Tickling the Digital Ivories: Adults' Experiences of Learning a Musical Instrument Using a Mobile Application

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Abstract

The growing popularity of mobile applications (apps) for learning musical instruments among adult learners has sparked significant interest in their impact and effectiveness. While many studies concentrate on the use of apps by children in the classroom, this study explores the use of apps by adults in non-formal settings.

This study investigates the effects of mobile learning (mLearning) apps on adult motivation and perception as they learn to play musical instruments through the lens of Self-Determination Theory (SDT) and Self-Efficacy Theory (SET). It focuses on how these theoretical frameworks can explain the interaction between technological use and perceived learning outcomes.

The researcher's personal journey of learning the piano using a mobile app was captured through autoethnography, offering a unique and distinctive perspective at the core of this study. This narrative was then expanded and contextualised by conducting semi-structured interviews with other adults engaged in similar learning endeavours using various apps and musical instruments. Their experiences were rigorously analysed and compared using reflexive thematic analysis (RTA), enriching the study with broader insights.

The findings show that mobile apps have significantly democratised music education, enhancing accessibility and flexibility for learners. Motivations for using these apps are deeply rooted in personal satisfaction, self-development, social connection, and external validation. Despite these advantages, users frequently experience frustration, primarily due to the instructional and technical limitations of current app designs.

This research highlights a critical need for innovation in app design and content development. By better leveraging psychological frameworks, developers can create more effective and engaging educational tools. Enhancements aimed at boosting self-efficacy and addressing the psychological needs of adult learners can foster greater engagement and more meaningful learning experiences. These advancements hold the potential to transform how adults interact with

educational technology, leading to more profound and sustained learning outcomes.

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Declaration: I declare that this thesis is of my own work and has not been submitted in substantially the same form for the award of a higher degree elsewhere. Any sections of this thesis which has been published, or submitted for a higher degree elsewhere, shall be clearly identified. If the thesis is the result of joint research, a statement indicating the nature of the candidate's contribution to that research, confirmed by the supervisor(s), shall be included.

Signature.....

Chapter 1: Introduction and Background

This chapter begins with a narrative of my experience of learning to play the piano using a mobile application (app), specifically how the journey began. It provides an overview of the current state of technology-enhanced learning, focusing on using apps in music education. By exploring how these apps have become a key part of modern education, this chapter sets the context for the study.

Following the narrative, the chapter outlines the research background, identifies gaps in the literature, and presents the problem this study addresses. It discusses the significance of understanding adult learners' experiences with mobile apps and their impact on motivation and self-efficacy.

Finally, the chapter presents the research aims and questions, providing a clear direction for the study.

Tickling the Digital Ivories

It was Christmas day in 2020, and three perfectly wrapped boxes sat under the Christmas tree: One oblong box about a metre or so long, one perfectly square box wrapped with a bow, and one flat package that looked and felt like a notebook. I tore the paper off one by one to reveal the items inside. In front of me sat a RockJam keyboard, a keyboard stand and stool, a sheet music holder and a collection of sheet music by my favourite band. I'd always wanted to learn the piano, and I had several conversations with my husband, Jon, who thought it was a good gift idea. We talked about how I'd learn the piano, and I expressed several concerns.

Firstly, the pandemic resulted in many piano teachers stopping their lessons or moving face-to-face (F2F) lessons online. I'd looked at some prices for a beginner's lesson, which cost between £30-45 per hour. There was something about this option that didn't feel right. What if I didn't like the teacher? Or they weren't very patient? What if I didn't see results? What if the lessons were

boring? As an adult learner, who would be learning a motor skill as a beginner, I felt I could waste a lot of time and money.

Secondly, what about my other commitments if I take lessons with a teacher? Can I commit to having a lesson, or online lesson, with someone every week? What if I needed to cancel on short notice due to work or personal commitments?

Lastly, the thought of group sessions or one-to-one lessons made me feel uncomfortable and anxious. Whenever I thought about taking a F2F lesson, I would imagine someone unsupportive, someone who would tell me to sit up straight and shout at me if I made a mistake.

At this point, Jon points out that some of these thoughts are exaggerated and that I am catastrophising. I reluctantly agree, but the culmination of these points makes me question the decision. “Well, there’s always an app for that,” Jon jokes, quoting the line from the famous Apple advert. He has a good point: "Why didn't I think of that?" I scrabble for my phone to do a quick search for possible apps.

I have a long history working within IT and the technology sector. I have been a key staff member within many companies when purchasing software and learning technologies applications. As someone introverted, the idea of starting my learning journey with an app sounded like the perfect solution. I pause and put my phone down for a moment. "What about the sheet music?" I flicked through the pages, glancing at the complex pattern of notes printed neatly on each page. "Well, maybe once you've learnt some of the basics, you can come back to it?” I looked at him and sighed. "I suppose so. Maybe learning to this level is my goal. Although I'm not sure how realistic that is, I’m not sure how I will feel about learning with an app or how I’ll stay motivated?” I put the books down and pick my phone up again. "Wow, there are a lot of apps. Some of these look quite fun” I pause for a moment. “But what if they are a gimmick? And what about the science behind these? What about the…" Jon interrupted. "Pedagogy?" we spoke in unison, and I laughed. "Yes, exactly. Do you think these apps have been designed with any learning theories in mind? Do you

think actual teachers have been involved in developing these?" Jon scratches his head. “Well, I guess that is something you'll need to find out.”

Three Months Later: The Research Journey Begins

I sat at the keyboard with my iPad propped up against the sheet music stand, ready to start a practice session, when Jon’s words ran through my head, “Well, I guess that is something you’ll need to find out.” In addition to learning the piano, I had always had a lifelong goal of undertaking a PhD. After finishing the first three years of my studies at Lancaster University, ideas for my final thesis were already on the table. Much of my professional work revolves around how technology can be used to help individuals to learn. I became curious about the pedagogical studies of music education, particularly the use of apps and the impact of this technology. I never started my music journey thinking it would turn into a research study, and it was only when I started to investigate the use of mobile apps for learning musical instruments that I realised the extent of the gap in the literature.

I thought about my previous music experience; I had never attempted to learn the piano before, but when I was ten, I did play the violin for roughly a year. I remember sitting for my Grade 1 exam, which was the first exam you took as a beginner, and how nervous I was at taking the exam and how lucky I was that I passed. I never really took my music studies seriously as a child. I looked at my iPad and studied the symbols on the screen: the staves and the notes. I would have learnt some basic music theory and note recognition, but as I sat there ready to begin my next lesson, no recollection or memory returned. It felt new and quite daunting. After three months of tickling the digital ivories, I realised that my experiences could make a useful contribution to the field of technology-enhanced learning.

This became my primary motivation to want to research this in more depth by conducting my own study. I decided that I would dedicate one year to learning the piano. I did not plan to follow a fixed practice schedule since I would be juggling work, home and study commitments, but instead, I set myself a goal of

three 30-minute practice sessions per week. This would start my research into an adult's experience learning an instrument using a mobile app.

1.1 Research Background

For over a decade, technology has been at the forefront of research investigating the feasibility of online teaching and learning (Shaheen, 2021). While much focus has been on video conferencing tools and pre-recorded materials, technology-enhanced learning has rapidly expanded to include innovations such as platforms for personalised learning, analytics, AI-driven tutoring systems, immersive experiences through virtual reality, collaborative and social learning tools and the proliferation of open educational resources (OERs) aimed at widening access to quality learning materials. While the term 'app' was regularly used in media during the late 1980s to describe various applications, the launch of Apple's App Store in 2008 helped solidify the definition and make the term a household name (Wade Morris & Elkins, 2015). In 2022, over 255 billion apps were downloaded worldwide, with consumer spending equating to approximately 167 billion dollars (data.ai, 2023a). As a result, apps have become a lucrative business.

Apps have become commodities that form an integral and operational part of modern mobile devices, and their use has become embedded in everyday life. By 2025, it is predicted that 95% of the UK population will be using smartphones (Hiley, 2022). With numbers as large as these, it is unsurprising that many industries are turning to technology to expand their businesses to deliver goods and services through apps.

Figures show the most popular type of apps are mobile gaming apps, with 'business apps' listed as a close second (AppFigures, 2022). Education is listed as the third-most-popular category in the Apple App Store, accounting for 9.8% of all active apps, making apps for learning and education an emerging market (AppFigures, 2022). A growing number of adult learners and university students are now using apps to support their studies, and it is now possible to learn a multitude of skills through an app on a mobile device (CIPD, 2021; Oliveira, Pedro, & Santos, 2021). The most downloaded educational apps are language

learning apps, with Duolingo leading the charts globally (AppMagic, 2022; 2024).

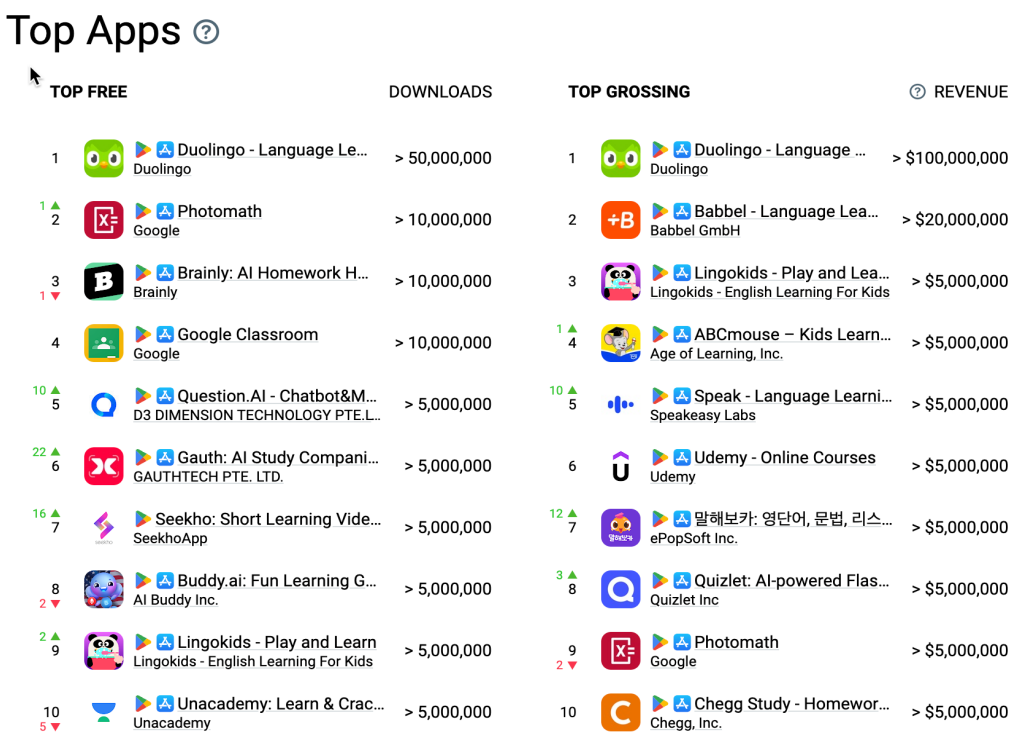

Figure 1.1 *The top ten most downloaded and top ten highest-grossing education apps worldwide (AppMagic, 2024).*

Language learning apps dominate download charts, but skills such as learning musical instruments are becoming increasingly popular as the barriers to learning disappear (Ashworth, 2019). Music lessons have traditionally been taught in a face-to-face (F2F) setting, either in small groups in the classroom or with a private tutor on a one-to-one basis. It has been suggested that while apps should not replace the need for a teacher (especially when teaching children), they should be used as positive supplementary materials (Heath-Reynolds & VanWeelden, 2015).

