, or that the majority of the playing contained inaccuracies. The rubric for the sight-reading section of the *Rocksmith* assessment followed this model (see Appendix E).

3.4.2 The Guitarcade Section

This section, as the term implies, involves two parts: the "own choice" part (where the participant chooses a game from the library), and the "assessors' choice" part (where the assessor determines a different game from the same library). Allowing the participant to choose a game from the *Guitarcade* library provides them with a choice. Choice (player agency) is important to videogame design. During the assessor's choice section, the assessor chose a different game, one that the participant was unfamiliar with, and this was achieved by asking the participant which game they had not played.

As mentioned, each game lasts for a short period (usually not longer than five minutes). Hence, it was anticipated that the assessors might have needed more time to

observe the participants (especially if the game was under a minute). To assist with this, each participant had two attempts in both parts of the Guitarcade section.

On the assessment sheet, three descriptors related to guitar playing and technique are included:

1. Posture and instrument hold
2. Right-hand position
3. Left-hand position

Along with these three descriptors was the "desired outcome score". This part of the assessment attempts to measure how effective the participant was in reaching the game's desired outcome. For example, the desired learning outcome in the game Scale Racer is to be able to play an assortment of scales in different keys (such as Aeolian, Dorian or Mixolydian) with fluency and speed. In terms of the assessment, if Scale Racer were chosen (by the participant or the assessor), the participant would then be marked on how well they could play diatonic scales on the guitar at different speeds while playing the game. The three descriptors and the desired outcome score were placed on a 1-5 Likert scale. A comment section was also included in the assessment sheet, which allowed the assessors to further comment on the participants' technical abilities.

I ensured that the assessors understood the marking criteria (and requirements) ahead of time (see Appendix E). The assessors were instructed to assess according to the participants' *overall* playing. In other words, the assessors did not assess the first and second attempts separately. The assessors were to evaluate the participants' playing ability on an as-is level to eliminate assessor bias. Furthermore, they were instructed not to compare the participants' playing ability with one another. Finally, the assessors were to allocate marks based on the already provided rubric (see Appendix E).

3.4.3 The Song Mode Section

In the song mode section, participants were marked on the quality of their performance. This section was comprised of two parts. In the first part, the participant chose a song from the *Rocksmith* song mode library, and in the second, the assessors chose a different song from the same library. The assessors had to make sure that the chosen song was unfamiliar to the participant – this was ascertained by asking the participant what song they have not played.

In *Rocksmith*, the level of difficulty adapts according to the accuracy of the player's guitar playing. The player's level is saved following every gameplay session so that the player does not have to start at the beginning levels again in subsequent gameplay. In the assessment, the participants accessed *Rocksmith* through Steam. Thus, for verification, participants needed to have access to a secure internet connection. However, their playing (and level) was not stored or backed up in the cloud. In terms of the assessment, this meant that there was no access to their previous game-playing level. When the participants took part in the assessment, the default setting was set at the easiest level, and the participant was given the option to manually adjust the level if they felt it was suitable to do so.

The song mode section featured a similar marking structure to the *Guitarcade* assessment. The assessors marked against a 1-5 Likert scale across seven descriptors (also see Appendix E):

- Moves through notes or chords with precision in the left hand
- Plays notes or chords accurately in the right hand
- Plays with relaxed fingers and an appropriate left-hand position
- Posture and stance are appropriate for playing the guitar
- Interacts with the game fluently

- Consistent rhythm/pulse
- Plays with performance flair and confidence

As mentioned, these factors were decided by myself and then adjusted according to the guidance of the guitar assessors. The previously mentioned examination boards also influenced the design of this assessment. In addition to marking against a 1-5 Likert scale, the assessors could also leave comments.

3.5 The Sight-Reading Section

Like previous sections, the sight-reading section of the assessment comprised of two parts (the own choice section, and the assessor's choice section), as mentioned, the song mode in *Rocksmith* features a moving "driving mode" (Shultz, 2008, p. 182) that resembles guitar tablature. Thus, the sight-reading section aimed to measure the transferability of skill from playing in the moving driving range notation (as featured in in the song mode section), to being able to read non-moving traditional guitar tablature. In both parts of the sight-reading section, the participants did not directly play the *Rocksmith* game. Instead, the participants were given guitar tablature to read, and they were assessed on how accurately they were able to read it.

The songs that the participants played in this section corresponded with the songs they played in the song mode section. Therefore, this assessment does not resemble a true sight-reading test. Unlike many traditional examination boards that offer the candidate repertoire that they are unfamiliar with, the participant was to a limited degree familiar with the score given to them in the sight-reading section because played the same songs in the song mode section.

The tablature was ascertained after accessing the game's PRSS files and using a free third party, open-source software known as *TuxGuitar* (Casadesus et al., 2020). In Tux Guitar,

traditional western music notation is displayed alongside the tablature. Despite this, it is possible to eliminate the traditional western music notation (or the tablature). Some of the participants were already familiar with reading traditional western music notation since they had played other instruments; this might have assisted them in the task of needing to read the tablature in the sight-reading section. Thus, western music notation was intentionally excluded from the scores that the participants played.

3.6 Interviews

I conducted semi-structured interviews following each assessment. The questions that formed the basis for the interviews can be found in Appendix F. These questions were centred on several key ideas: how the participant played the game (whether most of their time was spent playing in the song mode, *Guitarcade* games) as well as how the participant felt when they played the game.

The participants were also asked if they had taken part in playing the guitar *outside* of *Rocksmith*. Throughout the interview, I explored the participants' motivations behind playing this game (for example, did they wish to learn to play the guitar in the first place?). Inversely, the participants were also asked whether the game resulted in cultivating motivation to *continue* playing. The interview further explored whether the participants believed *Rocksmith* was an effective learning tool and whether they wished to continue playing the game.

In addition to the interview, the participant provided me with the total gameplay time reported by Steam. On average, each interview conducted took thirty minutes, with the longest interview taking forty-five minutes.

4. RESULTS AND ANALYSIS

4.1 Study Aims

Ubisoft claims that a person can "learn to play the guitar in 60 days" (Ubisoft, 2019): this is known as their "60 Day Challenge" (Ubisoft Entertainment, 2014). As mentioned in the literature review, Ubisoft recommends that the player play for an hour a day over the 60 days to complete the challenge successfully. How a player is to spend their time (whether in the *Guitarcade* mode, the song mode, Jam Session or Multiplayer mode) is entirely up to them. *Rocksmith* does include suggestions in the manner of adaptive learning. Following a song, if the player struggles in a certain area (such as the ability to read), then it would be typical for the game to recommend a *Guitarcade* game relevant to training the skill of tablature reading (such as Ducks Redux or String Skip Saloon).

This study aimed to test the validity of the "60 Day Challenge" (Ubisoft, 2019). It also aimed to observe the motivation of the participants; more specifically, their motivation to commit to the "60 Day Challenge" (Ubisoft, 2019). However, as mentioned, the researcher did not give the participants any extra recommendations on how frequently to play the game. The study aimed to emulate an authentic videogame playing experience, one where the player can choose how long and frequent each playing session is.

4.2 Meet the Participants

This section will describe the musical background, previous guitar and videogame playing experience of each participant. Information was gained from the initial questionnaire, and further information was acquired from the interviews conducted after the participants' assessment. Four participants took part in this study (n=4). Pseudonyms were used to establish anonymity. The participants' pseudonyms and ages are as follows: Wolfgang (28), Christoph (27), Felicity (26), and Leah (25).

4.2.1 Wolfgang

At the time of his interview, Wolfgang was 28 years old. Prior to entering the study, he had limited guitar playing experience. In his interview, he distinctly recalled learning how to play *Seven Nation Army* (The White Stripes, 2003) on the guitar in his school music class (which was almost two decades ago). Through primary school, Wolfgang also had private one-on-one instruction on the keyboard and described having a greater level of proficiency on the keyboard than on the guitar. Before participating in the study (and at the time of his interview), he did not identify as a gamer but did describe having experience playing action videogames. His playing experience included several first-person shooter games and an open-world game, the videogames he mentioned playing included *Rust* (Facepunch Studios, 2018), *Counterstrike* (Valve & Hidden Path Entertainment, 2012), and *Grand Theft Auto* (Rockstar Leeds, 2013). Wolfgang also acknowledged some limited experience playing other music videogames such as *Guitar Hero* (Ubisoft Leamington, 2005) and *Rock Band* (Harmonix & Pi Studio, 2008).

4.2.2 Christoph

Christoph was 27 years old at the time of his interview. He was working as a high school music teacher. He also had a high level of reported proficiency on the pianoforte, an instrument that he majored in during his undergraduate years. Before taking part in the study, his initial questionnaire responses indicated no experience in playing the guitar or in playing videogames. Contrary to this, during his interview, he revealed that he did have experience playing the Multiplayer Online Battle Arena (MOBA) game known as *DOTA 2* (IceFrog Valve, 2013).

4.2.3 Felicity

At the time of her interview, Felicity was 26 years old. She had just completed a Master's degree in music therapy. Group classes for learning how to play the guitar were a compulsory part of her Master's program. Her Bachelor's degree was in education and piano performance, and she also possessed two associate diplomas in piano performance. Prior to the study, she had little experience playing the guitar, but over the course of her *Rocksmith* playing experience, she started to attend group classes as part of her music therapy training. At the time of the study, she worked as a private piano instructor. Felicity identified as a gamer, citing previous experience with playing an assortment of action videogames belonging to the MOBA games genre, some of these include: *DOTA 2* (IceFrog Valve, 2013) and *Mobile Legends: Bang Bang* (Moonton, 2016).

4.2.4 Leah

Leah was 25 years old at the time of her interview. Prior to taking part in the study, Leah had little experience playing the guitar, but she had a moderate amount of experience playing the pianoforte. She achieved an AMEB grade six certificate in the last five years. Leah did not identify as a gamer, but she had some limited experience playing *Guitar Hero* (Ubisoft Leamington, 2005). During her interview, she also listed a wide range of casual and exergames[3] that she frequently played, including *Wii Sports* (Nintendo EAD, 2006), *Taiko no Tatsujin: Drum 'n' Fun!* (Namco, 2001) and *Pong* (Atari, 1972).

[3] *Exergames* as the word implies are exercise games – games where the player is expected to exercise to improve their level of fitness.

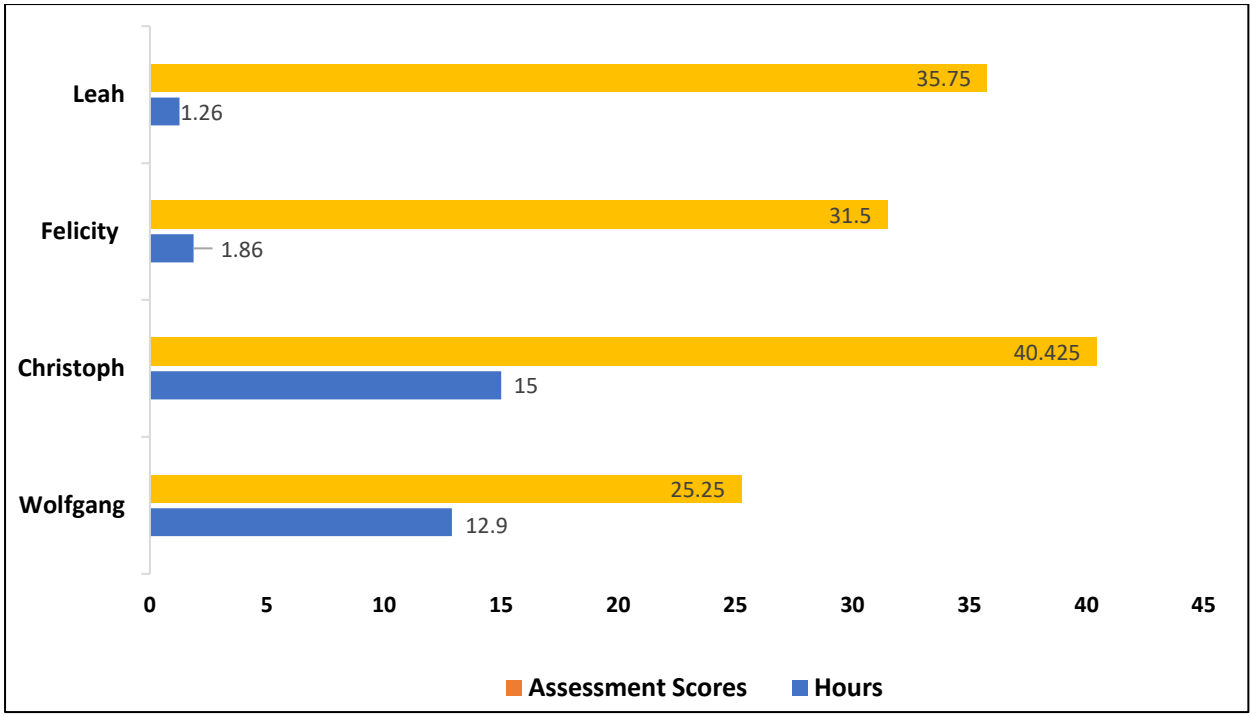


Figure 15. Hours spent playing and overall assessors' scores

4.3 Understanding the Assessment Results

Figure 15 shows the number of hours spent playing *Rocksmith,* against the participants' assessment overall scores. A high length of time spent playing *Rocksmith* did not correlate with higher assessment scores. For example, Wolfgang reported 12.9 hours of playing time, a figure almost 12 times greater than Leah's time (1.26 hours). Despite this, Wolfgang's overall assessment score (25.25) was significantly lower than Leah's score (35.75). Additionally, Leah's score was the second highest, but she spent the least length of time playing *Rocksmith*. Explanations for this have been included in the next section. Other themes that have been previously mentioned (technical issues, preference for different learning modalities and serious games) will be explored in the following section.

4.3.1 The Guitarcade Assessment

This section will include and examine the assessors' scores and comments for all four participants in the *Guitarcade* assessment. The assessors' scores will be compared alongside the digital game scores, but it is important to note that the assessors' scores were based on different metrics. For example, while the assessors observed the participants' technique, giving each participant a rating out of five, some of the points on the rubric were unmeasurable by *Rocksmith.* In other words, *Rocksmith* does not award its players for displaying correct left and right-hand position or posture and instrument hold. Unlike the assessors, *Rocksmith* did not award players with a percentage-based score; instead, points were rewarded cumulatively based on how much time the player spent playing the game.

Figure 16 shows the participants' assessor and digital scores in both sections of the *Guitarcade* assessment (the participant's choice against the assessor's choice) and Figure 17 shows only the assessors' allocated marks against each point in the rubric. Figure 18 shows only the digital game scores awarded in the *Guitarcade* section: it compares the participant's scores across the two attempts, showing the difference in the participant's choice and the assessors' choice.