The debate about whether technology can replace teachers is controversial and ongoing, and the COVID-19 pandemic has accelerated these arguments. Many F2F classes moved online during this time, and many questioned whether some classes should move online more permanently (Oliveira et al., 2020).

Despite the pandemic being over, many classes are still offered online as an alternative or blended solution.

Learning an instrument requires a mix of knowledge, skills and attitudes. Music theory requires propositional knowledge, whereas performance requires procedural knowledge (Shaheen, 2021) and psychomotor skills. Questions have been raised about the quality of alternative digital teaching materials (Plummer et al., 2021) and whether teaching psychomotor skills is easier in F2F settings (Seymour-Walsh et al., 2020). Many of these questions are driven by issues within educational establishments and traditional classroom environments, with questions about non-formal, independent learning being less common.

Mobile Learning (mLearning) can provide a seamless learning experience that enables individuals to switch between devices in different situations while maintaining the continuity of learning (Milrad et al., 2013). Mobile devices offer learners the ability to access relevant information at the moment it is needed, allowing for flexible learning experiences that are personalised to individual needs (Udell & Woodill, 2014, p. 25).

Motivation critically impacts online learning (Hartnett, 2016), as an individual's beliefs greatly influence their motivation in learning situations (Cogdill, 2014, p. 50). Studies have shown that learners who join massive open online courses (MOOCs) are more motivated when participating in small group discussions (Barak et al., 2016). Social media platforms can serve as collaborative spaces for individuals to engage with each other, with apps including and promoting access to their online communities.

1.2 Research Gap and Problem Statement

The popularity of mobile devices and educational app downloads demonstrates their growing significance in modern education. Over the years, mobile technology has evolved from Personal Digital Assistants (PDAs) to smartphones and tablets, becoming cheaper, more accessible, and deeply embedded in everyday life. While mLearning was a relatively new field in 2013

(Berge et al., 2013, p. 12), it has since developed into an established area of research. Compared to older technologies, such as desktop software and web-based e-learning platforms, apps have risen in popularity. Numerous studies have explored the use of apps in language learning, providing insight into their effectiveness. However, there remains a lack of academic research focusing on the use of apps to learn musical instruments and the specific skills required for such learning.

The interaction between technology and the affective and motivational aspects of non-formal settings remains understudied, highlighting the need for further investigation. Although the affordances and constraints of mLearning are well-documented, studies examining motivations for learning in online settings (Hartnett, 2016) remain limited. Earlier research, such as Orr (2010), introduced the potential of apps to influence individual learning journeys, but the expanding body of literature now provides a more detailed understanding of their impact, including user engagement and learning outcomes. Nevertheless, mLearning remains a complex field, and key factors determining the effectiveness of learning apps, such as design, accessibility, inclusivity, feedback, learner motivation, and prior knowledge, continue to require further exploration.

The development and publication of apps are still relatively unregulated, which presents challenges in fields like mobile health (mHealth) applications, where accuracy and content quality are particularly critical (Treskes et al., 2016). Popular app stores, such as the Apple App Store, Google Play Store, and Amazon App Store, review apps before publication, but their reviews primarily focus on functionality and usability. While some content is assessed, particularly in areas like health and education, the extent and consistency of this scrutiny vary (Huckle, 2018). As a result, users face an overwhelming choice of apps alongside concerns about content integrity, reliability, and trustworthiness. This lack of consistency may stem from limited pedagogical frameworks underpinning app design and a scarcity of longitudinal studies examining their impact (Traxler & Kukulska-Hulme, 2005).

Studies investigating mLearning in different capacities have historically focused on the use of technology in schools and universities, with many pilots being conducted in classrooms and lecture theatres, as observed in earlier research (Traxler & Kukulska-Hulme, 2005). While this trend has expanded in recent years to include diverse learning contexts, including workplace training and informal learning, there remains a notable gap in research focusing specifically on adults who prefer to learn in non-formal settings (Moore et al., 2024). The following sections outline the research aims, questions, and contributions, situating this study within the broader context of technology-enhanced learning and music mLearning.

1.3 Research Aims and Purpose

This research aims to understand why adults use apps to learn musical instruments, their experiences using apps, and how it affects their self-perception. Specifically, it examines motivations, experiences, and impacts on self-perception, considering factors such as psychological needs fulfilment and self-efficacy.

Conduct an autoethnography. To document the researcher's learning journey of learning the piano using an app. This autoethnographic approach will contribute to the qualitative data collection process, providing an in-depth understanding of the experiences and insights gained.

Conduct a series of semi-structured interviews. To gain qualitative insight into the motivations behind choosing apps for learning, the positive and negative feelings associated with mobile app-based learning, and the overall perceptions of this mode of instruction. These interviews will provide valuable insights into learners' subjective experiences.

Analyse data through reflexive thematic analysis (RTA). This analytical process will facilitate the extraction of qualitative insights into feelings and motivations associated when using apps to learn an instrument and categorise them into themes.

Analyse the themes generated from the study. To address the research questions. Drawing on the themes of the study aims to provide comprehensive and well-supported answers to the research questions.

Present and discuss the findings from the analysis. This discussion will culminate in a conclusive overview of the research study, highlighting its contributions to the field of technology-enhanced learning and music mLearning.

1.4 Research Questions

This study aims to answer three primary research questions, which have been broken down into three sets of sub-questions.

1. What are the initial motivations and perceptions of adults learning musical instruments using mobile apps?
    1.1. How do adults perceive their ability to learn musical instruments before using mobile apps?
    1.2. 1.2 What motivates adults to adopt mobile apps for learning musical instruments?

2. What are the experiences of adults using mobile apps to learn musical instruments?
    2.1. What are the main benefits and rewards perceived by adults when using mobile apps for learning musical instruments?
    2.2. What challenges and obstacles do adults face when using mobile apps to learn musical instruments?

3. How does using mobile apps to learn musical instruments affect adults' self-perception?
    3.1. How do mobile apps impact adults' self-efficacy and self-determination in learning musical instruments?
    3.2. What factors influence changes in adults' self-perception when using mobile apps?

1.5 Research Contribution

Autoethnography brings a new paradigm to this research area as it allows the researcher to explore subjectivity and investigate the topic at a deep and personal level (Ellis, Adams, & Bochner, 2011). To connect this study to culture and wider society, the researchers' experiences will be compared to the experiences of others through a series of semi-structured interviews. This research study aims to contribute to the following knowledge areas.

Technology-enhanced learning. Investigate the use of music apps for educational purposes, exploring their potential and impact in the field of technology-enhanced learning.

Autoethnography as a Research Method. Raise awareness of autoethnography and its value as a qualitative research method. How autoethnography can be applied in a PhD study to gain insights and deepen our understanding of complex topics.

Music mLearning. Expand on existing literature on music mLearning, exploring new avenues and uncovering innovative approaches to leveraging technology in music education.

Self-Determination Theory (SDT) and Self-Efficacy Theory (SET). Learn how these psychological theories can be applied to mLearning environments. Gain a deeper understanding of the implications and impact that learner motivation and engagement have on music mLearning.

1.6 Research Concepts and Definitions

This section clarifies the use of terms referenced within this research study. It provides a brief definition of each term and an overview of its use.

Piano or Keyboard

Although several participants in this study were learning the guitar, there is more focus on individuals learning the piano. The terms piano and keyboard

are used interchangeably. They describe musical instruments where different notes are sounded “by pressing a series of keys, push buttons, or parallel levers” (Ripin, 2021). Participants often referred to learning the “piano”, even if the instrument was an electronic keyboard. Most, if not all, the apps used in this thesis refer to “learning the piano” while acknowledging that the learner may be using a similar instrument, such as a grand or upright piano or an electronic keyboard.

Mobile Learning

In 2005, Traxler defined mLearning as “any educational provision where the sole or dominant technologies are handheld or palmtop devices” (p. 262). Traxler highlights the challenges in defining mLearning due to technological evolution, convergence, diverse applications, and evolving pedagogy. Traxler’s early definition is described as techno-centric, which places technology at the centre of the discussion.

Crompton and Traxler later expand on this by stating that mLearning should not be defined as a conjunction of ‘mobile’ and ‘learning’ (2015, p. 506) and that Crompton’s definition, “learning across multiple contexts, through social and content interactions, using personal electronic devices” (2013, p. 4), is perhaps more apt. This definition has become widely adopted as an acceptable definition of mLearning. This research study examines mLearning by adopting Crompton’s definition, which classifies the key constructs as content interactions, technology devices, context, and social interactions. While pedagogy is not explicitly included in Crompton’s definition, these constructs indirectly align with pedagogical principles by emphasising the importance of context, interaction, and technology in supporting learning.

It should be noted that while mLearning is associated with portability and flexibility, allowing learners to engage with educational content in various locations, the stationary nature of piano learning becomes a key consideration.

While learners access mobile apps to learn, the act of practising the piano requires them to remain in a fixed location with access to their instrument. This

contrasts with the conventional understanding of mLearning. In this study, mLearning is defined not solely by physical mobility but by the integration of mobile technologies to facilitate learning, even in stationary contexts like practising a musical instrument.

Mobile Applications

Mobile Applications, or Apps, are defined in this study as software designed for small personal wireless devices like smartphones, tablets, or smartwatches (Techopedia, 2020; Wigmore, 2013), excluding desktops or laptops. Wade, Morris, and Elkins (2015) highlight that apps differ from traditional applications by breaking down software into specialised functions. This study uses "apps" as shorthand for mobile applications.

Pedagogy, Andragogy and Heutagogy

The boundaries defining pedagogy, andragogy, and heutagogy have increasingly blurred. Knowles (1984) defined pedagogy as the art and science of teaching children, with andragogy being the adult equivalent. Today, pedagogy generally refers to teaching and learning activities (Beetham & Sharpe, 2019). In pedagogy, the learner depends on the teacher who decides what, where, and when teaching occurs (Cuenca, 2010) and focuses on transferring knowledge without emphasising its application (Sharma et al., 2020). As learners mature, they become more autonomous, deciding how and what they want to learn (Sharma et al., 2010).

Heutagogy, an extension of andragogy, was introduced by Hase and Kenyon (2000) and emphasises self-determined learning. Blaschke (2012) expanded on this concept, particularly in the context of contemporary educational practices and technology-enhanced learning. In this model, the teacher is a facilitator while learners take charge of setting and achieving their learning goals. It incorporates a flexible curriculum and learner-directed questioning to foster metacognition (Halupa, 2015).

While concepts such as pedagogy, andragogy, and heutagogy describe different approaches to educational practices, this study does not explicitly engage with them. Instead, it focuses on the psychological and motivational aspects of app-based learning, particularly for adults learning outside formal environments.

Motivation

Motivation is a psychological concept studied from various theoretical perspectives (Evans, 2015). This study defines motivation as “a person’s willingness to exert physical or mental effort in pursuit of a goal or outcome” (American Psychological Association, 2020).

Feelings and emotions

In neuroscience, feelings result from emotions; emotions are reactions to the body caused by stimuli, and feelings occur when the brain becomes aware of such changes (Lenzen, 2005). Feelings and emotions are often used interchangeably, and there is debate over whether the term “emotions” can describe feelings and emotions. To assist in identifying and categorising the different feelings captured in this study, the Feel Wheel (Roberts, 2015) was chosen as a model to help guide the data collection. This model is explored in more detail in Chapter 3.

1.7 Thesis Structure

This section provides an overview of the structure of this research study. It should be noted that this thesis contains a mix of academic writing and autoethnographic narrative. The goal is to give readers a deeper understanding of the subject matter through narrative excerpts.

Chapter 1. Introduction and Background

This chapter introduces the research study by providing background information and context. It presents the study’s aims, objectives, and research questions.

The study's importance and contribution to literature are justified, and the terms used throughout this thesis are briefly defined.

Chapter 2. Literature Review

Chapter 2 explores the academic literature on learning a musical instrument using apps. It examines the impact, themes, challenges, and motivations of mLearning and introduces relevant literature relating to SDT and SET. The potential and limitations of mLearning are analysed, focusing on user engagement and technology integration. This combines theoretical discussion and practical application to establish a foundational understanding of the role of mLearning and the psychological aspects of motivation and self-efficacy.

Chapter 3. Research Foundations

Chapter 3 details the research methodology, highlighting the application of SDT and SET in mLearning. It justifies the selection of these theories, outlines the research paradigm, and describes the use of analytic autoethnography. The chapter also discusses ethical considerations to ensure research integrity.

Chapter 4. Research Design

Chapter 4 provides comprehensive details of how the study was conducted, including the equipment and data collection and analysis process. It also provides an in-depth description of the research design, which focuses on autoethnography as a method and semi-structured questioning.

Chapter 5. Findings: Personal Journeys and Experiences

The findings are presented in two chapters. Chapter five introduces the study participants, their backgrounds, and demographics. This chapter presents autoethnographic narratives to contextualise and enrich the findings.

Chapter 6. Findings: Introduction to the Overarching Themes

Chapter 6 builds upon the findings in the previous chapter, offering a deeper examination of the narrative through the lens of RTA. Similarly, the findings are

enriched with quotations and narratives from the researcher-participant's learning journey, weaving and comparing these personal experiences with findings from participant interviews. This section presents the overarching themes identified in the analysis. It provides an insight into the learning process, as seen through the researcher-participant's perspective and the collective insights of other participants.

Chapter 7. Discussion

Chapter 7 examines the key themes derived from the findings, connecting them to the literature and theory. This chapter examines how the use of apps impacts adult learners, focusing on their motivations and experiences. It discusses how apps either support or hinder autonomy, competence, and relatedness, as well as their influence on shaping learners' self-efficacy.

Chapter 8. Conclusion

Chapter 8 marks the conclusion of this study, summarising its findings, discussions, and theoretical contributions. This chapter aims to succinctly synthesise the study’s main points, reflecting on the research goals. It will review the study’s implications, consider its strengths and limitations, and suggest areas for future research. In doing so, it offers clear recommendations based on the study’s outcomes and provides a foundation for further inquiry in this field. Ending with thoughts on potential research directions, Chapter 8 concludes the current study and sets the stage for future academic work.

Chapter 2: Literature Review

While not mandatory, researchers may incorporate a literature review in their autoethnography as it offers valuable context, theoretical background, or comparative analysis (Ellis, Adams & Bochner, 2011). Researchers can gain insights into their subject by reviewing prior studies. This can help them identify common themes, theoretical perspectives, and methods used by other scholars. Additionally, it provides readers with an overall understanding of how the study fits in with previous research on similar topics (Mertens, 2015).

A problem-based approach was used to conduct the literature review, and the research questions were categorised into key themes that focused on the topics of mLearning, SDT, and SET. As a result, this chapter is split into sections that examine literature across three key topic areas. The first topic introduces contemporary themes of mLearning and its impact. The second topic focuses on the challenges and obstacles of mLearning, while the final topic examines motivations, feelings and emotions experienced during the learning process.

2.1 Searching and Evaluating Literature

For the initial search, Google Scholar, Scopus and OneSearch were used to source and access literature. Scopus is a comprehensive database containing abstracts and citations of peer-reviewed scientific journals, conference proceedings, and books. Google Scholar is a web search engine that indexes the full text or metadata of scholarly literature across multiple disciplines and formats. OneSearch is the academic search engine offered by Lancaster University Library.

The initial search stage involved performing keyword and boolean searches. Different authors may use different terminology to describe similar concepts. Therefore, keyword variations were used to ensure that all relevant literature was included. This was particularly relevant when searching for topics related to musical instruments. It was crucial to specify that “instrument“ refers to musical instruments to avoid irrelevant search results, such as surgical or scientific instruments. In addition, the initial keyword “instrument” did not always retrieve

literature related to learning piano or guitar. Therefore, the keywords “piano” and “guitar” were included to improve results. Keyword searches included variations of "mobile learning," including "mobile education," "mLearning," "mobile apps," "mobile applications," and "smartphone apps" in combination with "learning an instrument," "musical instrument learning," and "music education."

A separate search focused on areas of motivation, feelings and the challenges associated with learning. Keywords such as “motivations,” “reasons,” “factors,” and “self-determination theory” were included for motivations. For emotional aspects, keywords such as "feelings," "emotions," and "experiences" were used. Similarly, for challenges and obstacles, the terms “difficulties," "obstacles," and "self-efficacy" were used alongside relevant descriptors. By following a systematic approach and including various targeted keywords and their variations, the search aimed to identify a diverse range of scholarly articles addressing different aspects of the research topic.

Concerning the date range of literature, according to Traxler (2021), there was a notable transformation in the accessibility, affordability, and usability of technology around 2008. While it is acknowledged that this date is somewhat arbitrary, it is evident from initial observations how rapidly technology has advanced in the past decade. Many technological devices mentioned in earlier research are now considered outdated or obsolete. This does not imply that the research itself has lost its relevance but rather that the affordances of these devices may have evolved or changed over time. MLearning is “an innovation that definitely will suffer changes based on new trends in education and technology” (Criollo-C et al., 2021, p. 3). Considering this, literature searches primarily focused on the most recent decade (plus or minus several years), emphasising recent publications. However, where relevant, older literature has also been included.

The literature highlights a significant research gap, particularly in diverse geographic contexts. Initial searches focused on autoethnography, expanding to empirical and theoretical literature. Journal articles, book chapters, and

dissertations were reviewed for relevance, with secondary searches through reference lists.

A literature review matrix was created (a sample can be found in Appendix A). This matrix included details such as the title, a summary, the publication year, the research question, the methods used, and the major findings. The titles and abstracts were reviewed for relevance and classified into three categories: highly relevant, somewhat relevant, and not relevant.. The literature identified as somewhat relevant was further evaluated to determine its potential contribution. A process of evaluation then began, which involved examining the literature's quality, relevance, and credibility, followed by selecting the most appropriate sources to be included in the final review.

The literature is presented in the next section. The first section provides preliminary insight into the context of the review. It then outlines an overview of the contemporary themes of mLearning, followed by an examination of its affordances and constraints. The topic then changes and focuses on motivation and self-determination when learning using apps. Finally, the literature examining the use of apps to learn an instrument is examined.

2.1.1 Preliminary Insights: Setting the Context for the Literature Review

During the planning of this study, a colleague recommended David Sudnow's 'Ways of the Hand' (1978; 2001). While not directly related to apps, this work offered relevant insights into traditional piano learning methods. While Sudnow did not use apps, it gave me a perspective on learning the piano in a more traditional way that contrasts with modern methods. As a former social anthropologist, Sudnow took up piano at the age of 30 when he became fascinated by the improvisational nature of jazz. His journey illustrates elements of competence as he progresses from a novice to a proficient player. Sudnow's work is not theoretical or explanatory but a descriptive and detailed account that aims to reveal the ways of the hand in producing orderly and musical gestures. His descriptions of learning chords, scales, and melodies with the help of a teacher and jazz records highlight the development of his musical skills, reflecting competence. His account is very similar to an autoethnography, and

his reflections provide a detailed insight into the feelings experienced when learning to play the piano.

Similarly, another piece of literature that captured my attention was that of Kruse (2013), who uses autoethnography to share his experience of learning to play the mandolin using online resources, YouTube and Mandolin Café. Even though Kruse did not use apps, his autoethnographic account provides insight into the feelings experienced when using technology to learn an instrument. The literature review highlighted several gaps, including the feelings experienced when learning an instrument using an app. As a result, finding similar literature to Sudnow and Kruse's was important to further understand the emotional experiences of individuals learning an instrument and compare these to those learning using apps. This enriches the comprehension of the topic but also highlights the relevance of historical and contemporary research in shaping our understanding of learning an instrument in the digital age.

2.2 The Definition of mLearning

While the debate over the accepted definition of mLearning and what should constitute a theory continues (Richards, 2019; Crompton & Traxler, 2015), many have hypothesised what should be included in such a theory. Sharples, Taylor, and Vavoula proposed an idea of mLearning in a framework that suggests that mLearning should be tested against the following criteria: *Is it significantly different from current classroom, workplace*, *or lifelong learning theories? Does it account for the mobility of learners? Does it cover both formal and informal learning? Does it theorise learning as a constructive and social process? Does it analyse learning as a personal and situated activity mediated by technology?* (2005, p. 4).

Park (2011) proposes a pedagogical framework for mLearning which combines transactional distance theory with social interaction. In addition, Valconi (2018) also describes three core characteristics that define mLearning: Firstly, mLearning environments are often constructivist, mLearning occurs outside the classroom, and instructors must be aware of the ubiquitous use of technology when used alongside formal learning environments. Furthermore, mLearning

should also be seen to “transcend both space and time constraints by allowing learners to access content asynchronously and independent of their location” (Crescente & Lee, 2011, as cited in Valconi, 2018). It is important to note that while mobile technology is an enabler of mLearning, a key idea is that the learner is mobile (Udell & Woodill, 2015; Shuler, 2009, as cited in Richards, 2019) with no constraints to location.

mLearning is a broad term for learning mediated by mobile technologies. Seamless learning is an instantiation of mLearning, characterised by its emphasis on the continuity of learning experiences across different contexts, devices, and timeframes. It offers constant access to mobile, connected, and personal handheld devices that enable learners to continue their learning experience across different environments, resulting in a continuity of knowledge acquisition (Chan et al., 2006).