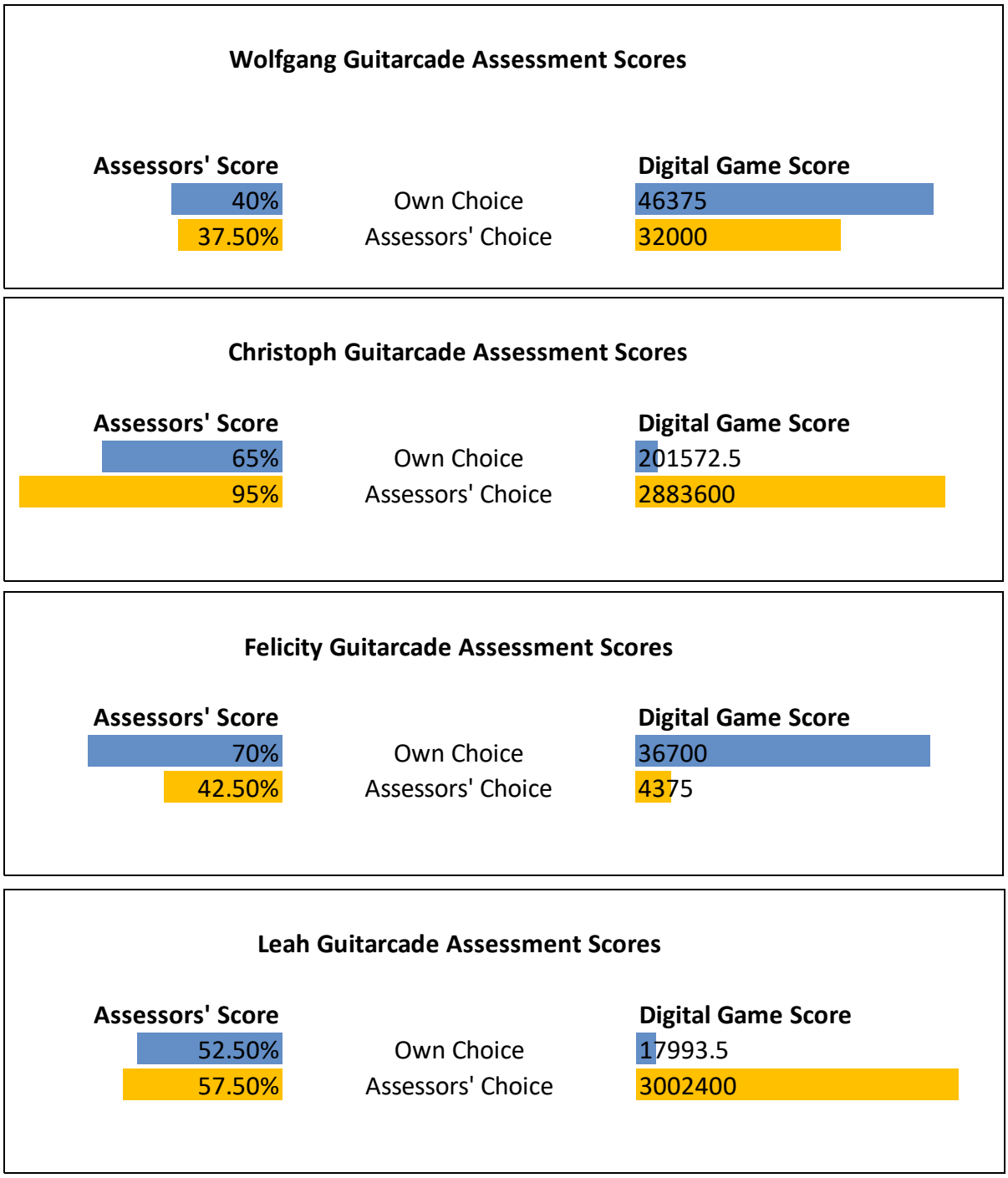
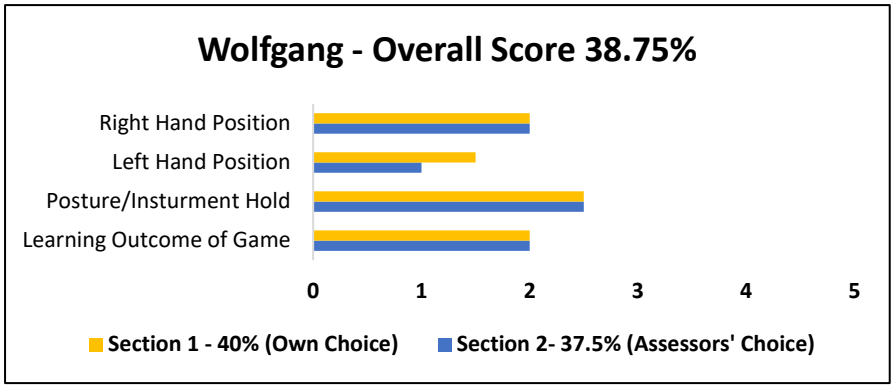
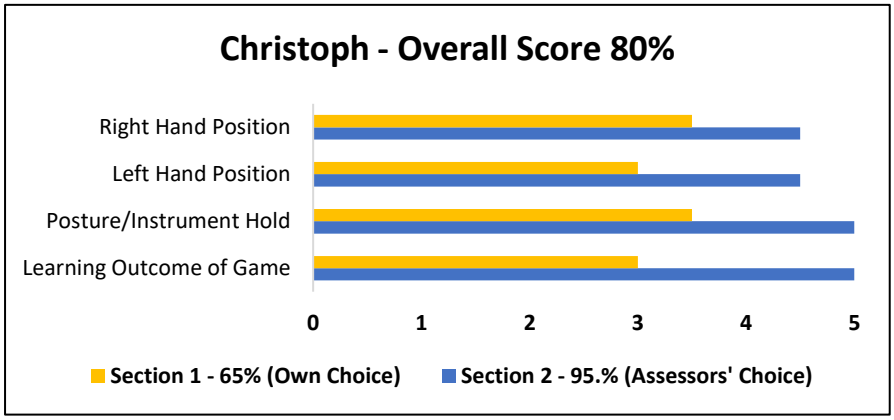
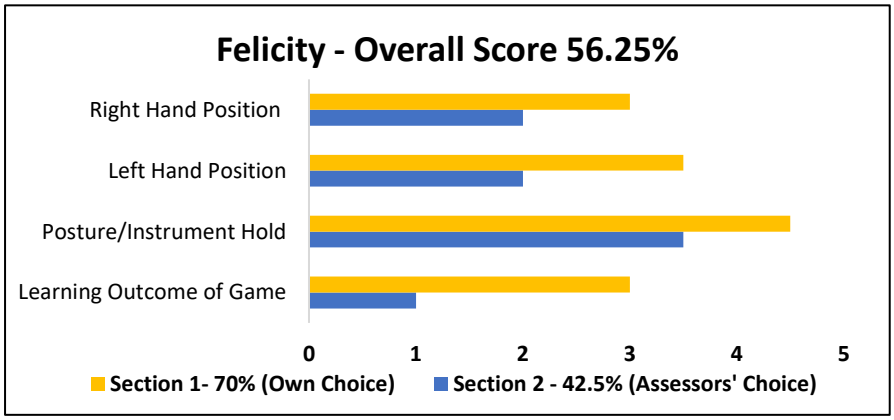


Figure 16. Assessors' Score and Digital Game Scores.







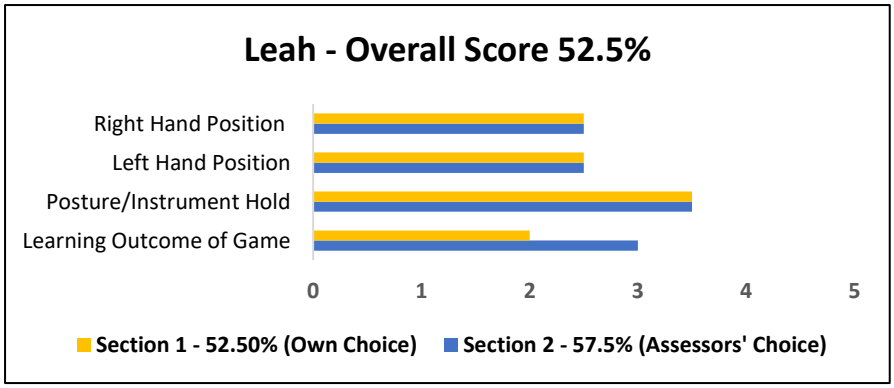


Figure 17. Assessors' Scores during the song mode section

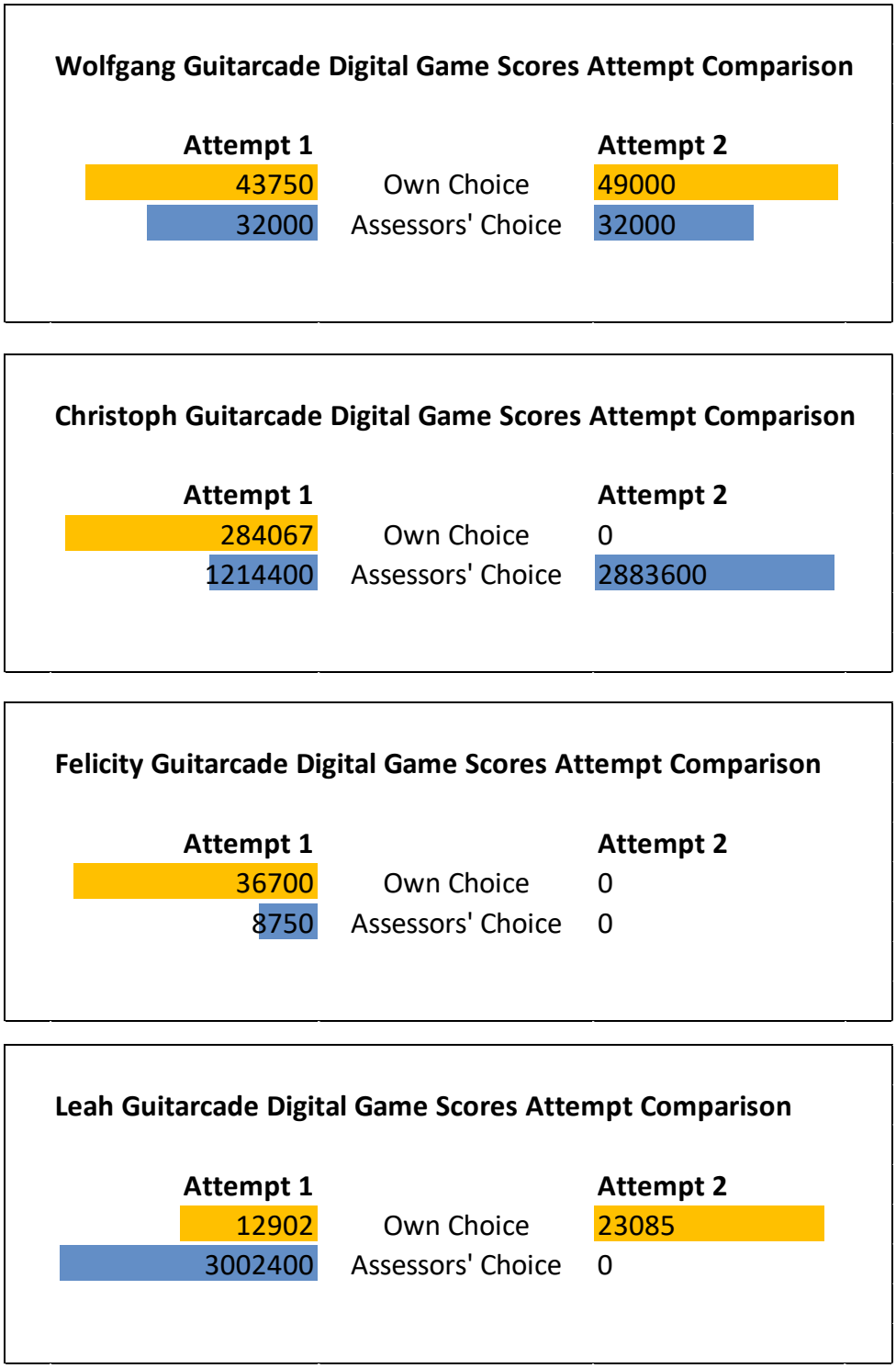


Figure 18. Digital game scores compared across both attempts.

Throughout the *Guitarcade* assessment, both assessors continually remarked that many of the participants did not understand the aim of the game and could not understand how to play the game. In Felicity's assessment, this was especially apparent as she scored higher in the own choice section. But in the assessor's choice section, it was clear that she was unfamiliar with the game.

The comments indicated this as one assessor wrote that Felicity "was unsure as to which fret to play, a result of not understanding the game (verbally discussed)" and another affirmed that Felicity "was unsure of how to play the game. Maybe the game isn't a fair measure of skill level".

Conversely, it was clear that Felicity understood how to play the game in the own choice part of the *Guitarcade* assessment. Despite several mistakes, the comments made by the assessors indicated that she nonetheless understood how to play the game. These comments are below.

- Strumming in R.H. is at sound level
- Can play chords and have L.H. movement but no dynamics on volume control

Unlike Felicity, Christoph scored higher in the own choice (95%) than in the assessor's choice section (65%) of the *Guitarcade* assessment. A comment left by one of the assessors indicated that he may have altered his guitar playing technique in order to achieve high scores in the game. One assessor commented that Christoph "uses L.H. to mute after playing strings as a way to attempt to increase accuracy". Another assessor indicated a similar issue: "thumb on L.H. tucked very high chocking the neck".

In second part of the *Guitarcade* assessment, Christoph played *Return to Castle, Chordead.* The learning outcome of the game is to be able to manage chord changes with

speed and fluency (see Figure 6). As shown in Figure 17, under “learning outcome of game”, he scored 5. The assessors’ comments indicated that he understood the aim of the game. One assessor wrote that Christoph “accurately shift(ed) from E5 to A5 chord in first position” and was “effective in using R.H. to strum to play the game – although lacking R.H. support”. The other assessor noted that he was able to play “accurate(ly) with chords and moving to them with ease”, that his “strumming with right hand (was) competent/accurate”, and he was “able to move from open chords to barred one(s) with relative ease”.

Leah and Wolfgang had consistent scores in both sections of the *Guitarcade* assessment. In the own choice section, Wolfgang scored 40%, and in the assessors’ choice section, he scored 37.5%. In Leah’s case, she scored 52.5% in the own choice section and 57.5% in the assessors’ choice section.

Comparatively speaking, Wolfgang scored the lowest with an overall score of 37.75% in both sections of the *Guitarcade* assessment. What was distinctive was the way the assessors described Wolfgang’s performance. In the first attempt, one assessor wrote: “Participant getting mildly frustrated with game”. This feeling of frustration was consistent in the second attempt as the same assessor wrote: “Participant feeling mild frustration from game”. This level of frustration appeared to have some effect on his playing ability. In the own choice section, one of the assessors indicated that the more Wolfgang played, the greater his decline in performance. One assessor noted that Wolfgang was “finding keeping up with scales difficult as game gets more difficult left hand getting lazier (in some instances using (his) thumb to finger down as opposed to fingers 1-4)”. In other words, Wolfgang used his thumb to move across the fretboard – this is an unconventional way to play the guitar. There was also an “overall decline of technique/posture as (the) game progressed”.

Although the difference between his scores in the own choice (40%) and assessors' section (37.5%) were marginal (only a difference of 2.5%), his frustration and decline in performance may have helped explain his lowered score in the assessor's choice section. Additionally, the fact that the assessors chose a game that he was unfamiliar with (in the assessors' choice section) may have been another factor that contributed to his lowered score.

In Leah's case, her scores were also mostly consistent in both sections of the *Guitarcade* assessment. As shown in Figure 17, she achieved a score of 2 in the own choice section and a score of 3 in the assessor's choice section under "learning outcome of the game". The assessors' comments indicated that she did not know how to play the game in the first section as one assessor wrote "Does not completely understand the goal of the game". And another noted that she "was unsure as to how the game worked". In the assessors' choice section, the comments indicated that Leah understood how to play the game, but struggled to meet its technical outcome. One assessor wrote that Leah was "very slow at chord changes but better after figuring them out, not really able to sight read" and the other wrote that she "needed to play more loudly to play the game but didn't realise this initially".

As mentioned, the digital game scores in Figure 18 observe the player's game scores across both attempts. During the assessment, the assessors were to give an overall mark that summarised the participants' performance across the two attempts. In some of the assessors' feedback, they indicated that once the participant became familiar with the game, their playing improved. The inverse of this effect was also evident in one assessment. As previously mentioned, the assessors noted that Wolfgang was frustrated with the game. As he became frustrated, the quality of his playing had declined, and this was apparent in his digital scores. When he played *Scale Warriors* (a game aimed at developing fluency and familiarity with a range of pentatonic scales), he scored 48, 000 points in his first attempt, while in his second attempt, only 43, 750 points.

In the assessors' choice section of the *Guitarcade* assessment, Wolfgang played *Hurling Hurdles* (the pedagogical aim of this game was to build control in tremolo technique). He scored 32, 000 across both attempts. The comments left by the assessors did not indicate that he was frustrated, or that his playing quality declined over time. Despite this, he had a marginally lower assessor score (37.5%) in the assessors' choice section, than in the own choice section (40%).