Milrad et al. (2013) look at ten dimensions characterising seamless learning, including concepts encompassing formal and informal learning, personalised and social learning and physical and digital worlds. These dimensions can guide the design and evaluation of seamless learning activities and technologies. It is suggested that seamless learning can foster skills and habits such as independence, inquiry and collaboration among modern-day learners. As with mLearning, seamless learning suffers from similar pedagogical and technological challenges, such as designing seamless learning activities that support innovative learning practices, integrating software components and devices across contexts, and assessing seamless learning outcomes (Milrad et al., 2013).

The main difference between seamless learning and mLearning is that mLearning primarily concerns the use of mobile devices for education, regardless of the degree of seamlessness. In contrast, seamless learning focuses on creating a cohesive and continuous learning experience beyond the boundaries of different learning contexts and technologies. By considering seamless learning, we recognise that learning is not confined to isolated

moments or devices but flows seamlessly across various contexts and platforms.

2.2.1 Evolution of mLearning

MLearning has evolved significantly over the past decades. Apps have become powerful tools for acquiring a wide range of knowledge and skills. Users can learn languages, access educational courses, develop professional skills, and stay updated on various topics. Apps offer interactive and engaging content, including quizzes, videos, and progress tracking. Furthermore, many apps provide opportunities for collaborative learning, fostering interaction and knowledge sharing among users. Whether mastering a new language, enhancing coding skills, exploring scientific concepts, or staying informed, apps offer a convenient and accessible avenue for continuous learning and personal development.

While not all mLearning is driven by apps, they play a significant role in facilitating mLearning experiences. While mLearning can include various forms of content delivery, such as mobile websites and messaging platforms, apps are a key component due to their ability to offer structured learning environments, interactive features, and offline accessibility. Therefore, while apps are not the sole driving force behind mLearning, their integration can enhance the effectiveness, accessibility, and engagement of mLearning initiatives. While it is important to document and acknowledge the development of apps and mLearning, an extensive body of literature already covers this aspect in-depth.

In addition, it falls beyond the scope of this study to explore this in detail. The topic of mLearning covers various themes that can be easily found through an online search.

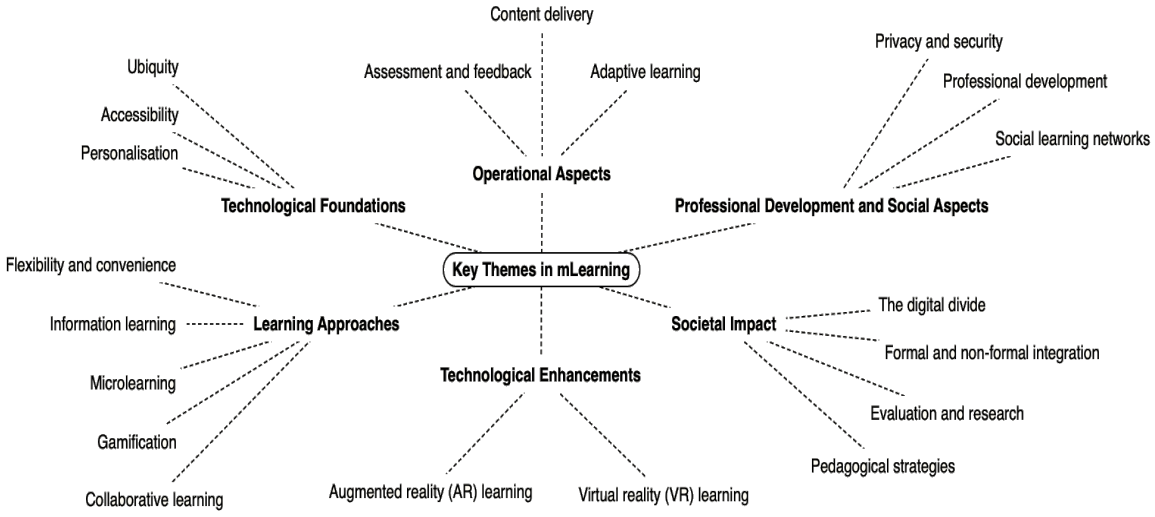

Figure 2.1 *Mind map highlighting some key themes related to mLearning.*

Crompton and Traxler (2019) explore the evolving concept of mLearning and highlight how apps have helped to shape and maintain its identity, which separates mLearning from the more traditional concept of eLearning. Both share similar characteristics, with the primary difference being ubiquity, which allows learners to choose their environment for mLearning (p. 794). Chan et al. accurately predicted that personal mobile devices would become “ubiquitous and pervasive within the lives of learners” (p. 5), ubiquity being a common theme across much of the literature, with many papers touching on the topic in one shape or form. Kukulska-Hulme (2018) suggests that ubiquity itself is a crucial attraction of mLearning, while Sharples and Pea (2014) emphasise learning across space and time with technology becoming a culture in people’s daily lives. Ubiquity is often defined as “learning anywhere, any time” (p. 8). Sharples et al. identified five dimensions that define the term ‘mobile’ in mLearning: physical space, technology, conceptual space, social space, and time (2009).

This opens a discussion about whether mLearning differs significantly from other forms of learning, with Sharples and Pea building on the concept further by introducing the idea of seamless learning, where networked mobile devices enable learning to extend beyond classrooms and homes (2014). There is now an argument about whether mLearning should be considered a form of

seamless learning. This distinction is relevant to the thesis as it indicates how apps, particularly those designed for learning musical instruments, aim to provide a seamless experience. In this context, apps enable learners to transition fluidly between spaces, devices, and times, reflecting the ubiquity and adaptability central to mLearning and seamless learning.

Learner experience and ownership are key themes in the literature alongside theory and pedagogy, with many questions about whether technology or the underlying learning theory defines mLearning. Crompton (2013) suggests that "the essence of mLearning is not in learning or technology, but the marriage between the two" (p. 10). The ongoing debate suggests that the nature of mLearning still needs to be agreed upon. Ethical concerns are also common themes found within mLearning literature, such as information overload, constant connectivity, distractions and ways to filter valuable knowledge from the profusion of online information (Sharples & Pea, 2014). The widespread use of mobile devices has led to various ethical issues, including cheating, cyberbullying, data privacy, and unauthorised image usage (Dyson, E. L, 2013). In the classroom, these concerns centre around cyberbullying, unethical usage of materials, parental and student consent, quick and easy sharing of materials, and the possibility of restricted information being shared with the public (Aubusson, Schuck, and Burden, 2009, as cited in Dyson, E. L, 2013).

According to Kukulska-Hulme (2000), the evolving concept of mLearning makes it challenging to provide a definitive overview of the field. Defining mLearning is challenging due to the ambiguity of the term "mobile," which can refer to both mobile technologies and learner mobility. Furthermore, mLearning involves more than just spatial movement; it encompasses time-shifting and boundary-crossing. As technology becomes more integrated into our surroundings, the definition and understanding of mLearning will continue to evolve (Kukulska-Hulme, 2009). What is important to acknowledge is that mLearning encourages independent learning by making education more accessible, convenient, and attractive, supporting both formal and informal educational goals (Criollo-C et al., 2021b). MLearning will change based on new trends in education and technology, and "in the future, mobile learning will no longer be an option as the

use of mobile devices will become a necessity in the modern educational system" (Dhaheri & Ezzitjane, 2015, as cited in Criollo-C et al., 2021b).

2.2.2 The Affordances and Constraints of mLearning

Orr (2010) conducted a systematic literature review into the affordances and constraints of mLearning. There is a debate over how persuasive the argument is to the affordances of mLearning (Moore, 2008, as cited in Orr, 2010). Orr defends this by stating that the use of mobile devices in education is well documented. However, since the paper was published, research in this area has grown and evolved, contributing to a more complex understanding of the affordances and constraints of mLearning.

Orr discusses the benefits and opportunities of using mobile devices for learning by outlining four key affordances. *Ubiquity.* Devices are small and portable, and data can be accessed anytime anywhere. *Mobile devices as a representation tool.* Mobile devices can gather information through various media such as note-taking, imaging, audio and video recording. *Mobile devices as a communication tool.* The ability to communicate with people through different communication streams is not limited to a phone call. *Limited learning vs. no learning.* In some countries, mobile users outnumber wired users, and mLearning can be used to overcome physical constraints (p. 108).

In addition, Orr identifies the challenges and limitations of mLearning by outlining four key constraints. *Size of the mobile device.* Small screen size, short battery life, and slow text input are all attributes that can affect small, portable mobile devices. *Connection issues.* Apps often require connections to remote servers, and losing connectivity can mean losing access to content. *Inconsistent Platforms*. Developing apps for various devices is challenging due to the lack of cross-platform consistency. As a result, these apps often focus on basic features rather than using the full capabilities of the devices. *Distracted mobile learners.* Learners can become distracted and perform non-related tasks. Orr's paper could be considered student-centred, as the affordances and constraints focus primarily on the student perspective. The student perspective is perhaps the most important to this research study, as teacher and

institutional perspectives are somewhat outside the scope. Still, it is important to highlight these aspects.

In a similar but more recent research paper, Criollo-C et al. (2021b) look beyond the student perspective to include teacher and institutional perspectives and explore the benefits and pending issues of mLearning in education. A total of 26 articles from around the world were reviewed. From the analysis of these empirical studies, key areas relating to the benefits, problems, motivations and impact were identified. From this, a list of generalisations was created which outlines prominent issues and benefits faced by students, teachers, and institutions concerning the deployment of mobile technology (p. 6). These include matters relating to mLearning applications, pedagogy, and mobile content design relatable to real-life experiences.

Educators face obstacles such as difficulty understanding and utilising apps, compounded by a culture resistant to change and the added workload of keeping up with the latest updates. Technological limitations such as security concerns, connectivity issues, and varying device capabilities add further complications. Students encounter usability issues, distraction in restrictive settings, and potential financial barriers. While educational institutions struggle with establishing robust technological infrastructure, deployment strategies, security for digital learning, and financial constraints (Criollo-C et al., 2021b).

Conversely, the benefits include constructivist, collaborative and motivational learning, student behaviour, learning spaces, informal learning, teacher resources, technology and support, affordability and portability, availability and flexibility. MLearning provides valuable resources for teachers to adapt to diverse learning needs, support innovative pedagogies, facilitate teamwork, and deliver immediate feedback. Technologically, mLearning is often free to access via educational platforms and can be implemented quickly. There are also many commercial tools available for creating and deploying content.

Finally, mLearning offers affordability, portability, and flexibility, enabling ubiquitous access to information and learning opportunities in various physical spaces, fostering motivational learning experiences characterised by ease,

interest, achievement, and enjoyment (Criollo-C et al., 2021b). This is similar to Traxler's view, which identifies benefits as increased access to education, personalised and contextualised learning, collaboration, flexibility, and convenience (2019).