In Christoph's case, his performance appeared to improve during the *Guitarcade* assessment – this was evident in both the digital scores and the assessors' feedback. In the own choice section, he played *String Skip Saloon* (the learning outcome of this game is to be able to differentiate the six different strings on a guitar – see Figure 1). In his first attempt, as shown in Figure 18, he scored 119,078 points, while in his second, he scored 284, 067. In the assessor's choice section, he played *Return to the Castle Chordead* (the aim of this game is to be able to play power chords fluently, see Figure 6). In his first attempt, he scored 2, 883, 600 points. Based on the screen capture footage, he did not have a second attempt. But his first attempt had two distinct sections. As mentioned, *Return of the Castle Chordead* gives the player the chance to continue playing after losing all their lives. In Christoph's case, he chose to continue playing, and the assessors appeared to treat this as a second attempt as their comments stated that Christoph had "a lot more accuracy in (the) second attempt" – this comment nonetheless shows that Christoph's performance improved in the second half of the game.

Across both sections of the *Guitarcade* assessment, Felicity attempted to play the *Guitarcade* games. In the first section, she played *Return of the Castle Chordead*, and in her first attempt, she scored 125, 900 points. In her second attempt, Felicity scored 0 points. The reason for this was not because she didn't try, rather, the "0" that she scored was because of the way the game rewards points. In *Return of the Castle Chordead*, the player shoots a

monster by playing the correct power chord (which hovers over the monster's head). This monster is capable of attacking the player, which in turn causes damage to the player (the player loses points and lives). In this game, the player starts with five lives, which are indicated by the heart-shaped symbols positioned on the left-hand side of the screen. Should the player lose all their lives, the game ends. However, in *Return of the Castle Chordead*, the game does not end when the player loses all their lives. The player still has the opportunity to continue playing in the same session. A message that says "Continue?" appears along with numbers counting down from ten giving the player time to make a choice. When Felicity played *Return of the Castle Chordead*, her highest score (before her points reduced to 125, 900) was 384,100 in the first attempt. In her second attempt, her highest score was 46,500. Subsequently, her points reduced down to 0, and she lost all her lives. In both games, she chose to stop playing.

In the second section of the *Guitarcade* assessment, Felicity played *Ninja Slide.* It was clear that she did not know how to play the game. In her first attempt, Felicity scored, 8,750 points and in her second attempt, she scored 0 points. The assessors' comments indicated that she did not know how to play the game. One assessor wrote that Felicity was "unsure of which fret to play – a result of not understanding the game (verbally discussed)". The other assessor noted that Felicity was "unsure of how to play the game", also raising the issue that "maybe this game isn't a fair measure of skill level". These comments nonetheless helped to explain why Felicity scored a 0 in her second attempt. In the screen capture footage, it was also apparent that she did not spend much time playing this game. Her first attempt at *Ninja Slide* lasted for 28 seconds, while her second lasted for 10.

During the first section of her *Guitarcade* assessment, Leah played *Gone Whalin'* (the learning aim of this game was to practice muting, dynamics, and strumming – see Figure 3). In her first attempt, she scored 12,902 points, while in her second, she scored 23,085 points.

One assessor commented that like Felicity, Leah was “unsure of how the game worked”. The same point was reiterated, that she “does not completely understand the goal of the game”. In the second section of the *Guitarcade* assessment, Leah played *Return to Castle Chordead*. It was apparent in the screen capture video that she opted for an “early exit” of the game and did not have a second attempt. In later correspondence, she revealed that this was due to wanting to finish the assessment sooner rather than later.

To summarise, a variety of insights can be gained from the *Guitarcade* assessment: one being that the games in the *Guitarcade* are designed to teach and reinforce guitar technique. Despite their intentions, it was evident that such games do not necessarily foster “good” or “ideal” guitar technique. This was especially evident during Christoph’s assessment as the assessors noticed him altering his guitar technique to achieve high scores in the game. Another aspect worth mentioning is the fact that some of the participants (namely Felicity and Leah) had under two hours of *Rocksmith* playing experience prior to being assessed (despite having the game for over 60 days). Their assessment essentially observed how they learned to play the game. The varied allocation of each *Guitarcade* game made it difficult to compare the participants’ digital game scores against the assessors’ scores. Additionally, it was evident that many of the participants did not know how to play the game. In turn, the assessors left a resounding comment that this lack of understanding made for an “unfair” assessment of the participants’ ability.

4.3.2 The Song Mode Assessment

As mentioned in the literature review, the song mode involved playing a song from the *Rocksmith* song library. It followed a similar format to the *Guitarcade* assessment. In the first section, the participant chose a song (own choice), and in the second section, the assessors

chose a song (assessors' choice). Figure 19 shows both the assessors' scores and the digital game scores.

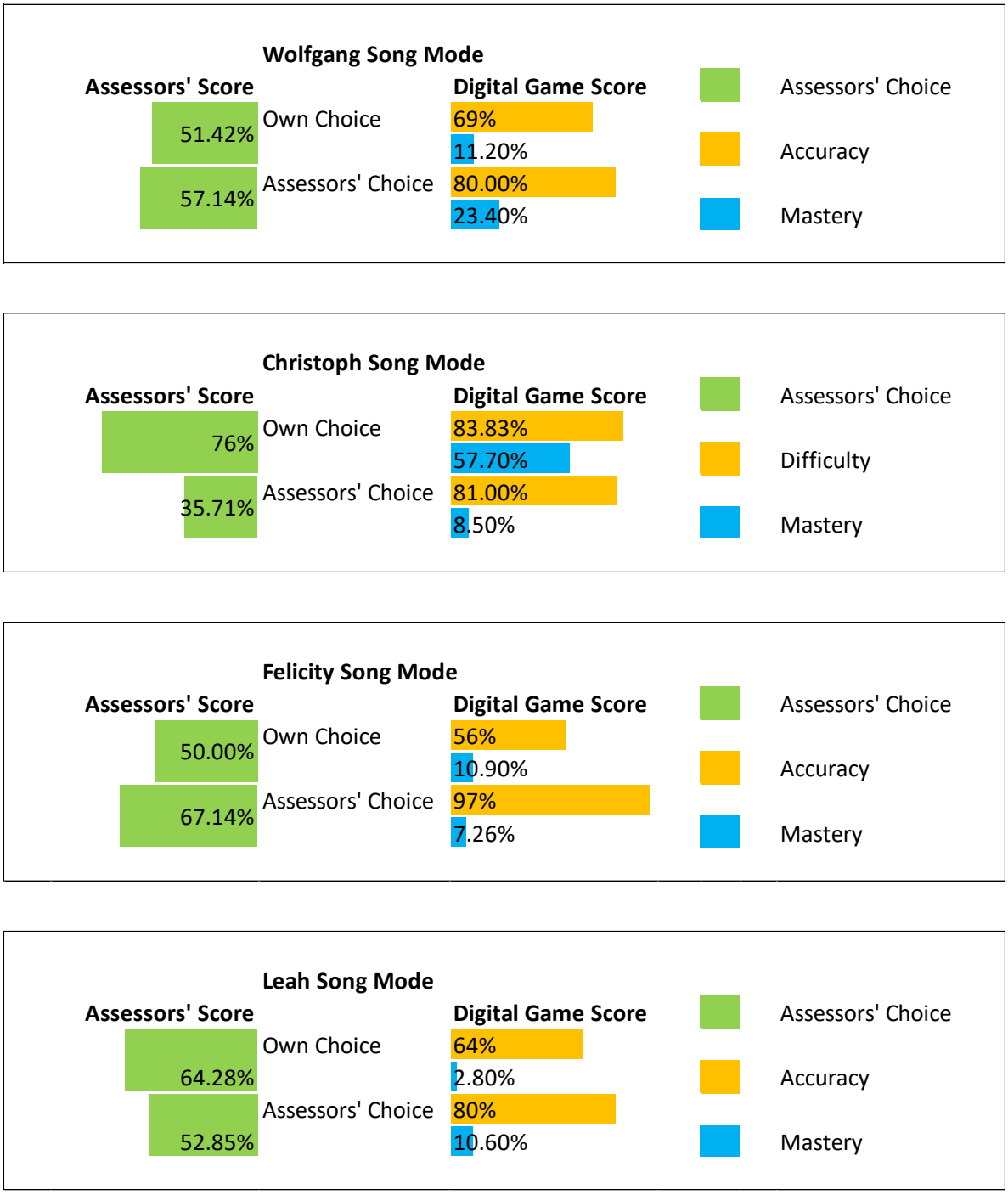


Figure 19. Assessors' Scores compared to digital game Scores in the song mode section

Leah, Felicity, and Wolfgang had scores that were consistent in both sections of the song mode assessment. Leah scored marginally higher in the own choice section (64.28%) than in the assessor's choice section (52.85%) showing a difference of 11.43%. The scores provided by *Rocksmith* did not correlate with this trend. In the first section, her mastery level was 2.8%, while in the second, her mastery level was 11%. However, it should be noted that after the second section, Leah manually adjusted the difficulty level to a harder setting (two levels higher than her current level). She did this because she felt that the default setting did not challenge her, which was noticeable to the assessors. One assessor commented that the first song was "fairly easy" meaning that there were fewer opportunities to make mistakes or show inaccurate playing. Which, in turn, may explain why her assessor scores were lower in the second section of the song mode assessment. Paradoxically, as mentioned, her digital game scores (despite the increase in difficulty) were higher in the second section, but this could be explained through Leah's manual adjustment of the sight-reading level – doing this allowed her to earn a higher mastery score.

Wolfgang's performance across both sections in the song mode assessment was similar. In the own choice section, he scored 47.14%, while in the assessor's choice section, he scored 51.42%, a difference of 4.28%. The digital game scores appeared to correlate with this trend, but the difference between both sections was more significant. In the first section, his accuracy score was 69%, and his mastery score was 11.20%. In the second section, these scores were higher. His accuracy score was 80%, and his mastery score was 23.40%. The difference in his accuracy score was 11% between both sections, and the difference in his mastery score was 12.4%. The comments left by the assessors revealed that he had some technical limitations in his playing. In the first section of the song mode assessment, one of the assessors noted that "initially, chords aren't played accurately (open chords) but this improves throughout", indicating some level of improvement with practice. Another assessor

commented that Wolfgang “struggled lots with chords” however could “accurately hit some single notes”. Such comments revealed that throughout his playing session, Wolfgang, like Leah, became more familiar with the song, and this, in turn, led to higher scores.

Converse to Leah and Wolfgang’s performance was Christoph’s performance. In the assessment, Christoph’s score in the own choice section of the song mode assessment was 75.71%, which was far greater than his score in the assessor’s choice section (35.71%).

Christoph’s assessor scores correlated with the digital game scores provided in *Rocksmith* as his mastery score in the own choice section was 57%, while his mastery level in the assessors’ choice section was 8.5%. Rather than play in the default mode and allow *Rocksmith* to adapt to his level, Christoph manually adjusted the level of difficulty to 80.8% - this is why the legend in Figure 19 includes a score for mastery and difficulty (not accuracy). Throughout his playing, the difficulty level rose to 83.83%, but in the assessor’s choice section of the song mode assessment, the difficultly level declined to 81%. The assessors’ comments further indicated that the song he chose was highly familiar to him. One assessor observed that Christoph “knew (the) song well enough to be able to add expressive technique such as slides”, and another indicated that he could “accurately hit notes and power chords (5 chords) for most of it”. However, as previously mentioned, there was a noticeable decline in his performance in the assessors’ choice section. This trend was evident in both the assessor’s scores and the digital game scores provided by *Rocksmith.* One assessor wrote “Struggling heaps, inaccurate chords and melodic lead playing”, and that he had a “lack of confidence with this chosen song”. Another assessor noted that Christoph “was able to form the correct power chord shape but struggled to keep up with the chord changes as they occurred”.

In Felicity’s assessment, her score in the assessor’s choice section was higher than her score in the own choice section of the song mode assessment. Her overall score for the own

choice section was 50%, while her score for the assessor's choice section was 67.14%, making this a 17.14% difference. In her digital games scores, a similar trend was evident. Her accuracy score was 56% in the own choice section, and in the assessor's choice section, her accuracy score was 97.00%, showing a 41% difference. Despite this, Felicity's mastery level was slightly lower in the second section. She scored 11% in the own choice section and 7% in the assessor's choice section, showing a 4% difference. It would seem that an accuracy score of 97.00% would have led to a mastery score higher than 11% (Felicity's mastery score in the first section). Since Felicity played in the dynamic difficulty setting, the difficulty level appeared to have dropped (and adapted to her level) when she played *Suspicious Minds* in the assessors' choice section. In effect, this would have led to a higher accuracy score as she would not have had to play as many notes.

The comments made by the assessors indicated that as Felicity progressed through the assessment, she became more and more familiar with playing the game. In the own choice section, one assessor noted that Felicity was "playing the correct fret, but on the incorrect string", however "as the song progressed (Felicity) was able to play the correct string". In the assessor's choice section, an assessor noted improvement in Felicity's level of accuracy "single notes more accurate with an improved rhythmic feel". In the case of Felicity, the game scores, assessor's scores and the feedback provided by the assessors indicate that more playing time meant increased familiarity, which in turn led to higher scores.

In the song mode assessment, the assessors' scores did not always correlate with the digital game scores. However, in the case of Christoph, a correlation between both scores were strongly evident. His performance declined in the second section, and it was apparent that he was familiar with the first song but the not second. The assessor's comments supported this. Although he did not play *Rocksmith* for the recommended sixty hours, he did have the most playing time when compared to the rest of the participants. In Wolfgang,

Felicity, and Leah's assessment, the digital game scores suggested an improvement in performance across sections 1 and 2 – especially since they had higher accuracy scores in the second section. Leah and Wolfgang's mastery scores were also marginally higher in the assessor's choice section. Despite her higher accuracy score in the assessor's choice section, Felicity's mastery score was slightly lower in the assessor's choice section. It is uncertain why this occurred since a higher accuracy score should lead to a higher mastery score. However, the screen capture video footage revealed that she regressed to a lower level of difficulty when she played the second song.

Many of the assessor comments also revealed some level of improvement with experience – this was evident in Wolfgang, Felicity, and Leah's performances. One assessor commented that in Wolfgang's performance "initially chords aren't played accurately (open chord) but this improves throughout". Similarly, in Felicity's performance, another assessor wrote: "As the song progressed, the participant was able to play the correct string".

Many of the comments identified that the participants had a guitar technique that was not "ideal". For example, one assessor commented that in the first section, Felicity's "string sustain (was) lacking as (she) chose not to perform with a pick". In the second section, another assessor commented that Felicity had a "poor finger technique from R.H.". During Leah's assessment, another assessor commented that the "main issue is plucking too hard on right hand, it wouldn't sound good in (a) real life situation, but it gets marked correct in the game". In the second section, the same assessor commented that Leah played with "no dynamics, but was not asked for any".

The previous assessor comments revealed an aspect lacking in *Rocksmith's* feedback mechanism, and that is the ability to ascertain the physical aspects of playing an instrument

(such as correct posture, using a pick when needed, effective picking, strumming, and sliding technique), as well as aspects related to the sound quality (tone and dynamics).

Ultimately, assessor scores did not correlate with the digital game scores because the assessors and *Rocksmith* marked on different metrics and outcomes. The assessors marked the participants on several outcomes, such as playing the notes accurately and in time, playing with relaxed fingers, and having correct posture. *Rocksmith* only marked the player's ability to play notes accurately (the right pitch, at the right time).

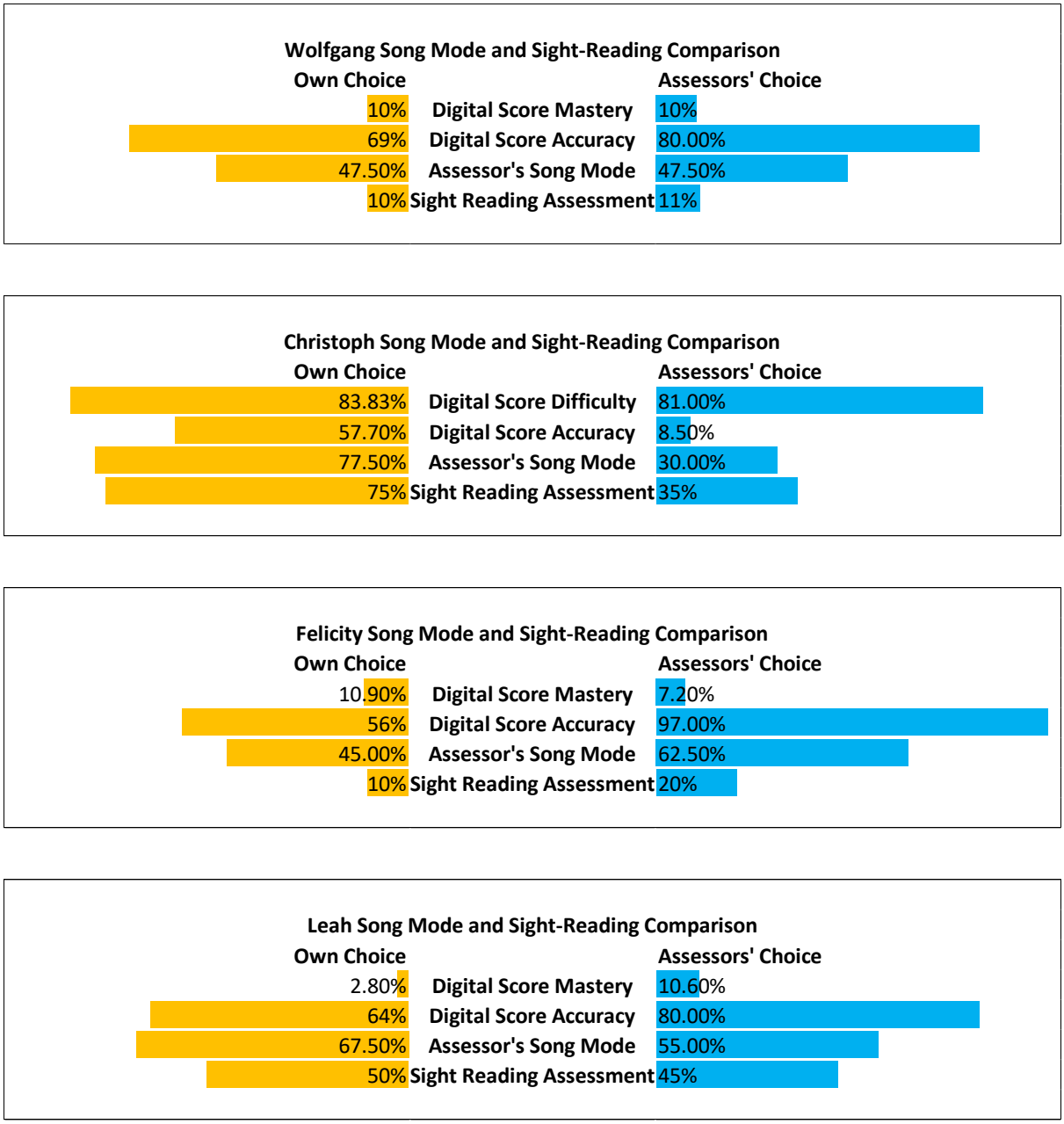


Figure 20. Sight-Reading Assessment

4.3.3 The Sight-Reading Assessment

As previously mentioned, in the literature review, the sight-reading section occurred outside the game. This part of the assessment aimed to test for transferability of skill, primarily since *Rocksmith* features a colour coded "driving mode" notation (Shultz, 2008, p. 182), which resembles guitar tablature (see Figures 8 and 9).

Figure 20 is a chart that compares the following:

- The digital mastery score provided by *Rocksmith*
- The digital accuracy score provided by *Rocksmith*
- The assessor's marks in both sections of the song mode assessment
- The assessor's marks in both sections of the sight-reading assessment

This chart aims to show the transferability of skill by comparing the digital game scores (in both sections of the song mode assessment) with the assessor's marks (in both sections of the song mode assessment and both sections of the sight-reading assessment).

As mentioned, in both sections of the song mode assessment, the assessors were given a sheet that included a range of outcomes marked on a 1-5 Likert scale (see Appendix D and E). Not all of the outcomes were related to sight-reading. To better understand whether being able to play a song on *Rocksmith* leads to a transfer of skill (being able to read the tablature of the same song), outcomes related to sight-reading such as "interacts with the game fluently" and "plays notes and/or chords accurately in the left hand" were included in the calculation of the assessor's scores in Figure 20. Other outcomes related to the physical aspects of guitar playing such as "posture and stance are appropriate to playing the guitar" were not included in calculating the assessor's scores in Figure 20, because they were unlikely to affect the participants' sight-reading ability. The assessor's scores were then averaged and made into

percentages. In the sight-reading assessment, the assessors' scores were also averaged and made into percentages.

Wolfgang scored 10% in both sections of the sight-reading assessment. The assessors' comments indicated that he had a lack of understanding for reading guitar tablature. One assessor wrote that he "struggled reading through the tablature", and another assessor wrote that Wolfgang had a "lack of understanding toward tab". The assessors noticed that he lacked other basic skills, commenting that Wolfgang's "rhythm was inaccurate with large breaks between the chords".

In Christoph's assessment, a very observable trend emerged. As mentioned, he scored higher in both sections of the song mode assessment. The digital game scores, numerical marks, and comments made by the assessors supported this. The assessors' comments indicated that he was highly familiar with the first song but highly unfamiliar with the second song. This trend carried over in the *Sight-Reading* assessment. In the first section of the sight-reading assessment, he scored 75%, but in the second, he scored 35%. In the first section, one the assessors commented that the "main riff (was) played with confidence and flair, other sections were shown to be challenging". Another assessor wrote that Christoph was "reading/following the tabs well", "not getting lost", and that he "was accurate for the most part and included some techniques such as glissando/hammer-on and pull-offs".

In the second section of the sight-reading assessment, a very different image appeared. As mentioned, it was clear that Christoph was less familiar with the song that the assessors chose in this part of his assessment. One assessor noted that Christoph "carefully position(ed) (his) hands before playing power chords" and that he found "single notes more challenging than chords". The same assessor wrote there were "breaks in between chords & riffs". The other assessor commented that Christoph was "able to follow the power chords at a very low/basic

level", that he had "almost no lead ability, struggled with more melodic licks/lines" and had a "rigid hand due to lack of confidence in (the) song".

In the first section of the song mode assessment, under the outcomes specific to sight-reading and accuracy, Leah scored 67.5%. In the second section, this figure had dropped to 55%. In the first section of the sight-reading assessment, she scored 45% while in the second section, she scored 50%. These differences were marginal. As mentioned, between the first and second section of the sight-reading assessment, Leah manually changed the difficulty settings by placing herself to a slightly higher level, which seemed to affect her accuracy score. The assessor's comments in the first section of the sight-reading assessment indicated that she "handled the task well although there were some interruptions when the (she) realised a mistake was made, then stopped before continuing to play". Another assessor wrote that she had "mostly correct notes" but was "very out of time on (the) lead melody". In the second section of the sight-reading assessment, the assessors' comments indicated a similar level of competency. One assessor wrote that she "took (her) time to work out the tab when translating it to the guitar which was good to see as (she was) aiming for accurate chords in the L.H.", and that "some phrases were played quite clearly and accurately however, they were not consistent and changing between phrases/sections (which) resulted in breaks in the performance". The other assessor indicated a decline in her performance, commenting that Leah read "chord symbols rather than tabs", "miss(ed) some chords and (her) strumming technique (was) a little inefficient". Additionally, the same assessor wrote that she "got lost in the reading", and also "missed expressions, like strumming, muted strings".

In Felicity's case, she had marginally higher (human assessor) scores in the second sections of both the song mode assessment and the sight-reading assessment. In the first section of the song mode assessment, under the four outcomes relevant to reading and accuracy, she scored 45% while in the second section of the same assessment, she scored

62.5%. In the first section of the sight-reading assessment, she scored 10% while in the second section of the same assessment, she scored 20%. The assessors' comments in the first section of the sight-reading assessment indicated that Felicity had "good (left hand) technique in terms of curved fingers however chord changes were inaccurate and playing doesn't resemble original song". The second assessor wrote that she had "inaccurate/poor rhythm", "work(ed) out correct shapes but place(d) them on wrong strings" and that she "stuck to some occasional notes but (her playing was) very inconsistent". In the second section of the sight-reading assessment, Felicity scored marginally higher than in the first section (20%). The assessors indicated a slight improvement in her reading, but on an overall level, her performance was still weak. One assessor wrote that the "rhythms were not adhered to", indicating that she may have ignored the rhythm and just focused on the pitch in her playing. Another assessor commented that she played with "no sense of rhythm…". Despite her low scores, the assessor's comments indicated that her performance had improved slightly between the first and second section of the sight-reading assessment. One assessor noted that Felicity was "able to read through the tab with minimal understanding". The same assessor further commented that Felicity was "accurate with single notes" and had a "better understanding of how to follow tab".

4.4 Interviews

As mentioned, the interviews happened after the assessments (except for Leah, because of technical issues, Leah was interviewed first before being assessed). Many themes emerged from the interviews conducted with the four participants. These themes were coded and explored below.

4.4.1 A Desire for a Teacher – Rocksmith and its Lack of Human Touch.

As mentioned, in this study, the participants were to self-direct their guitar learning by playing *Rocksmith*. No human instructor was provided, but the participants were not prohibited from contacting a teacher or seeking information elsewhere. Three participants (Christoph, Felicity, and Wolfgang) expressed a desire to have instruction from a teacher. They insisted that the technical components of guitar playing weren't (and can't be) addressed by playing a videogame. Wolfgang encapsulated this effectively in the quote below.

> I think a lot of what it (the *Rocksmith* game) has to teach in technique, it really needs to be a human because it's just, it's not immediately obvious what you're meant to do… the other thing is I can see someone picking up bad habits… if your only source of instruction is trying to win the game or trying to score highly in the game, it would do daft things like I did, like hook your thumb around the bridge to clamp strings on the fret from the top.

Later in the interview, he reiterated this.

> I think, from a pedagogical perspective… it would be beneficial to have a human teacher to instruct in guitar technique. The game asked me to do something called tremolo picking? I've never heard of that. Like I had a sort of rough idea but… if I had no musical background whatsoever, the only thing I could have said to that would have been *what*?

Wolfgang was referring was *Hurtling Hurdles* – a game that the assessors chose for him in the second part of the *Guitarcade* assessment. As he noted, the learning intention of *Hurtling Hurdles* is to practice tremolo picking.

Like Wolfgang, Christoph expressed frustration when the game was over-sensitive to incorrect note(s). He said (when referring to the negative parts of his playing experience) "technological stuff or the way your guitar is, so if you miss a fret by a little, it's kind of like (referring to the inbuilt feedback in *Rocksmith*), 'ah, do it again, do it again, do it again,' you know… like in comparison to having someone look at it and kind of like saying 'yeah, that's good, the guitar's out of tune, fix it up,' you know the system can't really tell you that".

Wolfgang acknowledged a similar issue, "when I was playing the low-E string, about 70% of the time, *Rocksmith* was not picking up the notes I was playing, that's a hardware issue".

Christoph also mentioned a conversation he had with the assessors after his assessment, which clarified this experience.

> I was talking to… the assessors… so they were kind of like, it really depends what you do with you guitar and how the sound kind of like travels through the system**,** cause it's very different, if you were my teacher and I played it to you, you can hear straight away what's happening where the system, it's kind of like a bit different, so my guitar, I brought a brand new, I don't know Les-Paul guitar and then even if I played the correct fret, the system wouldn't recognise it because maybe something is not aligned on my guitar.

Here the desire for a teacher was recognised for two reasons: firstly, to teach the physical aspects of guitar playing (such as how to hold the instrument correctly, or how to position the hand onto the fretboard)[4] and secondly, to provide clarity on the game's inbuilt corrective feedback mechanism. More specifically, to help the student when the game over-corrects them, or assist them when the game does not pick up their correct or incorrect notes.

[4] These topics are covered in *Rocksmith's* video library, but through the interviews, it became clear that the participants did not engage in the video library (see pages 126-131)

As mentioned, Wolfgang and Christoph repeatedly expressed that the game could not replace human instruction. Despite this, all four participants believed that *Rocksmith* still had a place in music learning.

4.4.2 Serious Games as a Trajectory into Formal Learning.

Felicity articulated similar beliefs in the need for a teacher and the importance of human instruction. In fact, she took group lessons in basic guitar playing, and she also sought out lessons from a teacher on a one-to-one level. As mentioned, the group classes that she attended were a part of the music therapy degree she was completing.

She started to play *Rocksmith* before taking group lessons on the guitar. She even described a particular trajectory of informal learning (playing *Rocksmith*) to formal learning (attending classes and finding a guitar teacher).

> I think the game helped with motivation, like I wanted to do guitar, got a guitar, um that's part of it… the group is the next level, like a group motivation… then I even want to be better at it, then I got a tutor, so it has to start from *Rocksmith*, for my journey (laughs). I'm really thankful for its starting.

I asked her if she was still playing *Rocksmith* today, and if she intended to continue to play in the near future. In reply, she said that she was "done with *Rocksmith*". When I asked her to explain her answer, she responded by saying that she felt a need to move on. She said: "like at the beginning stage it's done like for everything I want to… like a base". To Felicity moving on meant putting *Rocksmith* aside to focus on private one-on-one guitar tuition.

While Wolfgang suggested augmenting private instruction with *Rocksmith*, Felicity did not want that. She said: "I know a bit of the game, like most of the concepts there… then

I don't want to master the concepts cause I think it's better to do, to work one-on-one (with a teacher), properly". The word "properly" seemed to imply that *Rocksmith* lacked seriousness.

4.4.3 Informal Learning

Unlike Christoph, Felicity, and Wolfgang, Leah's views were vastly different. I asked Leah if she wanted to take lessons with a teacher and in reply, she answered that she was not interested in private lessons. To Leah, formal instruction involved a high level of commitment in time, energy, and finances. These were resources that she didn't have in her current set of circumstances. Despite this, she was still interested in learning how to play the guitar. The quote below encapsulates her view toward guitar learning.

> I feel like guitar's still like this, self-exploration activity… so I'm not planning to do grades, I'm just planning to use it as a self-care sort of technique… it's informal.

Leah found *Rocksmith* to be a useful tool for her needs. Despite having under two hours of playing, she wanted to continue to play *Rocksmith* on an ad-hoc basis. She put forward that in this mode of learning "you have more autonomy, it's on your own terms and if you win, yay, and if you don't win then eurgh. That's what's so great about *Rocksmith*".

The instant feedback from a computer game (and not from a human instructor) was appealing to her. She stated that when playing *Rocksmith,* "you get to see that visual feedback… hitting the right notes, and at the right timing". When I asked her to elaborate on why she did not want to learn from a teacher, she said the following:

> I think it's just the fact that there is a human person there with judgment and expertise, who's better than you. You really question yourself, and you're like, what am I doing for myself? What am I doing for the expectations of a teacher?... And if

> you don't get along with them it's just a basic clash. In a game it's like, well you don't have your teacher, you have yourself…

The contrast between playing a game and having a human teacher is startling in Leah's description. A human teacher is a sentient being who is capable of judgment and setting expectations. As Leah articulated, these sorts of pressures do not exist when playing a videogame.

4.4.4 The Seriousness of Serious Games

When I asked Wolfgang about his overall *Rocksmith* playing experience, he offered a single word: "frustrating". I will focus on frustration in greater detail later in this chapter. This section focuses on Wolfgang's negative emotion (frustration) and its possible link with serious games.