Finardi et al. (2016) examined the affordances of the language learning app Duolingo, it was suggested that affordances associated with mobile devices, such as portability, social interactivity, connectivity and individuality, offer more learning opportunities. This was later dismissed as the findings indicated that the app supported vocabulary and grammar development but did not promote broader language development (Finardi et al., 2016), which resulted from the lack of interaction and contextualised language production (p. 19). In this instance, teachers advised students to use Duolingo as a supplementary resource, not as their primary resource for learning.

Similarly, Samir SAAD (2019) examined the advantages and disadvantages of using apps to learn the piano and compared two apps, Yousician and Flowkey. The key benefits of mLearning in this context were; being able to access content anywhere at any time across a large geographical location, easily access a variety of online content, and encouragement, specifically the features within apps that encourage learners to continue (p. 44). The disadvantages were identified as software and hardware issues that disrupt the learning process and cause frustration, time management and motivation related to the ability to maintain a regular practice schedule, social interaction, specifically pertaining to isolation and disconnection from the learning community and lastly, learning styles, related to the app not matching the teaching styles of more traditional learning methods (p. 45). While this study draws on relevant literature and describes the methods used in other studies, it is unclear how this study's research was conducted and analysed. However, the advantages and disadvantages are consistent with much of the findings outlined in other literature of the time.

A slight divergence of affordances and constraints depends on the domain, such as learning a language or an instrument. One of the reasons for this could

be down to the fact that mLearning is multicontextual. For example, two students could be sitting in the same environment, accessing the same content but using different devices, resulting in a difference in perceived experience. Conversely, students could be using the same device in the same environment, but one student cannot view the device due to poor lighting conditions. More importantly, learning an instrument requires a different environment than learning a language. Language learning can often be done in a quiet space with minimal physical interaction. In contrast, instrument learning typically demands an environment that facilitates practice, requiring physical space for movement, appropriate acoustics, and access to the instrument itself. This is touched on in a study by Danish and Hmelo-Silver (2020), highlighting that many authors recognise that mLearning allows learners to access learning in new contexts.

The literature in this area shows that many of the benefits and challenges identified in contemporary studies overlap with those elucidated a decade ago. This correlates to Traxler's' view, which implies that one of the biggest challenges of mLearning is keeping up with the rapidly changing technological landscape and evolving societal needs (2021). Despite the evolution of technology over the years, it appears that many of the affordances and constraints experienced remain unchanged. During a keynote conference presentation, Arnedillo-Sánchez discussed the impact of mLearning in the last 25 years. While there are clear benefits, mLearning has undergone phases of scepticism, adjustment, commitment, and acceptance (Arnedillo-Sánchez, 2024). However, there are concerns about the evaluation of mLearning and an inability to combine learning theory with mobile technology. This often leads to a techno-centric approach to adoption, where technology is forced into teaching and learning (Arnedillo-Sánchez, 2024). This highlights the need for careful consideration when adopting mLearning and suggests that further analysis is necessary to identify the factors contributing to the implications of development and implementation.

2.3 Self-Efficacy and Self-Determination

This section explores the influence of self-efficacy and self-determination on motivation and emotions related to learning through apps. While this provides context and theory applied in the literature, Chapter Three will examine self-efficacy and self-determination in greater detail.

2.3.1 Self-Efficacy Towards Learning Using Apps

Bandura proposed that an individual's self-efficacy can influence behaviour and motivation (1977). This concept formed the basis for SET. In essence, an individual's self-efficacy can impact behaviour and motivation (Bandura, 1977) and approaches to goals and challenges (Bandura, 1995). Studies examining mobile phone self-efficacy found that technology boosts confidence and capability when using it for instructional purposes, positively impacting self-efficacy (Gloria & Oluwadara, 2016). Furthermore, it is suggested that students' belief in their abilities to use mobile devices can impact their readiness for mLearning (Lukuman, 2023).

A study conducted on students learning English as a foreign language found that those with higher self-efficacy levels demonstrated better language learning abilities (Wang et al., 2013). This observation was noted in other studies and suggests that individuals with higher self-efficacy have a greater sense of control over their learning. Although self-motivation, which refers to an individual's intrinsic drive to achieve goals, can contribute to this, it is distinct from self-efficacy. Students with higher self-efficacy appear more engaged and are more likely to tackle more challenging tasks compared with those with low self-efficacy (Bicen & Kocakoyun, 2018; Akkara et al., 2022).

A recent study that specifically examined the impact of technology on self-efficacy when using apps showed that self-efficacy evolved positively, which had a significant positive effect on performance (Loiseau, 2024). This suggests that self-efficacy has self-sustaining qualities which increase over time. This idea is similar to that of a feedback loop where the desire to learn leads to increased effort in learning, which further leads to the development of perceived

competence, increasing the desire to learn (MacIntyre et al., 2017). As a result, it has been recommended that educators and app designers focus on improving learner self-efficacy by employing positive feedback mechanisms. However, this highlights a gap that focuses on individuals with low self-efficacy. While the positive effects of increasing self-efficacy are well-documented, little research explores whether low self-efficacy fosters a similarly self-perpetuating cycle.

Turning the attention to the classroom when using apps alongside teaching, findings show that students who lack self-motivation when using learning apps can benefit from teacher intervention. Teachers can actively support, monitor, and provide assistance to influence learner motivation positively and as a result, apps were most effective when teachers provided support, positively impacting learner motivation (Akkara et al., 2022). This highlights the need for possible external assistance when using apps for learning.

There is a shortage of literature explicitly addressing self-efficacy in mLearning related to the use of apps (Loiseau, 2024). Literature suggests that further research should explore the emotional component of musicians' motivation (MacIntyre et al., 2017). With this in mind, looking at a particularly relevant study, Cherylyn (2020) investigates adult learners' motivation and self-determination towards learning the piano using mobile apps. The study targeted young, working adults living in Malaysia. Five individuals, three with previous music experience, were sampled through personal connections using Facebook and WhatsApp. The study was conducted over ten weeks, and it was recommended that each learner practise for at least 30 minutes, either at the weekend or 2-3 times during the week. The researcher chose the Simply Piano app for the study, and while participants used various mobile devices, most used an iPad.

In some cases, instruments were provided to participants. The study collected qualitative data from interviews and learning journals. Findings relate to self-management, problem-solving, self-reflection, self-motivation, lack of self-control and perceptions of learning with apps. Human agency, specifically the

need to make decisions and self-actualisation, was considered essential for learners. However, perceptions of learning using apps were mixed; the lack of facilitator presence made the experience feel incomplete, with many feeling that apps are only suitable for highly motivated individuals. Participants with prior music experience were able to progress much faster and, as a result, felt more accomplished (Cherylyn, 2020). Cherylyn (2020) states that learners must be "committed and resourceful to achieve their goals" (p. 55). Even though participants demonstrated independence in their learning, this did not necessarily make them successful learners. While this study does build on existing literature, it is a small study with a limited and specific sample of participants.

While personal growth and recreation were some of the motivations for learning the piano, there is limited discussion on motivations to learn using apps. This could be because the participants did not choose the app and were not already using apps before participation. Although not all participants could commit to the recommended practice period, some may have felt pressured or motivated to practise because they had committed to be part of the research study. Cherylyn (2020) emphasises that the absence of a facilitator in piano learning apps can leave participants feeling incomplete, suggesting a need for external guidance, which was a similar finding by Akkara et al. (2022). Both studies indicate that while independent learning is valuable, it may not always lead to successful outcomes.

2.3.2 Self-Determination Towards Learning Using Apps

As with SET, there is a similar lack of literature that looks explicitly at music mLearning through the lens of SDT, focusing more on mHealth apps. The literature highlights a general lack of a unified theoretical approach to music education (Evans, 2015). Motivation has been identified as an essential element of online learning, and SDT identifies autonomy, competence, and relatedness as fundamental psychological needs that foster intrinsic motivation. Addressing these basic psychological needs (BPNs) will likely improve online engagement, achievement, and satisfaction (Harnett, 2016). Building upon this

theoretical framework, a study was conducted by Villalobos-Zúñiga and Cherubini (2020) on 208 apps available on the Apple App Store. The study aimed to identify features supporting BPNs aligned with SDT and presented a taxonomy for developers to understand how each feature can be supported. Autonomy-supportive features include reminders, goal setting, motivational messages, and pre-commitment. Competence-supportive features include activity feedback, history, log/self-monitoring, and rewards. Relatedness-supportive features include performance sharing, peer comparison, peer challenge, and messaging. The study concluded that only 25.5% of the apps analysed provide full support for all the BPNs. The most popular features that align with the BPN are reminders and goal setting (autonomy), activity feedback (competence), and performance sharing (relatedness).

Further research is needed to determine whether multiple features are supportive or detrimental to the individual. While learning through apps can offer valuable opportunities for skill acquisition and personal development, the absence of external guidance may hinder the learning experience. These findings suggest that while independent learning is beneficial, external support may remain essential for optimal learning outcomes. Furthermore, identifying features within apps that cater to SDT indicates the potential for app developers to improve user engagement by integrating such elements.

Focusing on music education, Evans (2015) provides a comprehensive overview of SDT in music education, specifically examining the fulfilment of BPNs and motivation types and outlines various strategies for fulfilling BPNs in music education. This highlights the conflicting nature of SDT and suggests that overlapping BPNs can cause problems for researchers when analysing data. Despite this, an attempt has been made to outline the behaviours that can foster (need supporting) or hinder (need thwarting) these needs in music education.

Supporting competence can be achieved by encouraging a growth mindset that de-emphasises talent and fixed ability while highlighting the importance of effort. Praising efforts and strategies rather than outcomes and teaching

practice strategies for skill development are also recommended. On the other hand, needs-thwarting behaviours involve maintaining perfectionistic standards, comparing students' abilities, emphasising competitive success as an indicator of musical success, and using norm-referenced evaluation criteria (Evans, 2015, p. 72).

Educators can encourage peer interactions, consider how music learning influences students' social roles, foster positive relationships with students, and appreciate the significance of friendships over rigorous practice to promote a sense of relatedness. On the other hand, behaviours that hinder students' sense of relatedness include setting rigid standards, disregarding students' emotional well-being, emphasising formal learning exclusively, and using guilt or shame as a means of control (Evans, 2015, p. 72).

To support autonomy, it is important to adopt certain behaviours, such as providing reasons for instructions, acknowledging students' feelings, giving them choices in repertoire and learning activities, assisting them in developing meaningful goals, and encouraging creative activities such as improvisation and composition. Thwarting autonomy involves pressuring students to perform, being rigid with lesson plans without considering student input, instructing without explaining reasons, excluding students from planning, emphasising strict rules, assigning practice tasks without context, and using external rewards or punishments to control behaviour (Evans, 2015, p. 72).

It is important to highlight that while the literature raises some valid arguments related to music education, the suggested guidelines for supporting BPNs are again tailored more towards traditional learning methods rather than mLearning and independent environments.