In his interview, Wolfgang clarified that he was not frustrated with *Rocksmith.* Instead, his frustration was with himself for not being able to play the guitar. When I asked Wolfgang about his other videogame playing experience, he quickly identified several commercial entertainment games with non-serious outcomes. As mentioned, some of the titles that he listed included: *Grand Theft Auto* (Rockstar Leeds, 2013), *Counterstrike* (Valve & Hidden Path Entertainment, 2012), and *Rust* (Facepunch Studios, 2018). In response, I asked Wolfgang if he felt the same level of frustration with other games (I referred explicitly to games with non-serious outcomes). Since he was familiar with *Grand Theft Auto,* (Rockstar Leeds, 2013) I asked him if he believed he'd feel equally as frustrated playing that game. Wolfgang seemed to be unable to answer this, saying "This sort of questioning works better on people with expertise in psychology, education…".

Like Wolfgang, Christoph had some experience playing commercial entertainment games, but he did not indicate this in the initial questionnaire. It was in the interview where he revealed playing one other videogame (besides *Rocksmith*), and that game was *DOTA 2*.

Before continuing, it would be worth exploring some context on MOBA games. As the term implies, MOBA games are multiplayer online games that require other players to work as a team and make real-time decisions in a game. Sometimes these games are time-limited, and other times they are outcome-based. In the realm of psychiatry and addiction medicine, research into videogame addiction exists (O'Connor, 2014). Videogame addiction is similar to gambling addiction because both are behavioural (not substance) addictions. In a review of internet addiction (Kuss & Griffiths, 2011), the real culprits of videogame addictions lie in MMORPGs. Common titles that fall under this genre include *World of Warcraft* (Blizzard Entertainment, 2004), and *Final Fantasy* (Square, 2020).

The player needs to invest a lot of time and effort to progress through these games. One game component includes committing to a single slow, laborious, and repetitive activity such as chopping down hundreds of trees, which involves clicking one part of the screen for extended periods – this is known as the "grind". The grind also includes some interdependency between players as they can interact with one another by trading items. When the player reaches a high level, they can participate in battles (which are team-based); this adds to the social dimensions of the game experience. In a typical MMORPG, players can join social groups (known as clans or guilds), allowing them to compete and cooperate with others. Players who fail to commit to playing the game during specific periods, or who leave the game early may receive an in-game penalty. They may also suffer ostracism from other team members. The social interdependence is a key mechanic that encourages and maintains further gameplay as players feel socially obliged to help their team members (King, Delfabbro, & Griffiths, 2013).

In terms of risk in videogame addiction, second to MMORPGs are MOBA games. MOBA games are similar to MMORPGs as there is a multiplayer online mechanic integral to playing the game. Acquiring proficiency in such a game requires a lot of time and practice (Kuss & Griffiiths, 2011).

In his interview, Christoph told me that he would play *DOTA 2* "at the end of the day when you know, (he) finished all the things (he) had to do in a day, and it's kind of yeah, a bit of a relaxment". Of course, his word "relaxment" is not an actual word – in the sense that one cannot find this word in an English dictionary. Despite this, it is a useful word or sentiment as "relaxment" appears to conflate two words, relaxation and entertainment.

The way Christoph described his experience when playing *Rocksmith* was vastly different. He described the experience as a highly stimulating one. In his interview, he said: "*Rocksmith* … it's kind of engaging… you need to switch your brain on to be able to do it … like you can do it, just purely as a relaxment, but if you do want to achieve something, it needs to be a bit more of a kind of like an 'okay' I want to do this".

Christoph identified two mental states he required to have success while playing *Rocksmith*. First, some level of mental energy to be able to sustain a playing session and second, motivation to play the game in the first place. His experience emphasises an important point: not all videogames are the same (see page 64 and 65). The way he described *Rocksmith* and *DOTA 2* captures the difference between serious and entertainment games.

4.4.5 Valuing Serious Outcomes

Part of the allure of playing games goes back to Caillois' (2001) definition of a game. Caillois wrote that games are "unproductive" (p. 13). More precisely, he theorised that any currency, success, or status gained from playing a game could not exist outside of a game. The magic circle is separate from reality. Loss and defeat are possibilities that are likely to

happen in a game, but a game is unlike reality because the stakes for losing (or winning) are lower. Paradoxically, the opposite also exists: since videogames are unproductive, this can be highly unalluring. When a person is absorbed in playing a well-designed videogame, this same person can feel a low locus of control, especially when a lot of time is spent (or lost) playing that game (Bogost, 2012; Rigby & Ryan, 2011).

Serious games and gamification blur the boundary between game and reality because the outcome (education or health) has value outside of the game. Throughout the interviews, the participants spoke at great lengths about how much they valued serious outcomes and productivity.

In his interview, Christoph successfully differentiated serious games against entertainment games. He also articulated valuing serious games over commercial entertainment games. He said, "I feel playing games is a waste of time. Okay, in my world, because you could be doing something that will contribute to your knowledge or whatever you want to do". According to Christoph, there was little that videogames had to offer in terms of valuable learning beyond relaxing and entertainment.

Since Christoph revealed that he did not have much time to play videogames, I presented him with a hypothetical scenario. In Australia, in the state that we lived in, the summer school holiday period typically lasted for six weeks – this is especially relevant to him since he worked as a school teacher. I asked him if it were the summer holidays which game would he play? *Rocksmith* or *DOTA*? He responded:

> Yeah, that's a good question, it would really depend, on my, on my mood, like if I'm, you know probably if I woke up and it's kind of like you know, when I'm like, when I've got my guitar, it would be *Rocksmith* 100%, and then *DOTA* would be at the end

> of the day when you know, you finished all the things you had to do in a day, and it's kind of yeah, a bit of a relaxment…

It was again apparent that he valued *Rocksmith* higher, stating a preference for playing *Rocksmith* at the start of the day. *DOTA 2* was secondary to other activities and only reserved for times when he had less energy.

The value for *Rocksmith* over *DOTA 2*, or for seriousness over entertainment was reiterated many times through his interview. Christoph asserted that one can "get something out of" playing *Rocksmith* and that it offers opportunities for learning. Conversely, later in the interview, when describing *DOTA* 2, he said "there's nothing to get out of it… yeah, I'm relaxing… but it's kind of like, learning stuff, and all of that, yeah well, are we going to learn about the heroes and stuff?"

This perspective goes back to the theory of the magic circle. While it is possible to learn "about the heroes and stuff" in *DOTA 2*, Christoph articulated that "there is nothing to get out of it" because these skills are only useful inside the magic circle.

When I interviewed Leah, I asked whether she believed *Rocksmith* was an effective tool for learning. She responded by saying that she had some limited experience playing *Guitar Hero. S*he thought that *Rocksmith* was "better than *Guitar Hero* definitely". She provided me with some more context, talking about the time she cajoled her parents into buying her a *Guitar Hero* set for Christmas. This happened in the year 2009 when she was fifteen years old. She recalled her game playing experience and described it unpleasantly. The quote below encapsulates this:

> "I like playing *Guitar Hero*, but I'm not the best at it. I just found it annoying, I think. It's because of um the latency between like the remote control and my system, so I

> kept pressing the button, and it wouldn't go, argh… Yeah, I'm not that good at it. I think my sister's better than me. I keep losing at that game…"

Despite the passing of time (specifically, a whole decade), she described her playing experience in the present tense – which seemed to indicate that her memory of playing *Guitar Hero* was connected to the present and that it did not belong to another era.

I asked Leah why she was interested in playing *Guitar Hero* in the first place. She responded by saying: "It just looked so hyped up, back then, when I was like fifteen". She drew comparisons between *Rocksmith* and *Guitar Hero* saying:

> So when you compare that to *Rocksmith*, it's totally different, in the sense of, you have the strings, and it feels more like an actual guitar, because you are actually playing the electric guitar, compared to *Guitar Hero* where it's just, you have five buttons… There was a real guitar, and then you could practice you know playing the guitar, especially like the individual frets, rather than when you play chords, so I felt like there was much more movement and dexterity in my left hand than what you get from *Guitar Hero.*

Later in the interview, I asked Leah why she took part in the study. She responded:

> Well, ah, I really suck at playing the guitar I think, I think I can get by on chords, I just wanted to become better… and I wanted that experience without a teacher? So this was the perfect opportunity to see what was out there and that wasn't *Guitar Hero,* cause *Guitar Hero* to me is like *Dance, Dance Revolution,* but in guitar form, … so knowing that *Rocksmith* was out there, you got to play with your real guitar, and learn some real skills so that's what was like, a winner for me!

Leah valued *Rocksmith* over *Guitar Hero.* The quotes above showed that she appreciated the experience of playing a "real" electric guitar over a plastic abstracted

controller (which was a part of her *Guitar Hero* playing experience). Her inclusion of the phrase “real skills” highlights a preference for a game with serious outcomes.

When I interviewed Felicity, she presented me with a different image. Felicity identified as a gamer. She used words like “hooked” to describe her gaming experience with commercial entertainment games. She talked excitedly about her videogame playing habits and shared that she had been playing *Mobile Legends* for “two years now”. Unlike Leah and Christoph, Felicity seemed to value the serious outcomes of *Rocksmith* to a lesser extent. As mentioned before, she described *Rocksmith* as an important starting point to her guitar education but mixing gamic elements through her playing and practice was unnecessary. She was content to practice playing scales on their own. There was no need to “fancy it up”, and practice “(didn’t) have to be a game”.

4.4.6 Informal Learning: Nurturing Affinity Spaces

When James Paul Gee (2009) described an *Affinity Space*, he referred to open online spaces established around a common interest (Gee & Hayes, 2012). Such open online spaces facilitate player support and establish a sense of community. An example of an affinity space would be in the online forums for the MMORPG game *World of Warcraft.* These forums allow players to help one another with issues related to technical support (installation, hardware issues or optimisation), gameplay (quests, battles, professions), as well as strategies (guild recruitment, joining guilds).

David Price used the term “open” to describe such phenomena (Price, 2013). He stated that technologies in today’s world have led to a wide sharing of information that is easy to access and readily available at a moment’s notice.

At present, a high number of open online spaces exist for *Rocksmith* players to access and share information (Rodriguez, 2019). I asked the participants if they pursued such open

online worlds or if they were active members of any affinity spaces. Leah's experience supported the use of affinity spaces. When Leah played *Rocksmith,* she went back and forth between the open online world and *Rocksmith.* The excerpt below demonstrates this:

> … Yeah like going to YouTube and seeing like, people put the tabs there, like seeing their tutorials, breaking that down, and sort of like okay, I want to learn this piece, because it wasn't available in *Rocksmith,* so down that avenue, I remember looking at, I think it was like a whole of *Royal Blood's* collection on YouTube? Someone had managed to tab that and then like show people how to, and speed it up. Yeah it's opened up, and then I started to get interested in like the Bass Guitar because of those tutorials that were available on YouTube and I remember *Rocksmith* wasn't just the guitar, the other instrument was bass guitar… but I didn't have a bass guitar, so I was like, playing on the four…

It was clear that Leah's motivation to explore this informal world of learning was that she could not find the song that she wanted to learn in the *Rocksmith* song library. Instead, she went searching for it on YouTube.

When I interviewed Wolfgang, he described an aversion to learning through open spaces. He stated that this learning modality did not suit him. According to Wolfgang, human instruction was an ideal way to learn. The quote below demonstrated how adverse he was to learning through YouTube tutorials.

> Oh god no, I can't learn things from YouTube, no, no seriously, I've tried, I prefer like, written text to, someone going (makes a bunch of nonsensical sounds), talking into a really shitty microphone with really poor elocution.

4.4.7 Player Motivation

The participants did not receive any remuneration for taking part in the study, and they were able to opt-out of the study at any time. Their experience was entirely voluntary, so when they chose to play *Rocksmith,* it was likely that they were intrinsically motivated. When I directly asked the participants "what did the game (*Rocksmith*) do for you in terms of motivation?" many of the responses were positive. For example, Christoph said:

> Every time I would put my headphones on and would hear like I don't know, I'm really interested in like the rock band music and stuff, especially if you get to play the game that you really enjoy, and it's kind of like you can hear the music, you can hear the drummers and the audience, and it's kind of like, 'Yeah, this is so cool! I really want to play,' so it does get you pumped up … But like, altogether it's engaging, I think like definitely it's a great tool, that could kind of like get you interested into like the guitar as an instrument.

Throughout much of his interview, responses of this nature were consistent. He used the words "engaging" and "pumped" continuously. When I said affirmingly "so it sounds like it's done a lot to your motivation" he confirmed by saying "yeah 100%, 100%".

Leah reported a similar experience. She said that she enjoyed playing *Rocksmith,* confirming that she "was motivated". Likewise, Felicity said, "I think the game helped with motivation, like I wanted to do guitar, got a guitar, um that's part of it".

Although the participants described feeling highly motivated to play *Rocksmith,* the hours reported by Steam indicated that the participants did not actually spend very much time playing *Rocksmith.* The participants were aware of this, and many offered explanations into their lack of *Rocksmith* playing time. Christoph reported other commitments which interrupted his life, limiting his ability to play *Rocksmith.*

> So it got me started, there were other things that were happening in my life, that I kind of had to like, stop playing the game, and stuff, it just got extremely busy, and so I had no time to keep playing, but then, probably was time if I wanted to make time for it…

Similarly, Leah said "because I haven't had the time". Not having time to play a videogame is not uncommon. It is especially common to put professional commitments ahead of entertainment or leisure time.

Christoph and Leah were quick to express this, but in Leah's interview, she spoke about the games she currently played which included: *Wii Sports, Atari Pong* and *Taiko no Tatsujin.* When I noticed Leah's discrepancy of not having time to play *Rocksmith* but having time to play other videogames, I put this forward to her and asked her to clarify. She pondered the utility of such games, thinking about what they offered her and said:

> I think it's because like I'm playing Atari Pong, because it's an old retro game, that I felt like I never appreciated until now, as a child but now as an adult. And then I play Wii Sports because I can't really bother to do exercise, so that's like kind of my excuse.

Curiously, she described *Rocksmith* to still offer some utility to her, saying that "*Rocksmith,* it helps with concentration" but speculated that the reason why she stopped playing was because of perfectionistic attitudes, which in turn stifled her motivation to continue playing.

> I kind of feel like a perfectionist, like if I don't, you know with practice, like when you play a musical piece, you'd play the certain piece again and again and again and again.

The comment above also includes the word “practice” and “play(ing)” in the context of playing a musical instrument – not a videogame. The perfectionism that Leah described was stressed in her repetition of the phrase “again and again”. Leah’s comments seemed to confirm that she gave a serious framing to the *Rocksmith* game, and a non-serious framing to the other videogames that she played, especially since she described such games as “purely entertainment”. Her perspective of such games may have been the reason why she played *Rocksmith* for a limited length of time.

4.4.8 Technical Issues – Latency

When I asked the participants about the negative aspects of their *Rocksmith* experience, technical problems were a commonly cited issue. Christoph talked about his experience with the corrective feedback feature. He described feeling frustrated when the computer repeatedly instructed him to re-attempt a “wrong” note, without much instruction for what exactly was wrong:

> …like I mentioned before, a lot of times yes, sometimes I felt like I was playing the right thing… and it, just because something’s not right in the connection or something like that, ‘oh that didn’t sound like correct, let’s do it again’ and you do it, and it’s like ‘let’s do it again’ especially when you get to like, there was something that I practiced, which was actually a few days ago and it was a pull off, and I haven’t done it before, and then in the beginning, it’s like this is a really easy thing and it’s so common, just try and do this, you press the string and then you pull it off, flick it off, you know, and then I tried it and it’s like probably 30 times… this would probably be the only negative thing that I’ve found about it that’s kind of like there’s, they tell you something’s wrong, but what that something is and how can you fix it, that’s missing…

Wolfgang's experience was similar. During the assessment, he described his experience playing one of the arcade games known as *Scale Warrior*:

> Like it's where I don't know whether it's a case of the string sitting high over the fretboard and so it wasn't contacting the fret fully with the amount of pressure I put on it, or whether the amplifier in the USB, the real-tone cable I think you called it, perhaps that has a low-pass filter that doesn't quite work properly at those ranges, or perhaps I don't know in fact know how to play a guitar. All an explanation but if I'm, if it's telling me, you need your finger to be here and you need to strum and I do that, and it's ignoring me, all I have is the sound of the note I'm playing and no indication of what's wrong…

Latency refers to the length of time between sending out a command (for example plucking the high 'E' string in a *Rocksmith* song) and receiving a response (being told that this was the correct or incorrect note). The word "lag" is a colloquial term used to describe the same issue. Several times in her interview, Leah expressed feeling frustrated by issues related to latency. She said, "sometimes not all the time, sometimes there would be like latency issues, lag and then, yep". She explained that this affected her gameplay experience and the chance of success in the game.

> So I did mention latency a couple of times… yep, so that was a thing and um, I think it was just my guitar, like every time I played the high 'E' string it didn't quite pick up, which was really quite frustrating because it really did affect my percentage of like accuracy and success…

Leah, Christoph, and Wolfgang identified a variety of technical issues, but in the end, these issues were overlooked because they did not stop the participants from playing

Rocksmith. As mentioned, Christoph described these technical issues to be "the only negative thing" in his experience.

4.4.9 Game Playing Style

All four participants reported that they spent most of their time playing in the song mode and less time playing and exploring the *Guitarcade* games. When Leah said she spent most of her time playing in the song mode, I asked her why.

> I just wanted to test my skills out, and so I went to the song mode, rather than arcade mode, to get it over and done with.

The last phrase "to get it over and done with" seemed to highlight the belief that playing in the song mode was the most efficient way to learn how to play the guitar. Also, It seemed to indicate that Leah did not enjoy playing *Rocksmith*. Later in the interview, Leah spoke about her playing experience differently. She said that her playing style flipped between different playing modes. She identified the *Guitarcade* games as "training". Her use of the word "training" was perhaps analogous to sports training, or practice– training, by way of kicking a ball into a goal from one end of the field to the other, versus playing a game of soccer. This analogy can also be applied to music practice – practising scales, versus playing a piece of music. The quote below further articulates how Leah played *Rocksmith.*

> Like I know there's mostly, there's like training, and you could do training section *before* you get into the, but I usually go into the original and then see how bad I am, and then go back to the training, and then go back to that… Yeah I go back and forth…I kind of test it out thinking, well I kind of like, overestimate how good I am and then realise how much I suck and how much training I need.

As mentioned, when a player finishes playing a song, *Rocksmith* offers the player suggestions for improvement. Some of these suggestions include playing a related game in the *Guitarcade* to improve particular techniques that the player shows weakness in (this may be anything from reading tablature to sliding or playing power chords). This mechanism adds both guidance and variety to the playing experience. Leah described a "back and forth" style of playing. This involved playing in the song mode and then "training" (or playing *Guitarcade* games) after playing in the song mode. Despite this, Leah did not specify whether she followed the in-game playing suggestions.

Wolfgang also spent most of his time "primarily using it at home …running through songs". He explained that it was "because … if you know what the end product's meant to sound like, you can sort of to some extent self-direct when you make errors on the guitar". He also expressed some level of scepticism when it came to the effectiveness of the *Guitarcade* games.

> Some of the technique exercises and they were ah… inquisitorial, I think a lot of what it has to teach in technique it really needs to be a human because it's just, it's not immediately obvious what you're meant to do.

Christoph was less interested in the *Guitarcade* games because he was more interested in learning how to play a song. In his interview, he said:

> I think I played one or two of them? Just to kind of like, see what that tab does, but I was a lot more interested in kind of learning a song, learning how to play a song.

Despite his lack of interest in the *Guitarcade* games, he could understand that each game had a learning outcome that was relevant to learning how to play the guitar. He knew that these games were designed to vary a player's experience. When I asked him if he could recall playing any arcade game, he replied with:

C: Yes, so I played one that was, *Saloon* something?

R: Oh yeah? The one with the cowboys and you're like plucking

C: Just plucking, yeah, yeah plucking the strings

The game that Christoph was talking about is known as *String Skip Saloon* (see Figure 1) and he played this during the own choice section of his *Guitarcade* assessment. Since the interview happened straight after the assessment, his ability to recall a game and describe it was hardly surprising. When Christoph talked about his playing habits, he believed that he spent most of his playing time in the song mode. His responses in the interview also indicated that he saw value in the arcade games.

> So that was pretty good, so like trying to get you to know what the strings are… then because, they all work with colours, and it's kind of like, in the game, like when you press frets, it would be like, you know, fret 7 and there would be a little green box where you know you go to press the green string, and this game would relate to that really well because you know, it would tell you the green string is a, I don't know a B string or something? Whatever, and it's kind of, everything in the game, relates to everything. So it's kind of like you do need to explore, and that's a good way because that's a good thing, because you can learn a song, and then if you get sick of that you can play the little arcade game, which is also kind of like 'okay you need to practice that part,' and there's so many of those different games, how to play chords, power chords, pull-offs stuff like that.

Felicity also reported that most of her playing time was spent in the song mode. She said that she was "mostly playing the solo songs … (to) develop it (her guitar playing)". She also played the arcade games but to a limited extent. In her interview, she said: "I did go through all of them, but I don't, I don't like it that much". When I asked her why, she

responded with “um it’s just, I don’t think it’s interesting when you play chords to kill someone (laughs), it’s just the concept of it, yeah”.

The games in the *Guitaracade* library could be described as the “gamiest” part of the *Rocksmith* experience. Since Felicity identified as a gamer and acknowledged that she spent a lot of time playing videogames, it was surprising to hear that the arcade games in *Rocksmith* did not appeal to her. Like the other participants, she spent most of her time in the song mode. The transcript below clarifies some of the motivations behind Felicity’s gaming habits.

R: How could *Rocksmith* be improved?

F: You know like *Rocksmith* in an arcade setting, like …

R: Oh, what so you *go* into an arcade, are you saying?

F: And if they have like, … um, one verse one, I play first and you play the second game, that’s going to be, I’d do that,

R: Competition?

F: Competition

R: Oh my god, like *Dance, Dance Revolution,* like those kind of games, yeah?

F: Yes, like those kind, DDR, yeah, like I went to Japan and there’s a lot of um, competition music arcade games and I did that with my friends, which is quite, we just kept going on, I guess so… the social aspect is quite important.

Although Felicity did not live through the era of arcade gaming (late 1970s to early 1990s), a strong arcade culture still exists in Japan, and she visits Japan to take part in this very culture. To Felicity, games from the arcade genre should preferably happen in a very specific environment: the arcade. She was familiar with the genre of arcade games and could

appreciate the similarities between the games in the *Guitarcade* and the games in a typical arcade. But the games in the *Guitarcade* and typical arcade offered different types of experiences. To Felicity, the arcade was a social and competitive gaming environment. The transcript above described some of her ideas on how *Rocksmith* could be improved. It further described what *Rocksmith* lacked and why that made her less interested in playing the game. In addition to this, she previously explained her lack of enthusiasm for the *Rocksmith Guitarcade* games on a deeper level. According to Felicity, the game-world and the real-world were two separate entities. She did not see a need to merge these two worlds as she expressed that she was perfectly content to practice a scale on the guitar. There was no need to gamify the experience or make it a game.

4.4.10 Digital Natives vs Digital Immigrants

As mentioned, the appeal for gamifying music education lies in the fact that videogames are a popular activity for today's school-aged population. Prensky (2001b) put forward a generational divide between digital natives and digital immigrants – digital natives refer to the generation who were born into a world of digital technology. Since they are native to this world, they can speak the "digital language" fluently. Conversely, as the term implies, digital immigrants referred to the generation who have needed to learn to speak the digital language, so they speak the digital language with an accent. Prensky's examples of digital immigrant behaviours included: printing off emails, calling up for technical support (rather than searching for the answer in a search engine), and reading the text before graphics. He advocated for an education that put the digital native first. He posited that a teaching style and modality should be developed and adapted to suit the digital native in an ideal world. Part of this involved designing digital games to teach serious content. In fact, in 2001, Prensky (2001a) also wrote the book *Digital Game-Based Learning* and posited that DGBL would be the future of learning for digital natives.

This study was conducted on adults who were aged 24-28 at the time of being interviewed. Given their ages, they would have all been in primary school when Prensky wrote *Digital Game-Based Learning* (2001) – these young adults fit the Prenskian generational label "digital natives". Despite this, Wolfgang, Christoph, and Leah said that learning through videogames is best suited for an audience younger than themselves. For example, when I asked Christoph why he took part in this study, he explained that he wanted to get closer to the younger generation by understanding why they play videogames.

> We are in this 21st century, everything's about technology… you know when you look at the 13, 14 year old, you see them on their phones, they are watching videos… they are learning in their own way, or whatever it is that they want to learn, so you know, this could be it, this, it could be like a way, kind of like, oh, how to play guitar, there's a game, there's music, there's a song that you like, just give it a go…yeah, so, that's, that's one of the reasons.

The interest in being immersed in a world that his students were engaged in appealed to him because Christoph worked as a secondary school music teacher.

Similarly, Leah was a primary school teacher. When she described her experience with games, she identified a *previous era* – a time when she was younger and deeply involved in video games.

> As a child I did (play videogames) but then pre-teens I didn't, and then some time, I do, well see, I have a younger sister who plays lots of games.

She talked more about game playing as an activity common to children. The quote below includes this view.

> It's like, why do little kids play games? And they become better at it like they develop so much mastery.

Wolfgang expressed a similar idea when I asked him why he wasn't so interested in the *Guitarcade* games. He did not answer my question directly. Instead, he proposed an alternate study which included individuals who belonged to a younger age bracket, implying that such technique games weren't suited to him.

> I think for that sort of study, what you actually need is 10-12 year-olds… because that, what you want do is give 10-12 year olds tasks that's like 'play this game, get good, come back, let's see how you do', and then you watch for the… um the behaviours that they've developed, the way they've absolved the problem, and then you look at that and you compare that.

Later in the interview, I asked him why he specified a younger age group, and if he believed that *Rocksmith* was ideal for this age group.

> I'm honestly not sure. I would still maintain that ah, learning under the tutelage of a competent teacher is important, um especially there is a certain structure used for music teaching that is proven to work over and over again. I would not say that it would replace, um a music teacher. I would consider it a very powerful enticement to practice, especially for people in that age bracket.

Wolfgang could not explain exactly *why* he identified a younger age-bracket, but his answers and responses consistently alluded to an age bracket younger to his own.

Leah hinted at the different learning modes between adults and children. She identified the difference between self-directed, informal learning through playing videogames and learning formally through a teacher.

> "…in a game it's like, well you don't have your teacher, you have yourself, so it's like I'm going to pick up those skills, it's like why do little kids play games? ... And they become better at it like they develop so much mastery…"

Leah's rhetorical question "why do little kids play games?" seemed to put forward her personal view that learning through games (and playing games) is both a modality and experience that belongs to children. The absence of a teacher means the absence of authority. Later in the interview, she spoke about the negative aspects of adult learning. She acknowledged that learning through a teacher (as an adult) can be a confronting experience.

> R: I'm curious, like you said, the social aspect of learning, and being with a teacher, are for your needs, are something you don't want, like kind of a negative thing?
>
> L. Yeah I think also because I'm an adult learner… I'm not a 13 year old so, that's sort of like 'oh you're 13, you're learning, that's going to be okay,' it's like 'YOU'RE AN ADULT!'

Leah also thought that *Rocksmith* was more appropriate for a younger audience. Despite this, Leah insisted that a DGBL approach was highly suitable to her. Playing videogames allowed her to learn and enter an activity in her own time, on her terms.

Conversely, Felicity identified as a gamer and did not suggest that *Rocksmith* was more suitable for a younger audience. As mentioned, she did not continue playing *Rocksmith* because she saw no need to merge the serious, non-entertainment world with the entertainment world. She preferred to play other videogames for the sake of play (and socialising) than for educational gains.

While Prensky suggested that digital games were a defining marker of the digital native, the participants in this study (who fit this age bracket and belong to this generation) still implied that *Rocksmith* suited a younger audience. When Wolfgang, Christoph, and Leah remarked that a younger, school-aged audience was better suited to playing *Rocksmith*, they appeared to imply a broader cultural idea that has existed for centuries: games and playing is a part of childhood and development (Caillois, 2001; Hirsh-Pasek & Golinkoff, 2003).

4.4.11 Learned Skills and Contents

Through the interviews, I asked participants if they believed their guitar playing had improved since playing *Rocksmith*. Wolfgang's answer indicated that he did not notice much improvement, but he also acknowledged that he didn't spend a lot of time playing *Rocksmith*.

> … Objectively yes, noticeably probably not? … Well I mean, objectively any practice is going to yield improvement or at least familiarity… but at the same time, if you're starting from vaguely remembering the concept of the guitar, I don't even, if you asked me to play *Seven Nation Army* now, I wouldn't even remember the chords, much less the fingering for them… I've lost all that knowledge. The knowledge I had was basically: how to hold a guitar, and so after a few hours of *Rocksmith,* like you can't see that much of a jump in skill, but by any measurable… there must be some improvement simply by the fact that I've actually picked up a guitar again.

Leah also listed several learned skills such as "fingering technique" as well as agility and fluency. She described the process of the riff-repeater mode in *Rocksmith* and noted that it helped her. In her interview, she said, "I get to practice that slow motion, and then I get to practice that quick and then make it faster". She evaluated this experience by saying "I think that's a positive?"

Christoph was quick to list a variety of skills that he gained from playing *Rocksmith*. He noted that he was able to use and apply these skills in his work as a high school music teacher.

> I didn't even know what a pull-off was, or a hammer on before, now I tell kids, 'in this song, you can do a hammer-on,' 'you can do a pull-off, you can try to do it,' so it did come from a game, so I learned something, 100% from it, so yeah.

Felicity listed a different set of skills that she felt she improved. She noticed that in the song mode there was “quite a lot of like tab reading” and these opportunities “developed (her) reading”. She also said that *Rocksmith* helped to develop her “finger-picking”. Felicity offered an evaluation, in her interview, saying “I think that helped quite a lot for the beginning stage… yeah, for the lessons”. Felicity expressed that *Rocksmith* helped get her set-up and ready to take private lessons on the guitar.

4.4.12 Experience – Flow/Immersion

Felicity spoke of feeling “hooked” when playing *Mobile Legends* (a *MOBA* game for mobile devices) but she did not describe playing *Rocksmith* in the same way. Before entering the study, the initial survey revealed that Felicity was familiar with a small range of action videogames and had no experience playing the guitar. Since Felicity was a high-level pianist, the idea of practice (or more precisely, practising on a musical instrument) was not foreign to her. She was also not a foreigner to the videogame world. She stated that she was “quite hooked onto that (MOBA games), for like, two years now…”

As mentioned, her *Rocksmith* playing experience was very different from her previous experience playing videogames. She described *Rocksmith* to be something that she was “at first… very interested (in)” but then this interest “eventually it died out”. I asked her why she felt this way, and she offered a few suggestions. The first was in the equipment: “if, I have a very good sound system at home so if this game is on a PS4 (PlayStation 4), and then it has a good quality TV, and, and the sound quality that comes out is good, and I play it on, um yeah, a guitar, with a nice touch, then um I probably would be really hooked on to it”.

After the interview, when I checked on *Rocksmith’s* compatibility with different hardware, Ubisoft did indicate that *Rocksmith* is compatible with PlayStation 4 (Ubisoft, 2017). Although Felicity owned a PlayStation 4, she seemed to be unaware of this. Still,

high-quality equipment, as identified by Felicity, would have offered her an experience that was both visually and sonically pleasing, and this could have potentially brought her closer to experiencing the flow-state.

Unlike Felicity's experience, Leah's experience could be best described as one that was interspersed with periods of flow and frustration. She explained that at certain points, her playing was interrupted with confusion for having to learn how to play the game. I asked her if she felt highly engaged or "hooked" when playing the game.

> I felt when I was playing *Rocksmith,* that I was trying to understand the game and understand what was on the screen? And how that ah, like corresponds, or coincides with the actual frets, like the other frets, yeah so that was what I was trying to understand and then I was hooked… I was a bit frustrated especially if I had played that game before on the guitar and I knew the tabs, I felt like that, the original tabs that I knew didn't really match the accuracy of the um, the game but it was kind of entertaining, especially if that was your favourite song you haven't played the tabs to.