2.4 Learning to Play a Musical Instrument Using Mobile Apps

This section examines literature related to learning a musical instrument using apps. During the literature review, it was identified that there was more literature available on language learning using apps, also known as Mobile-Assisted Language Learning. Consequently, a small selection of relevant

papers that use apps for learning languages, which focus on motivation, feelings, and emotions, have been included.

2.4.1 Apps for Learning Musical Instruments

In an early study, Elfaki et al. (2012) outlined the process of developing an app called “The Pianist” for educational and entertainment purposes. The app was designed to teach individuals how to play the piano while providing a fun and interactive experience. The motivation behind its creation was to support the Samsung BADA apps market and provide a platform for individuals to learn and play the piano using their smartphones. The app was created to make piano learning more accessible and affordable, as it was identified that not everyone had easy access to physical musical instruments, and private tuition was costly. In addition, the app aimed to promote piano learning and generate interest in music through mobile technology. Elfaki et al. primarily discuss the design and development of the app and do not indicate how successful it was among users.

In a similar study, Ng, Lui, and Kwok (2015) present the app “Easy to Learn Piano", designed for beginners learning the piano. A comparison of the apps at the time highlighted that while most apps allow individuals to practice reading sheet music and playing through a keyboard, there were limitations around teaching skills related to composing music, singing and listening skills. The study’s outcome showed that the app was effective in helping individuals learn fundamental knowledge of music theory and basic piano skills. The app provided different materials and exercises for users to learn basic music theory, practice keyboard playing, listen and distinguish keys and chords, and compose music. It also included a sight-reading practice to improve users' sight-reading skills. An evaluation of the app showed positive feedback, with most users agreeing that the application helped them learn music theory, improve their sight-reading skills, and discern different tones.

De Villiers (2018) identified additional areas of improvement within music apps for learning the piano. These gaps were identified as difficulty identifying notes and patterns, the transition from written music to performance, lack of basic

concept knowledge, frustration and lack of progress, and limited access to instruments and practice opportunities. De Villiers argues that regardless of age, learners often struggle to identify individual notes and patterns in written music (p. 14). Learners without formal music education may not understand basic concepts, including the symbols used to represent notes, rhythms, and other musical elements (p. 15). In addition, learners can become frustrated and feel they are not progressing when they cannot effectively translate written music into performance. Finally, learners from disadvantaged backgrounds or rural areas may not have access to instruments or the opportunity to practice. These issues hinder the ability to develop skills and can be demotivating, leading to the belief that learners are wasting their lesson time (pp. 14-15). As a result, the "PianoBoost" app was developed. This app was designed to engage learners, provide real-time feedback, and allow them to learn music notation independently, freeing up teaching time for other purposes. The app was developed on the core elements of gamification, computer-based learning, and blended learning, identified as central themes in the study. When the app was launched in 2017, it received positive feedback.

Zhou (2016) introduces "JChord", an app designed to detect and provide feedback on guitar chords. The app was created to help new guitar learners learn basic chords by providing real-time feedback, similar to how many modern-day music apps function today. However, Zhou (2016) does not go into detail about how successful "JChord" was received.

2.4.2 Assessing the Use of Apps in Music Learning

Several studies focus on the impact and potential of music learning apps when used as supplementary tools alongside traditional teaching methods. Sochor (2020) investigated the use of apps in private piano teaching. The study found that many piano teachers use apps to teach note and rhythm concepts to their students. Nonetheless, some teachers experienced challenges and technical issues, which resulted in reluctance to use apps. Furthermore, some teachers did not feel the need to keep up with the latest technologies. In conclusion,

apps positively reinforce music concepts and increase student engagement, but they should be used thoughtfully and intentionally to ensure their benefits.

Yun Yi & Thiruvarul (2021) explored the potential of apps in learning the guitar using the Yousician app through a series of case studies. Participants found the app user-friendly, engaging and attractive. In addition, the gamification features of the app, namely the scoring system and instant feedback mechanism, motivated and engaged participants to learn and practice. Kuš & Čarapina (2022) found similar motivational aspects related to gamification in an app called TuneHop. However, this study focused primarily on music education in young children rather than adults.

Yun Yi and Thiruvarul (2021) identified challenges with the Yousician app's ability to accurately recognise notes and register sounds, which frustrated participants and hindered their learning process. The study also highlighted the lack of adaptability in the app's difficulty levels, which made it challenging for some users to progress effectively. Despite these limitations, the researchers concluded that the app effectively facilitated music learning and practice by providing a structured approach and interactive features. However, they recommended improvements in sound recognition accuracy, user feedback mechanisms, and adaptive learning features to accommodate diverse learner needs better (Yun Yi and Thiruvarul, 2021, p. 12).

Liu and Shao (2022) explored the effectiveness of several apps, including Udemy, Skillshare, and the Chinese-specific app Xiaoyezi AI Piano Tutor. Their findings demonstrated that mobile apps can effectively support music learning, with their impact varying based on the skills targeted and the functionalities offered. While Liu and Shao (2022) did not directly address app improvements, they emphasised the importance of selecting suitable tools to meet specific learners' needs.

Zhang & Gao (2022) assess the effectiveness of interactive piano teaching in a comprehensive distance learning programme. The training programme aimed to provide a comprehensive approach to learning the piano, which focused on technical, creative, and psychological skills and promoted active student

participation and engagement. One of the digital tools used within the programme was the piano learning app Flowkey, which was chosen as it provided a user-friendly interface and facilitated effective learning and progress tracking in piano playing. While this study focused on the evaluation of the training programme as a whole, the findings show that the app substantially contributed to students' piano playing skills development (p. 9).

Finally, a Brazilian study by Magalhães et al. (2018) examined mLearning as a motivation method in music education. As with much of the previous literature, this was a classroom study, and the app was used as a supplementary tool. The study is small and does not explicitly state the children's ages. However, based on the photos within the study, it can be inferred that they are teenagers. The findings show that the chosen app, Ritornello, was easy to use, interesting and well-received by the students. Overall, the app was found to have positively impacted their learning experience and is credited with supporting the development of creativity and artistic expression.

2.5 Exploring Personal Narratives in mLearning

While this literature review aims to provide an overview exploring the experience of learning using apps, several studies should be emphasised as they use autoethnography as a methodology. It should be noted that there was limited autoethnographic literature in this area. An autoethnography by Kruse (2013) highlights an experience associated with mLearning rather than using apps. Themes highlighted in this autoethnography included enculturation (community, becoming vulnerable); learning mode (online, offline, acceptance, avoidance); role conflict (becoming an insider, remaining an outsider); frustration (schedule, lack of practice time, inferiority); and resurgence (confidence, purpose, strength) (p. 298).

Osborn (2013) and Alm (2021) use autoethnography to explore the use of apps to learn a language. Alm (2021) shares the journey of a researcher learning Spanish using an app for a year. The study uses journalling as a data collection method, and Schumann's five-dimensional stimulus model underpins the theoretical framework. This study highlights a potential issue with using apps for

learning a language in that several apps must be used to achieve the desired outcome. During the study, four apps were used, each with a distinct deficiency that was satisfied by one of the other apps. As a result, when the learner becomes aware of their changing needs, different apps are required to address them (p. 218).

Similarly, Osborn (2013) investigates the use of mobile devices to support foreign language vocabulary learning. The purpose was to inform the researcher's professional practice as a language educator and a designer of interactive language learning materials. The technology used at the time was an Apple iPhone, and the app was chosen based on the developer's description and user reviews. The app was used daily, two to three times a day, for approximately ten to fifteen minutes for two weeks. A learning journal was kept, and a Reflexive Thematic Analysis (RTA) was conducted, which identified four overarching themes: *Learning strategies, Approach, Motivation, and, Device and app interface.*

The findings from the first theme are domain-specific and relate closely to pedagogical language learning strategies. However, themes two through four relate more closely to motivation and technology. Osborne's findings indicate that the app's quality significantly impacted the user experience. Lack of clarity in the instruction and content caused uncertainty, while the ability to personalise or edit content was desirable (2013, p. 302). While the technology (iPhone) has been described as convenient, the interface is referred to as irritating, and the researcher describes a situation where using one hand in portrait mode was more convenient (Osborne, 2013, p. 303). Lastly, the researcher states that boredom and frustration ultimately affected motivation. The app's lack of a reward system is attributed to the need for more diverse exercises and enhanced interactivity (Osborne, 2013, pp. 302-303).

Osborn and Alm's autoethnographic studies on learning with apps highlight common challenges and unique insights. Osborn identifies issues such as app quality, interface design, and clarity of content and instructions, while Alm focuses more closely on the mechanics of language learning. The studies

conclude that language learning apps can effectively facilitate informal autonomous learning. Still, they also point out areas for improvement, such as app quality and the need for more diverse exercises and enhanced interactivity.

2.6 Literature Review Summary

The literature review provides an overview of the use of apps for learning instruments. However, there is a notable gap in comprehensive studies that directly compare the effectiveness of these apps in facilitating adult learning. While individual studies highlight specific apps' features, usability, and impact, there is a limited analysis in determining which apps are most suitable for skill development, engagement, and user experience. Furthermore, there is a need for research that focuses on the specific needs and preferences of adult learners. The literature also highlights the potential of apps and limitations in enhancing music education. Early initiatives such as "The Pianist" and "Easy to Learn Piano" aimed to make piano learning more accessible and engaging by leveraging the convenience of mobile devices. "PianoBoost" signified a shift towards addressing challenges through gamification. What these studies indicate is that while there are a multitude of different apps available, there are some significant gaps around quality, educational content and functionality. In a 2021 study, Bobbe et al. demonstrated how technology can improve distance teaching, addressing stage fright and motivation. The authors emphasise the importance of involving users in the early stages of app development to ensure the apps meet their needs and are accepted by the community. The importance of user involvement in the development process cannot be overstated (Bobbe et al., 2021). The concepts behind creating apps demonstrate how they can be designed to offer more comprehensive learning and playing experiences and include valuable features and functions.

In summary, technology has the potential to transform music education by offering tools that enhance learning, engagement, and accessibility. While the literature highlights the benefits of apps in music education, further research is needed to address their limitations and the varying contexts in which they are used.

Chapter 3: Research Foundations

This section outlines the approach taken towards research methodology. This includes an in-depth review of the chosen methodology, the theoretical concepts underpinning the research, research integrity and ethical considerations.

Autoethnography is a self-reflexive qualitative research methodology where the author acts as both researcher and participant (Anderson, 2008). The purpose is to connect the autobiographical self to culture and wider society (Chang, 2008). The researcher typically shares personal experiences while demonstrating reflexivity to share insider knowledge, cultural phenomena, and experiences (Adams et al., 2015). Autoethnography allows the researcher to look inward as the participant, to document and explore a personal experience and share it outwardly, linking it to culture and wider society. Providing a first-person account of an experience or situation allows the author to tell a story and share epiphanies.