Since she was familiar with the concept of flow, I asked Leah if she ever entered a flow-state when playing *Rocksmith,* to which she responded: "yeah, I was concentrating, motivated and concentrating because you wanted to get highest percentage… so I was motivated, and I was concentrating because I wanted to get the highest percent of like accuracy, and then also like play the notes correctly...".

According to Leah, *Rocksmith's* inbuilt feedback system drove her to continue playing. She described a type of focus as she used the words "motivated" and "concentrating" several times through her interview, indicating that she may have entered a flow-state during her playing. Despite this, when Leah gave me her playing hours, provided by the Steam application, I discovered that Leah did not actually spend much time playing *Rocksmith* (to

reiterate, she spent less than two hours playing *Rocksmith*). If she was truly "hooked", "motivated", and "concentrating" why did she spend so little time playing? As mentioned, when I noticed Leah's contradiction (she had no time to play *Rocksmith,* but she instead had time to play other videogames), I asked her why this was the case. Another aspect of her reply included having a "perfectionistic" attitude. Despite claiming to feel a sense of flow, it seemed those attitudes hindered her motivation to continue playing *Rocksmith.*

When I interviewed Christoph and asked him if he felt "hooked" or immersed when playing *Rocksmith,* he asked me what I meant by "hooked". I provided clarification describing what typically happens when an individual (like myself) is in the flow-state. In his interview, I said: "well there are certain games that I play, where … the sun has come down, and I'm still there, just, it's like I haven't blinked". In reply, he said: "I'm probably wrong person to be asked if you are asking the question to be hooked to any of those games". He explained by saying that he played videogames in a short-term and sessional style.

> I take games in a way, like *DOTA* is one of the things after a month of hard work, I'm kind of like, okay, you know one hour, just have a game, just switch off, I'm too tired to do anything have a game, with *Rocksmith*, I wouldn't be able to play the game for the entire day

On reflection, it may be possible that my example of the flow-state and the use of the word "hooked" illustrated something pathological. Being so immersed in an activity, that the passing of time goes by unnoticed does describe the flow state, but it also describes something possessive. Csikszentmihalyi (1990) has advocated for a flow-centric view to living, stating that being in the flow-state is experiencing the "optimum" state (Mihaly Csikszentmihalyi, 1990, p. 1). Despite this, he repeatedly posited that flow is neither good nor bad, especially since it is aligned with addiction. Research in the field of videogame

games and flow affirm that flow is a strong predictor of gaming addiction (Chou & Ting, 2003; Hull et al., 2013).

My description might have implied that a person (or player) lacked agency or self-control to the extent that they couldn't bring themselves out of the game. Perhaps it would have been better to ask Christoph that in the time that he put aside to play *Rocksmith* (however long or limited), did he feel immersed and wholly absorbed in the activity? Throughout the interview, he seemed to express a lot of positive regard for *Rocksmith,* saying that he found the game to be "very interesting, engaging". "Engaged" was a word that he kept using to describe his *Rocksmith* playing experience.

> It did sound pretty cool and engaging so the experience, like the overall was like pretty good, positive, so I'd say 4 out of 5, for the engagement. Or maybe even like 5 out of 5, like yeah the engagement was pretty cool, like I did it, especially when you get the song it's kind of like ah, I know this song and I can play it and you know, it feels very interesting…

It is not possible to conclusively say that he experienced flow, but his descriptions of playing *Rocksmith* seemed to indicate that he was engaged in a flow-like state.

As mentioned, Wolfgang continuously described feeling frustrated when playing *Rocksmith.* I asked him later in the interview if he was familiar with the concept of flow and he confirmed that he was. I asked him if he experienced being in the flow-state while playing *Rocksmith*. He responded with:

> No, I did feel what I would characterise as um a slight obsession? A need to invest myself, to get closer to perfection, but I think that's ultimately the point. I never entered a flow-state or engaged in that way.

Unlike flow, frustration is a negative emotion, but it is an emotion common to playing videogames and will be explored in the following section.

4.4.13 Frustration

After Wolfgang described his *Rocksmith* playing experience to be "frustrating", I asked him to elaborate on this. When I asked him to elaborate, he said that "despite the fact that the game is a very simplified abstraction of guitar technique, it's still quite taxing to figure out how to actually play a guitar and also then to operate a guitar in the manner that *Rocksmith* can expect". Later in his interview, I asked Wolfgang if he thought *Rocksmith* could be improved in any way – especially since he was so frustrated with the game. In reply, he said said "I'm not sure that it could be improved for what it's trying to do. You see, my frustration isn't with the game. My frustration is with my own lack of technical proficiency with the guitar".

Throughout his interview, this theme of frustration continually recurred. I asked Wolfgang if this game made him want to "rage-quit" (a colloquial term used when a game becomes so hard to progress through that the player gives up entirely in a "rage" and stops playing). Wolfgang declined again, insisting that the game was not the reason for his frustration. He said: "no, no, no, if you rage-quit, you would want to throw the glass against the wall. This (playing *Rocksmith*) just made me want to drink… as I said it's, it's, it is a very good way for someone who is like, you know me, I'm a generalist, I have a lot of skills in a lot of areas and most of them I'm decent at, and I'm confronted with a guitar, and it's like, 'what the fuck is this,' I'm objectively very bad at this".

In his interview, it became apparent that he didn't blame the game for his inability to play the guitar. According to Wolfgang, his lack of success was entirely his fault. In an attempt to understand why, I asked him a series of questions, and his responses revealed

some preconceived assumptions. He believed he lacked a particular aptitude that was needed to learn how to play the guitar. Wolfgang believed that his limited one-one-one training on the keyboard shaped his understanding of music. The keyboard provided a “modality” that was “very different” to playing the guitar. In his words, “I already have some experience with the piano, um which is probably part of the reason why I find guitar so frustrating honestly, it’s a very different modality of playing”.

Sometimes this frustration makes the player feel more motivated to win or to continue playing to win (Huang et al., 2017; Werbach & Hunter, 2012). Such motivation to continue playing because of frustration was especially relevant in Wolfgang’s case. Despite his level of frustration, he still continued to play the game, which indicated a different motivation to continue playing. His experience verifies that sometimes what “hooks” the player to continue playing is not the experience of being in the flow-state, but is instead frustration (Huang et al., 2017; Johnson, 2015; Mills et al., 2018; Werbach & Hunter, 2012).

5. CONCLUSION

5.1 Summary of Findings

We have seen that the effectiveness of DGBL is contingent on a variety of factors, such as the player's attitude towards gaming and informal learning (Bourgonjon et al., 2011; Kuang-Chao, 2012) and is evident in this study which centred on *music* learning. This study showed that the participants' previous experience (as musicians and video gamers) shapes their attitudes in musical and game-related contexts. This study attempted to assess the validity of the Ubisoft claim that through *Rocksmith,* one can "learn to play the guitar in 60 days" if they committed to practising for an hour a day. Although each participant was given the *Rocksmith* game (and required equipment) and sixty days to play this game (in fact, in all cases, the participants had longer than sixty days to play the game), the results revealed that all participants did not dedicate that length of time, nor over sixty days. Reasons given for this included preferring other more serious learning modalities (such as learning from a teacher), feeling frustrated by technical issues in the game, and valuing other work and life-related pursuits over playing the game. Even though videogames are known to provide people with an immersive experience (Rigby & Ryan, 2011), this was not always the case when observing the experiences of the participants in this study. Of course, this study only observed four individual cases. A statistical study with a larger sample size would better determine whether *Rocksmith* can "hook" the player into a flow-state.

The post-test indicated a wide range of scores. Given the limited sample size, it was difficult to conclude that *Rocksmith* is an effective way to learn the electric guitar. Notably, there was no correlation between the participants' playing hours and their assessment scores. Additionally, the comments left by the assessors indicated other factors influenced the participants' performance in their assessment. For example, frustration and not understanding how to play a *Guitaracde* game despite being given two tries meant that it was hard to assess

the participants' performance. More importantly, although *Guitarcade* games were designed to teach and drill guitar technique, the assessors noted that many of the participants had a poor guitar-playing technique, calling in question whether these games could successfully teach guitar technique.

The final section of the post-test attempted to assess the transferability of musical skill. More specifically, it tested whether the participant could play a song in traditional non-moving guitar tablature after playing a song in the *Rocksmith* song mode (which featured an adapted moving guitar tablature notation). The results were inconclusive because of the nature of the assessment. The weaknesses of this research study are considered in the following section.

5.2 Weaknesses in the Study

5.2.1 No Baseline or Standards due to the Adaptive Levelling Model

The test following the sixty-day period attempted to measure *Rocksmith's* effectiveness as a learning tool. However, this was not without challenges as it is difficult to "lose" in *Rocksmith* or even to have low scores because of the adaptive learning mechanism. In other words, if the participant struggled to play a song at a particular level, the game would revert to the previous level. In terms of the study, the participants were not assessed at a fixed level of difficulty. Participants defaulted to the easiest level and allowed the game to adapt to their level of competency. Additionally, two of the participants manually adjusted the difficulty level themselves, feeling that the level that they played at did not challenge them. In turn, this affected their digital game scores and seemed to influence the assessor's scores.

5.2.2 Participants Played the Game but were Assessed up to Two Years Later

It was difficult to find participants who would take part in the study and commit to playing the game, let alone commit to playing the game over a sixty-day period. As a result of this, the participants were assessed one to two years following the time of playing *Rocksmith.* When they were assessed, the participants still had access to the game, and they were encouraged to play the game (closer to the assessment day) to refresh their skills. The great time-lapse in their *Rocksmith* playing period probably influenced their performance during the assessment.

5.2.3 Issues with Assessing Transferability of Skill

In the sight-reading section of the assessment, the participants were given traditional (non-moving) guitar tablature of the songs that they played in *Rocksmith's* song mode (or the second section of the assessment). The tablature administered to the participants were transcriptions of the *Rocksmith* songs at their highest levels (or at 100% difficulty). Therefore, this did not assess a true transferability of skill, mainly because three out of four of the participants played at easier levels.

5.2.4 Participants Played the Game but Did Not Play for an Hour a Day over Sixty Days

This study aimed to assess the validity of the claim that through *Rocksmith*, it is possible to "learn to play the guitar in 60 days" (Ubisoft Entertainment, 2014). Despite Ubisoft's recommendation to play *Rocksmith* for an hour a day over sixty-days, none of the participants succeeded in this task. The participants had access to the game for a period greater than sixty days, and they still did not come close to the sixty-hour figure. The participants came into the study wanting to play the guitar and keen to use *Rocksmith* as a learning tool, but in the end, they had a low level of motivation to play *Rocksmith* for a sustained period.

5.3 Avenues for Further Research

The insights that the participants shared during their thirty to sixty-minute interview reiterated that there is a place for videogames in music education. However, what this ought to look like in practice varied from person to person. Nonetheless, we can use this information to inform future research. The following section will avenues for future research.

5.3.1 Augmenting Rocksmith with Guitar Instruction

Christoph, Felicity, and Wolfgang consistently spoke about the limits of learning without a teacher. As mentioned, Felicity and Christoph received a formal and highly structured music education, having achieved a high level of proficiency on the piano evident by their conservatory training. Naturally, their previous experience influenced their attitudes when it came to learning how to play the guitar. In Felicity's case, she sought out guitar instruction by other means (group lessons and private one-on-one instruction).

Wolfgang was unlike Felicity and Christoph, in the sense that he did not have a traditional conservatory training. Despite this, he was adamant about the effectiveness of human instruction and suggested augmenting *Rocksmith* with formal guitar instruction. He put forward that the presence of a guitar tutor would assist a student with motivation (and incentives) to practice, but Leah expressed the opposite view. In her interview, she insisted that the absence of a teacher motivated her to pick up the guitar and try to play it. The modality of playing the guitar through a videogame made her more compelled to play the game. Despite her enthusiastic response, she did not spend a significant amount of time playing *Rocksmith.*

Further research involving a teacher augmenting her practice with *Rocksmith* could further investigate the effectiveness of DGBL.

5.3.2 A Study that Observes the Cultural Attitudes and Assumptions of Learning Through Digital Games

The idea of learning through a teacher brings to attention a particular cultural worldview, that although it is possible to learn how to play the guitar through a digital game, learning from a teacher is more "ideal" and "legitimate" modality. What was curious was that in this study, two out of three of the participants (Christoph and Felicity) who put forward this view, were high-level conservatory trained musicians – they had a high level of "success" in the formal music education realm. The other two participants in this study grew up in this cultural landscape – Wolfgang had private music instruction through his primary school years, and Leah achieved grade six on the pianoforte. Wolfgang supported and recommended learning how to play the guitar through an instructor, stressing that it is not possible to successfully learn how to play the guitar without one. Leah very emphatically stated that she did not want to receive instruction from a teacher. But her reasons seemed to originate from her negative experience of formal music instruction – learning how to play a musical instrument through a videogame appeared to be a retaliation against her formal music education. A broader study which includes popular musicians, informal learners, and autodidacts may show a very different image.

5.3.3 Understanding the Transferability of Skill in Reading Tablature

In the previous section, I stated the issues related to the song mode and tab-reading tests as they failed to establish the transferability of skill in reading guitar tablature. A research study that includes non-moving tablature set to the level of a song that the participant can comfortably play would more accurately test the transferability of musical skill in *Rocksmith*. Statistical studies with pre-tests and post-tests would give further evidence of the effectiveness (or ineffectiveness) of DGBL.

5.3.4 Rocksmith for Younger Audiences

This study included four young adults between the ages of 25-27 (at the time of being interviewed). Christoph, Leah, and Wolfgang all mentioned that videogames were an experience that belonged to an audience younger than them. But Felicity did not express this view since she had identified as a gamer. It would be interesting to see *Rocksmith* used in contexts that included a younger audience (primary and secondary school-aged students). It would also be interesting to compare and understand the effectiveness of *Rocksmith* as a teaching tool in contexts that included younger, school-aged students.

5.3.5 Research into Rockmith Player Types

As mentioned, in the literature review, Richard Bartle theorised that there were ultimately four player types – the achiever, socialiser, explorer, and killer (Bartle, 1996). This theory emerged after analysing the interactions between players on MUDs. As other game genres started to emerge, this theory was adapted and challenged to describe the changing digital game world (Konert et al., 2013). *Rocksmith* is a serious game with educational outcomes but varying levels of "gamefulness". For example, the *Guitarcade* is the "gamiest" of all the features that *Rocksmith* has to offer, and the song mode is less gameful and a more serious mode of playing, although it still features game-like elements such as real-time feedback, points scoring.

During the participant interviews, all participants confirmed that they had spent most of their playing time in the song mode, which should come at no surprise since this is *Rocksmith's* most dominant playing mode. However, this information inevitably raises broader questions related to serious games with educational outcomes: are there different player types in this genre? Ultimately, who plays serious music games? Are there players who wish to play for the sake of playing (and not for learning), and vice versa?

At present, there is a limited amount of literature that attempts to evaluate how effective *Rocksmith* is as a way to learn how to play the guitar. However, the question that continually resounds is: how are players learning when they play *Rocksmith*? Are they learning how to play the game to learn how to play the guitar, or are they playing the guitar to learn how to play the game? As discussed in chapter two, there were two research studies centred on *this* very question: *Playing to learn or learning to Play? Playing Rocksmith to learn electric guitar and bass in Nordic music teacher education* (Havre et al., 2018) and *Rock god or game guru: Using Rocksmith to learn to play a guitar* (Graham & Schofield, 2018). Research that observes player typology could be useful in informing future music game design and education.

5.3.6 A Study that Observes Rocksmith Players with a High Level of Experience

This study assessed and interviewed participants who had no previous experience playing *Rocksmith.* Of course, the participants were not coerced or forced into playing this game and were able to opt-out of the study at any time. However, taking part in the study could have made them feel some level of obligation to play the game. For example, Wolfgang was open to the idea of improving his guitar playing skills, but in the interview, he revealed that his motivations for entering the study were in furthering knowledge because he described himself as a "whore for science" and further explained that he "like(s) to participate in research whenever (he) can". Wolfgang's remarks indicated that he didn't have much motivation to learn to play the guitar in the first place. He was more motivated to take part in any study than to learn to play the guitar. His lack of initial enthusiasm may have been the reason why he did not play *Rocksmith* for the recommended sixty hours. Converse to this, Christoph, Leah, and Felicity all expressed a desire to learn to play the guitar. In particular, Christoph and Felicity wanted to learn to play the guitar through a videogame. Despite their initial interests and intentions, they also did not play *Rocksmith* for the recommended sixty hours. A

study which includes participants who had already chosen to play for the recommended sixty hours would help to test the validity of the claim it is possible to "learn to play the guitar in sixty days" (Ubisoft Entertainment, 2014).

5.4 Significance of Research & Concluding Remarks

Despite the popularity of music rhythm games, there is little research that investigates their effectiveness as a learning tool. More research needs to be conducted in this area to inform best practice. Research of this nature is significant and relevant to music educators and curriculum writers. This research attempted to examine how effective *Rocksmith* is as a learning tool in four young adults with varying levels of experience in videogame playing and music education. As mentioned, a response that was reiterated many times, by three out of the four participants, was that *Rocksmith* is a useful learning tool, but it should not replace a teacher. These views are aligned with a certain cultural attitude, that formal one-on-one instruction is an "ideal" way to learn.

Ultimately, music education has, for a long time, emphasized discipline over engagement (Williams, 2012b, 2012a), but in the realm of videogames, this trajectory is inverted (Gee, 2007; Squire, 2011; Squire et al., 2005; Williams, 2012b). Music videogames are thus an area worthy of further research. The more we understand what it is about videogames that make players want to continue playing, or conversely, why certain videogames fail to provide an immersive and absorbing experience to the player, the better we can shape student experience and increase learner engagement.

In this study, it was evident that the skills gained from playing *Rocksmith were* transferable to other music-making contexts. For Felicity, playing *Rocksmith* motivated her to take part in more formal music learning. For Christoph, he entered the study to understand how his students learned. Although he was a classically trained pianist with years of formal

instruction, his experience of learning how to play the guitar through *Rocksmith* was entirely different. He noted that he learned a few songs and guitar techniques (hammer-ons and pull-offs) through playing *Rocksmith* – terms that he had not previously encountered. Although Leah did not play *Rocksmith* for long, she discovered a learning modality that was informal and highly suited to her. Wolfgang seemed to take little from the study, but curiously, later correspondence with him revealed that he still played *Rocksmith* after his interview. The participants' experience varied, but as stated, many of them gained skills transferable to other music learning contexts.

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APPENDICES

Appendix A

THE UNIVERSITY OF SYDNEY

Sydney Conservatorium of Music
University of Sydney

ABN 15 211 513 464

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Initial Survey Questions

Part 1 – Guitar Playing Ability Questions

1. Do you have any experience playing the guitar? Yes / No (go to Question 7)
2. Did you at any stage take private lessons on the guitar? Yes / No (Go to Question 6)
3. How many years did you spend taking private lessons on the guitar _____?
4. Did you undertake any guitar examinations or complete any grade examinations by registered exam boards such as the Australian Music Examinations Board (AMEB), Trinity Guildhall London (TGL) or Associated Board of the Royal Schools of Music (ABRSM)? Yes / No (Go to question 6)

5. What was the last grade level that you completed? ___
6. How many years have you spent playing the guitar? ___

Part 2 – Action Video Gaming Experience

7. Have you ever played the Rocksmith video game developed by Ubisoft? Yes / No (if no, please return the survey)
8. Do you have much experience playing digital games (please note, this can include casual games such as Angry Birds, Solitaire and 2048)? Yes / No
9. On average how much time do you devote to playing video games in a week?

a. 0-5 hours b. 5-10 hours c. 10-20hours d. 20-50 hours

10. On average, how many gaming sessions to do you devote to playing video games?

a. 1-2 days b. 3-4 days c. 4-5 days d. 6 -7 days e. Not applicable

11. Have you played games belonging to the following genres?

- Real-Time Strategy (RTS) Yes / No
- First Person Shooters (FPS) Yes / No
- Music Rhythm Games Yes / No
- Combat/ Street fighter games Yes / No
- Racing games Yes / No
- Platformer/Maze Games Yes / No

Appendix B

Sydney Conservatorium of Music
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Participants needed for research on a music video game and learning Can video games teach you how to play the guitar? The current commercial video games market is saturated with games belonging to the music video games genre. Rocksmith is a music video game that requires players to play through a real (not plastic) electric guitar as a controller. This study aims to observe how effective the video game Rocksmith is in learning how to play the guitar. As a participant in this study, you will be given the Rocksmith video game (a downloaded edition through Steam), a real tone cable and an electric guitar (if required) for a period of sixty days. Following this period you will be assessed on your guitar playing and video gaming ability by two guitar experts at the University of Sydney. Once this assessment finishes, you will be interviewed by the researcher on your experience with playing the Rocksmith video game. All equipment: the game, real tone cable and electric guitar (if relevant) will be returned during the guitar assessment. If you are interested please contact Rebecca Ly at rely8347@uni.sydney.edu.au or [REDACTION] .

Appendix C

THE UNIVERSITY OF SYDNEY

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A learning tool or a waste of time?: Assessing the pedagogical effects of digital game-based learning in music education

PARTICIPANT INFORMATION STATEMENT

(1) What is the study about?

You are invited to participate in a study of the pedagogical effectiveness of the music video game *Rocksmith.* This study aims to test whether this game

teaches skills that are transferable to other music related skills (such as having the ability to read a chord lyric sheet or guitar tablature). The study also aims to observe whether this game is better suited for people with a lot of action video game playing experience, or alternatively people with a moderate amount of guitar playing experience.

(2) Who is carrying out the study?

The study is being conducted by Rebecca Ly and will form the basis for the degree of a Master of Music (Music Education) at The University of Sydney under the supervision of Dr James Humberstone (Lecturer, Music Education Unit).

(3) What does the study involve?

The study involves

- The completion of a pre-questionnaire
- The use of screen capture software to record the onscreen video game playing experience (your face will not be captured).
- A performance assessment of your guitar playing and *Rocksmith* gaming skills to be conducted by two guitar experts at the University of Sydney
- An interview with the researcher on your game playing experience

(4) How much time will the study take?

A learning tool or a waste of time?: Assessing the pedagogical effects of digital game-based learning in music education

The game playing experience will be sixty days. It is up to you how frequently and how long you may choose to play the game, however it is recommended that you play the game for an hour a day, over the course of the sixty day period. A guitar playing assessment will happen after the sixty day period and it should take no longer than twenty minutes. Following this, it is anticipated that the interview conducted with the researcher should be no longer than thirty minutes.

(5) Can I withdraw from the study?

Being in this study is completely voluntary - you are not under any obligation to consent and - if you do consent - you can withdraw at any time without affecting your relationship with The University of Sydney.

You may stop the interview at any time if you do not wish to continue, the audio and video recording will be erased and the information provided will not be included in the study.

(6) Will anyone else know the results?

All aspects of the study, including results, will be strictly confidential and only the researchers will have access to information on participants. A

report of the study may be submitted for publication, but individual participants will not be identifiable in such a report.

(7) Will the study benefit me?

We cannot and do not guarantee or promise that you will receive any benefits from the study, however it is anticipated that your guitar playing ability may or may not improve. You will also have free access to an electric guitar (if you do not already possess one) and the *Rocksmith* video game for a period of sixty days. The guitars will be supplied by the researcher, thus there will be no commercial interest involved should you choose to take part in this study.

(8) Can I tell other people about the study?

Yes, you are welcome to tell other people about the study.

(9) What if I require further information about the study or my involvement in it?

When you have read this information, Rebecca Ly will discuss it with you further and answer any questions you may have. If you would like to know more at any stage, please feel free to contact Rebeca Ly, a Master of Music (Music Education) student at the Sydney Conservatorium of Music at

rely8347@uni.sydney.edu.au, +61 [REDACTION] or alternatively, the chief investigator Dr James Humberstone, Lecturer of music education at james.humberstone@sydney.edu.au, +61 2 9351 1270.

(10) What if I have a complaint or any concerns?

Any person with concerns or complaints about the conduct of a research study can contact The Manager, Human Ethics Administration, University of Sydney on +61 2 8627 8176 (Telephone); +61 2 8627 8177 (Facsimile) or ro.humanethics@sydney.edu.au (Email)

Appendix D

Rocksmith Assessment Rubric

Guitaracade Section

Participant's Choice

Name of Game

Desired Outcome

Game Score	**Attempt 1:**			**Attempt 2:**	
Assessor's Desired Outcome Score	**1**	**2**	**3**	**4**	**5**
Posture/Instrument Hold	**1**	**2**	**3**	**4**	**5**
Left Hand Position	**1**	**2**	**3**	**4**	**5**
Right Hand Position	**1**	**2**	**3**	**4**	**5**

Comments

Assessor's Choice

Name of Game

Desired Outcome

Game Score	**Attempt 1:**			**Attempt 2:**	
Assessor's Desired Outcome Score	**1**	**2**	**3**	**4**	**5**
Posture/Instrument Hold	**1**	**2**	**3**	**4**	**5**
Left Hand Position	**1**	**2**	**3**	**4**	**5**
Right Hand Position	**1**	**2**	**3**	**4**	**5**

Comments

Song Mode Section 1

Participant Picks One Guitar Song

Game Score

	1	**2**	**3**	**4**	**5**
Moves through notes, and/or chords with precision in the left hand					
Plays notes and/or chords accurately in the right hand					
Plays with relaxed fingers and an appropriate left hand position					
Posture and stance is appropriate to playing guitar					
Interacts with the game fluently					
Consistent rhythm/pulse					
Plays with performance flair and confidence					

Comments:

Song Mode Section 2

Assessor Picks One Guitar Song

Game Score:

	1	**2**	**3**	**4**	**5**
Moves through notes, and/or chords with precision in the left hand					
Plays notes and/or chords accurately in the right hand					
Plays with relaxed fingers and an appropriate left hand position					
Posture and stance is appropriate to playing guitar					
Interacts with the game fluently					
Consistent rhythm/pulse					
Plays with performance flair and confidence					

Comments:

<u>Phase 3</u>

Assessor Hands Participant Tablature (First Song)

Grade	Guideline
9-10	Participant is able to accurately read chords in the chord lyric sheet, at a highly proficient level, playing correct chords in the correct timing, demonstrating performance flair (being able to play with expression, and not be encumbered by technical weaknesses)
7-8	Participant is able to accurately read chords in the chord lyric sheet, at a proficient level, playing correct chords with correct timing, with the odd misreading, or wrong note. Participant demonstrates some level performance flair (being able to play with expression, and not be encumbered by technical weaknesses)
5-6	Participant is able to accurately read chords in the chord lyric sheet, at a satisfactory level, playing mostly correct chords with mostly correct timing.
3-4	Participant is able to accurately read chords in the chord lyric sheet, to a satisfactory level, playing some correct chords with some correct timing.
0-2	Participant is unable to accurately read chords in the chord lyric sheet at a satisfactory level, or do the activity.

Comments

Assessor Hands Participant Tablature (Second Song)

Grade	Guideline
9-10	Participant is able to accurately read chords in the chord lyric sheet, at a highly proficient level, playing correct chords in the correct timing, demonstrating performance flair (being able to play with expression, and not be encumbered by technical weaknesses)
7-8	Participant is able to accurately read chords in the chord lyric sheet, at a proficient level, playing correct chords with correct timing, with the odd misreading, or wrong note. Participant demonstrates some level performance flair (being able to play with expression, and not be encumbered by technical weaknesses)
5-6	Participant is able to accurately read chords in the chord lyric sheet, at a satisfactory level, playing mostly correct chords with mostly correct timing.
3-4	Participant is able to accurately read chords in the chord lyric sheet, to a satisfactory level, playing some correct chords with some correct timing.
0-2	Participant is unable to accurately read chords in the chord lyric sheet at a satisfactory level, or do the activity.

Comments

Appendix E

Guidelines for the Guitar Assessment

Guitarcade Test

In the first phase of the study, the participant will choose the game from the *Guitaracade.* They will have two chances to play this game (since these games resemble small arcade games, it's anticipated that they may quickly lose on the first try, thus their two chances). Record the name of the game, e.g. *Gone Whalin, Scale Warriors* and record the outcome of the game according the guide sheet on page **3,** then give a rating out of 5, for how you think the participant went in playing the game according to the desired outcome (e.g. if they played *Scale Warriors,* did they play the scale correctly with the desired technique?). Also give a rating for the points in the provided table (The following is a breakdown of what the numbers mean:

1. The participant cannot do the activity
2. The participant *can* do the activity but to a limited degree
3. The participant can competently do the activity
4. The participant can proficiently do the activity
5. The participant does the activity at a highly professional standard, showing a lot of experience

Song Mode Test

In the part of the second phase of the study, the participant will choose a song from the song list. Rate them according the numbered system above (under Phase 1), of course rate the participant under the listed points in the table (accuracy of notes, etc).

In the second part of phase two, the assessor will choose the song that the participant has *not* played (do this by, *asking* the participant what they have not played).

Sight Reading Test

In the third phase of the study the participant will play tablature which can be found in the provided folder. They should be playing the songs which correspond to the songs chosen (by the assessor and participant in phase 2)

Rate their ability to read tablature with the backing track (they'll be playing in unison)

ROCKSMITH GUITARCADE PEDAGOGICAL AIMS

1. **Gone Wailin'-**

Dynamic Control through picking/strumming and volume knob control.

2. **String Skip Saloon-**

Accuracy with string skipping

3. **Ducks redux-**

Reading/playing Tablature

4. **Ninja Slide N-**

Reading/playing Tablature
Developing/maintaining finger callus
sliding between frets

5. **Scale warriors-**

Fluency with Root pentatonic minor scale Shape
Fluency with Root pentatonic Major scale Shape
Fluency with Root position Aeolian mode scale shape
Fluency with Root position Ionian Mode Scale shape
Fluency with

6. **Harmonic Heist-**

Clear harmonics

7. **Star chord-**

Speed and fluency with chord changes

8. **Hurtling Hurdles-**

Control with tremolo

9. **Temple of Bends-**

Accuracy and speed with bends

10. **Scale racer-**

Fluency and speed with Minor and Major Pentatonic, Aeolian, Major, Dorian, mixolydian, Phrygian, lydian, Blues, harmonic minor and Phrygian Dominant scales in a variety of keys

Appendix F

Interview Protocol

Information about the interviewee

Name (only first name required)

Sex

Video game playing experience (low,

moderate, advanced)

Participant Group (phase 1, 2 or 3)

1. On the whole, how did you find the video game playing experience of *Rocksmith*, did you enjoy it or find it frustrating?
    a. Do you think the game was lacking anything, was there anything you would have liked to see, any aspects you think are improving?
    b. Do you think you can learn to play the guitar using the game on its own, without the assistance of a teacher or the internet?
    c. Has it made you want to keep playing the guitar, or learning it (if the participant has a low level of guitar playing experience)
2. In terms of motivation, was it easy or difficult to motivate yourself to play?
    a. Did you feel 'hooked' in the sense that you really felt like you wanted to keep playing when you put it down? Or did the game bore you quickly?
3. Did you spend more time playing arcade games, or playing through the pieces in the playlist (or both)?
    a. Why did you spend more time playing through the pieces in the playlist or arcade games (or both)

4. Did you use the video guides to help you learn? How did you use them – like a manual/go-to resort when you are stuck? Or did you go to the video guides first? Why did you choose this approach?
5. Prior to the study, did you have a desire to improve on your guitar playing ability (or to learn the guitar)?
    a. What motivated you to take part in the study?
6. Do you think your guitar playing skills have changed since playing the video game?
    a. Tell me more about that (if the playing skills have improved since playing the video games, or worsened).