Autoethnography is both a method and methodology that emphasises personal narrative, self-reflection, and the researcher's role. As a methodology, it provides context and rationale, while methods are the techniques used in data collection and analysis. When conducting an autoethnography, a combination of methods can be used to collect data; common methods include personal narrative, field notes, observations, interviews, document analysis, visual data collection and reflexive journaling. Autoethnography can be highly creative, with work appearing in various formats, for example, music compositions, poetry, photographic essays, novels, short stories, and journals (Bartleet, 2009; Bochner & Ellis, 2016). More diverse formats are becoming popular among musicians and music researchers as they provide a way to share personal stories and understand more profound creative experiences (Bartleet, 2009). Reflexive journalling is a popular way of capturing self-narration as it provides a "window through which self and others can be examined and understood" (Chang, 2008, p. 13).

Autoethnographies are often written from the researchers' point of view, meaning authors can choose to write in the first person rather than using a traditional academic writing style. One of the essential aspects of evocative autoethnography is to elicit emotions that start conversations (Hunt & Junco, 2006, as cited in Ellingson & Ellis, 2008), which is characterised by personal narratives and storytelling. Bochner and Ellis describe evocative autoethnography as "powerful, comforting, dangerous, and culturally essential" (2016, p. 87). Autoethnography is almost always considered evocative (Muncey, 2010); however, other forms have emerged. Analytic autoethnography uses theory to develop broader social phenomena from analytical research (Hunt & Junco, 2006 as cited in Ellingson & Ellis, 2008; Anderson, 2006; Adams et al., 2015) and analytic autoethnography often sees narratives interweaved with traditional writing and formatting conventions.

3.1 Philosophical Foundations

A research paradigm is described as common beliefs shared between scientists regarding how problems should be understood and addressed (Kuhn, 1970). It encompasses ontology and epistemology to provide a broad framework for how researchers approach and construct research studies. Autoethnography is a research methodology that can be aligned with several research paradigms, such as constructivism, interpretivism and postmodernism. Constructivism is the idea that individuals construct meaning and reality through their experiences. At the same time, interpretivism emphasises understanding social phenomena, for example, how personal experiences contribute to interpreting cultural or social dynamics (Creswell, 2018). Postmodernism aligns ideas of subjectivity, multiplicity and fragmented identity and can be used to explore the complexities and contradictions of experiences and identities (Cohen et al., 2017).

This research study does not aim to solve a specific problem but seeks to explore, understand and add meaning. I hold the ontological view of a constructivist and acknowledge that subjective meanings are formed through interactions with others. Constructivism is not a single approach (Braun &

Clarke, 2021, p. 180). My particular approach aligns with the epistemological view of interpretivism, which emphasises the importance of understanding and interpreting human experiences through the lens of subjectivity, context, and multiple perspectives and how these experiences differ from inanimate natural phenomena (Cohen, Manion, & Morrison, 2017, p. 8). It is important to note that autoethnography is a reflexive and subjective approach, and the researcher's positionality and subjectivity play a central role in the research process. While autoethnography can be associated with various paradigms, its primary focus remains exploring and communicating personal experiences and their connections to broader cultural and social contexts.

3.2 Methodological Foundations

Analytic autoethnography interpretation connects personal experiences with society and theoretical frameworks. This approach enables a mix of systematic scientific analysis and artistic storytelling (Rogers-Shaw, 2021). Anderson (2006) first proposed analytic autoethnography and outlined three principles that differentiate it from its evocative counterpart.

The first principle states that the researcher must be a full member of the research group, emphasising the need for insider knowledge and a deep understanding of the group's culture, practices, and experiences. The second principle requires the researcher to be visible as a member in published texts, acknowledging their role and subjectivity. The third principle is a commitment to developing a theoretical understanding of broader social phenomena, connecting personal experiences to wider society and contributing to theoretical knowledge.

Anderson (2006) further elaborates on the three characteristics by outlining five features that make an autoethnography analytic: *Complete member researcher status, analytic reflexivity, narrative visibility of the researcher's self, dialogue with informants beyond the self,* and finally, *commitment to theoretical analysis* (p. 6).

Anderson's article was controversial, and Bochner and Ellis initially did not recognise different variations of autoethnography (2016). They responded to Anderson with an article accusing him of taming autoethnography, stating that it "should not be used as a vehicle to produce distanced theorising" (2006, p. 433). Over time, it has become evident that there is a distinct difference between analytic and evocative autoethnography, although that is not to say that the approaches cannot be combined. Fourie (2021) argues that autoethnography can be both analytical and evocative; emotional aspects need not be disregarded in an analytical autoethnography, and theoretical elements need not be excluded in an evocative autoethnography.

More recently, Bochner and Ellis reflect on their response to Anderson's article, stating that it had been interpreted as an attempt to appropriate and poach the appeal of autoethnography and its growing popularity in social sciences (p. 62, 2016). Bochner and Ellis continue this reflection by stating that they have "no desire to police autoethnography…we are thrilled that interest in autoethnography has escalated and expanded in many different directions" (p. 62) and have come to recognise that other forms of autoethnography such as analytical, critical and collaborative are becoming more widely adopted (Bochner & Ellis, 2022).

3.2.1 Approach to Analytic Autoethnography

My research interests include exploring how storytelling can be used in education as a teaching tool through branching scenarios and as a learning tool through self-reflection exercises. Stories can help individuals connect to a topic, making the subject matter more memorable. Having written evocative autoethnography in the past, I found analytic autoethnography more appropriate for this new study, which was less emotionally impactful but desired theoretical application. I have a lot of highly creative interests outside of music, including arts and crafts. It is no surprise that when I discovered autoethnography, I felt a connection to this methodology. Muncey (2010) suggests that you cannot separate who you are from what you do, as we are both participants and observers of our own experiences (p. 23).

According to Fourie (2021), elements of evocative writing can be included in analytic autoethnography, provided that Anderson's (2006) five key features are fully met. These features include: (1) Complete Member Researcher (CMR) Status, (2) Analytic Reflexivity, (3) Narrative Visibility of the Researcher's Self, (4) Dialogue with Informants Beyond the Self, and (5) Commitment to Theoretical Analysis.

In this study, I fulfil the role of a complete member by actively participating in the research as a learner using a music app. RTA facilitates analytic reflexivity, and narrative reflections are incorporated throughout the study. Excerpts from participant interviews are included in the findings section to ensure dialogue with participants beyond the self. Finally, a commitment to theoretical analysis is demonstrated through a comprehensive literature review and the application of SDT and SET to interpret the findings.

Due to the qualitative and creative nature of the study, other methodologies such as phenomenology or a case study were considered but would not have allowed me to take on the role of both researcher and participant.

3.3 Theoretical Framework

While mLearning provides most of this study's foundational knowledge framework, this research study looks at learners' motivation through SDT and SET. SDT suggests that individuals have three basic psychological needs: autonomy, competence, and relatedness, and if the right conditions are met, individuals are likely to experience high motivation (Harnett, 2016). SET is a theory built on an individual's belief in their ability to succeed in a specific task or situation (Bandura, 1977).

Before exploring these concepts in more depth, it should be noted that while these theories are related and have some commonalities, they are distinct theoretical perspectives and not necessarily complementary. SDT addresses broader social and environmental factors influencing motivation, emphasising the importance of autonomy, competence, and relatedness in achieving self-determination (Ryan & Deci, 2017). In contrast, SET focuses on an individual's

self-perception of their capabilities, which can be influenced by motivation, effort, and perseverance (Bandura, 1977). Understanding both theories provides a comprehensive view of how motivation and self-efficacy impact learners' experiences and achievements.

3.3.1 Theoretical Framework Justifications

SDT and SET have been chosen for this study for several reasons. Using an app to play a musical instrument encourages autonomous learning, giving learners control and choice over their learning process. SDT can study autonomy, perceived competence, and the influence of external factors on the learning experience. SET can be used to understand how confident individuals are in learning to play an instrument using an app, impacting motivation, effort, and persistence.

3.3.2 Self-Determination Theory

SDT is a psychological theory that seeks to explain human motivation and personality development. The theory stems from the idea of being self-determined, which in turn impacts motivation.

SDT is a comprehensive theory that considers social, cognitive, and emotional factors and behaviours in social environments (Evans, 2015). Being self-determined typically involves acting according to your interests and values rather than being controlled by external forces. Ryan and Deci (1985) proposed SDT and introduced two types of motivation: intrinsic, where motivation stems from internal factors, and extrinsic, which stems from external factors. In addition, two assumptions underpin SDT: the need for growth and the importance of autonomous motivation. The need for growth stems from the idea that human behaviour is driven by the need to grow and improve, while autonomous motivation focuses more on intrinsic motivation.

Furthermore, Ryan and Deci (2017) outline three basic, innate psychological needs for growth that underpin SDT: autonomy, competence and relatedness. These needs are the central mechanisms of motivation. Autonomy relates to an

individual's feeling of control over choices and behaviours. Autonomy should not be confused with independence. While they are related concepts, independence refers to self-reliance and self-sufficiency, while autonomy is related to actions and a sense of responsibility for the outcomes (Ryan & Deci, 2017, p. 10). Competence is the feeling of skill or mastery of a task and the need for individuals to feel capable and effective at achieving goals. Relatedness is an individual's sense of belonging to other people. For example, people feel relatedness when they feel cared for by others (Ryan & Deci, 2017, p. 11). When all three needs are met, individuals are highly motivated, more likely to achieve goals, and experience personal growth and development.

To provide a more comprehensive understanding of motivation and behaviour, SDT is divided into six theories. These theories further elaborate on intrinsic and extrinsic motivational factors and their influence on motivation.

Figure 3.1 *The six theories of SDT.*

SDT is a large and complex concept; therefore, this study focuses on Basic Psychological Needs Theory (BPNT). BPNT is particularly relevant for exploring how mLearning environments influence learners' autonomy, competence, and

relatedness, as these psychological needs are foundational to motivation and engagement. By narrowing the focus to BPNT, this study provides a manageable scope while maintaining theoretical depth, aligning with its aim to understand the motivational impact of learning using apps. In this study, SDT is referred to as the overarching theory, with BPNT being the specific focus.

Other theories within SDT were considered, but their narrower focus made them less suitable for this study. For example, Cognitive Evaluation Theory (CET) examines the role of rewards and feedback, which is only one aspect of learning using apps. Similarly, Organismic Integration Theory (OIT) focuses on the progression from extrinsic to intrinsic motivation but does not directly address factors like self-efficacy. Relationships Motivation Theory (RMT) primarily examines the role of relatedness in fostering engagement and well-being. While relatedness does play a role when learning using apps, this is just one aspect of the experience. Learning using apps also involves other factors, such as autonomy, self-efficacy, and motivation, which extend beyond the scope of RMT. Therefore, RMT's narrow focus on relatedness does not sufficiently address the broader dynamics, making it less aligned with the primary aims of this research. Goal Contents Theory (GCT) was also considered, but its focus on intrinsic versus extrinsic goals was less central to the exploration of self-efficacy and motivation in this context. BPNT's ability to provide a broader understanding of motivational factors made it the most suitable choice for this research.

SDT’s breadth makes it advantageous in music education as it helps to explain a wide range of behaviours and factors that affect motivation in music learning (Evans, 2015). The hypothesis, therefore, is if an individual feels they have control over the learning process of learning to play the piano using an app (autonomy) and they feel they are progressing well (competence) while receiving support and encouragement from others (relatedness) then they will be more likely to be self-determined and feel a greater sense of satisfaction.

3.3.3 Self-Efficacy Theory

SET is founded on the concept that motivation is built on self-belief; the higher an individual's self-efficacy, the more likely they are to succeed in a specific task or situation. Bandura (1977) outlined four experiences from which we can source self-efficacy: mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states. SET is a subset of Bandura's (1986) Social Cognitive Theory.

Figure 3.2 *Self-efficacy theory: Adapted from Bandura (1977).*

Mastery experiences, also known as performance experiences, refer to both negative and positive past experiences that can influence an individual's feelings towards a similar task (Bandura, 1977).

Vicarious experiences involve an individual observing someone else in a similar position and can either increase or decrease self-efficacy through competency comparisons (Bandura, 1977). Verbal persuasion involves encouraging or discouraging others through feedback. Physiological feedback relates to the physical experiences individuals may feel towards a particular task, such as anxiety or nervousness.

3.3.3.1 Measuring Self-Efficacy

The literature suggests a need for more reliable and valid measures of psychological needs in music learning (Evans, 2015). As a result, a new scale for measuring self-efficacy has been designed. There are two key areas to be aware of when measuring self-efficacy. Firstly, because self-efficacy differs across domains, measurement scales should be customised to be relevant (Bandura, 2006). Bandura provides an example and states that an individual might "have a high sense of organisational efficacy but low parenting efficacy" (2006, p. 307).

Secondly, the wording of the measurement scale must be phrased in a specific way because self-efficacy is concerned with perceived capability and not an individual's intention. Several scales were analysed to measure self-efficacy. It was decided that an adaptation and combination of the Self-Efficacy in Discipline Scale (SEDS) by the Centre for Higher Education Research and Scholarship at Imperial College London and Bandura's Driving Self-Efficacy scale (2006, p. 323) should be used. SEDS was adapted from the Harvard-Panorama Student Perception Survey, which measures self-efficacy within an individual's discipline or profession (Imperial College London, n.d.). SEDS has undergone rigorous development to ensure a valid and reliable scale. Imperial College London has followed the best practice guidelines of Krosnick and Presser (2010) and Schwarz (1999) concerning designing research instruments, question-wording and questionnaire design.

SEDS is a five-item Likert scale questionnaire that asks an individual to answer the questions while thinking about their life in general. The scale ranges from one to five, with the lowest answer being "not at all confident" and the highest being "Extremely confident". If individuals rate themselves as confident in one or more areas, they can be described as having high self-efficacy in that area. Bandura's Driving Self-Efficacy Scale (2006) is a seven-item questionnaire with an overarching question: "Please rate how certain you are that you can drive in the situations described below". An example situation is "Drive on narrow mountain roads". The learner is then asked to rate their confidence against

each item by recording a number from zero to 100, zero being the lowest, "cannot do at all", to the highest, 100, "Highly certain can do". Similar to SEDS, the higher the recorded number, the higher an individual's self-efficacy is said to be. Bandura's Driving Self-Efficacy Scale was chosen as driving a car and playing an instrument are considered psychomotor skills. Psychomotor skills are movement-oriented activities which often require hand-eye coordination. These skills require the learner to focus on learning the physical attributes and the associated knowledge and value (Oermann, 1990).

3.4 Ethical Foundations

Like all forms of research, autoethnography involves a range of ethical considerations that researchers must address before conducting their study. Adams et al. (2015) categorise ethics into three categories. The first is procedural ethics, which includes board reviews and institutional processes for seeking permission to conduct research. The second is situational ethics, described as "processes for engaging with others ethically as projects unfold" (Adams et al., 2015, p. 60). The third is relational ethics, which refers to the ethical considerations and responsibilities arising from the relationships between the researcher and those included in the narrative.

The topic of self-ethics is also an important consideration, as Chang (2008) points out that there may be an assumption that ethics does not apply to the use of self in the research design (p. 68). While autoethnography offers unique opportunities for insight and understanding, it also presents complex ethical challenges that must be carefully managed throughout the research process.

3.4.1 Procedural Ethics

Procedural ethics refers to the formal ethical review process researchers must undergo before conducting a research study. Because of the personal nature of autoethnography, the researcher can be presented with challenging ethical situations; therefore, researchers must provide a detailed proposal outlining the risks and benefits of autoethnography on participants and how these risks might be mitigated. For this study, ethical approval was obtained from Lancaster

University. A participant information sheet and consent form (see Appendices B and C) were provided to all participants prior to conducting interviews and collecting data.

3.4.2 Situational Ethics

Autoethnography often involves recounting personal experiences, including interactions across different cultural contexts. Situational ethics in autoethnography relates to being mindful of the complex relationship between the researchers' personal experiences and the broader social and cultural contexts in which they are situated and making ethical decisions that respect this complexity. An example of this is to ensure that if a change of circumstance or a particular theme is generated due to the conversation, the appropriate consent has been provided. Explicit permission must be obtained from participants and anyone (such as family or friends) who may appear in quotes or narratives. Any potential privacy concerns must be carefully considered, and it is essential to respect the privacy and anonymity of all participants to ensure that ethical standards are maintained.

3.4.3 Relational Ethics

Relational ethics focuses on the interconnectedness of individuals, acknowledging that our actions affect others and that ethical responsibilities stem from our relationships with others (Adams et al., 2015). A researcher must consider several critical ethical considerations when conducting an autoethnography. First and foremost, researchers must consider how their research and writing will impact the individuals represented in the study and themselves. The researcher must not harm or cause distress to their participants (Muncey, 2010). One approach to relational ethics is friendship-as-a-method, where researchers treat their relationships with participants as a friendship (Adams et al., 2015). However, this method does not address all ethical dilemmas that can occur. I did not anticipate any participants would feel any distress from my prepared questions. However, I did have notes to check that the conversation was not causing anyone any distress.

Other questions I would ask myself during the write-up stage of this study are as follows: *How are individuals, including myself, depicted? How might this representation impact me or my participants? Have I protected the identities of my participants? Could they be identified from their quotes or narratives?*

All information that could potentially identify participants (such as their names) has been removed to maintain anonymity. Additionally, I have taken measures to ensure that no direct quotes or specific details from the study could be used to identify any participants. Regarding autoethnographic data, I have committed to only sharing experiences and narratives that directly relate to the topic of this research project. Family and friends consented to share conversations, and names have been altered where required. I can confirm that sharing this narrative will not cause an adverse impact.

Member checking is a process that involves participants checking and verifying the collected data to determine whether the participants feel that they are accurate and credible (Creswell, 2018). For the autoethnography, I used member checking with friends and family to review personal reflections and ensure accuracy. Additionally, I invited participants from the semi-structured interviews to review and validate the data related to their contributions, maintaining accuracy and authenticity in their responses.

3.4.4 Self-Ethics

If not approached and planned carefully, autoethnography can carry personal risk. Autoethnography often involves delving into personal, potentially sensitive, or traumatic experiences and researchers should consider their emotional well-being throughout the process (Adams et al., 2015). Another area to consider is the impact of the research on personal and professional relationships when made public. For example, the researcher's identity is already known. Therefore, including stories or narratives from real-life situations from close friends and family may not be enough to ensure privacy. Privacy is crucial for both the researcher and the individuals or communities who may be indirectly involved in the research. Even if pseudonyms are used, the researcher must consider whether individuals could still be identified from the narrative.

Researchers should also be respectful of others even if shared stories conflict with the researcher's own experiences.

Experience of writing an evocative autoethnography in the past allowed me to develop a personal gauge to determine how comfortable I am with sharing specific narratives. In addition, member checking with friends and family and talking through potential issues with my supervisor have helped me to make informed ethical decisions about the impact on myself and others.

Chapter 4: Research Design

It is important to clearly and concisely explain the methods used when conducting research to ensure accurate and reliable results. In doing so, it helps to establish the credibility of the research and ensures that others can replicate the study if necessary. In this section, I outline the methods for gathering and analysing data. While this study focuses on analysing qualitative data, some contextual quantitative data was captured, such as the number of practice sessions completed and how long each session lasted.

4.1 Research Environment: Equipment and Technology

Research equipment facilitates data collection, measurement, and analysis. It can include various tools, instruments, and devices designed to meet specific research needs. This section describes the research environment, including the hardware and software chosen and used in this study.

4.1.1 Hardware

After an initial assessment of the equipment, it was initially thought that lessons could be conducted using an Android smartphone. While this approach could be appropriate, some accessibility issues were discovered. The initial smartphone consisted of a 6.5-inch screen.

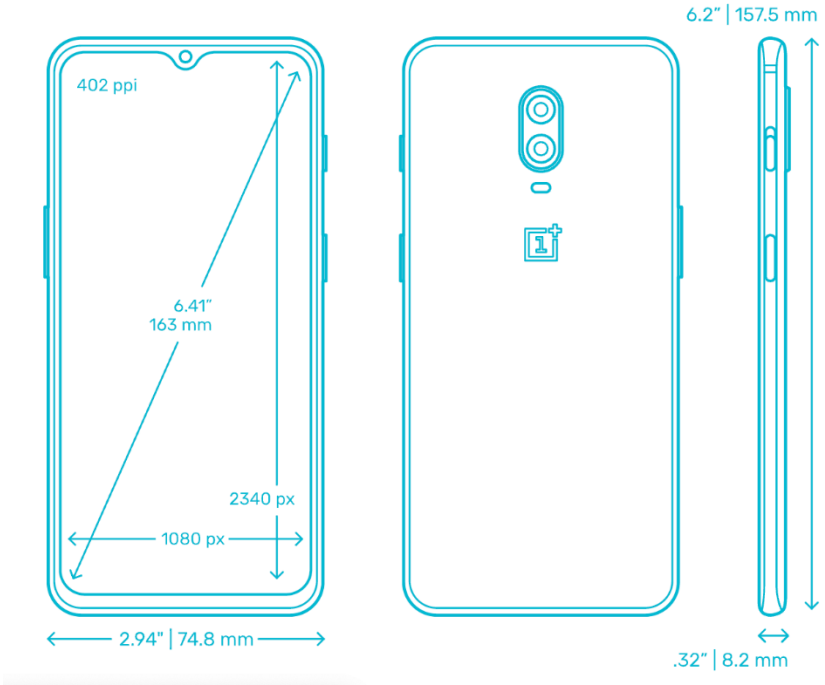

Figure 4.1 *Dimensions of the One Plus 6T smartphone (Dimensions.com, n.d.).*

While this is usable in hand close-up, the screen size was too small when placed on the sheet music stand, making the app challenging to see. Consequently, a 10.5-inch, 3rd-generation Apple iPad Air was chosen instead.

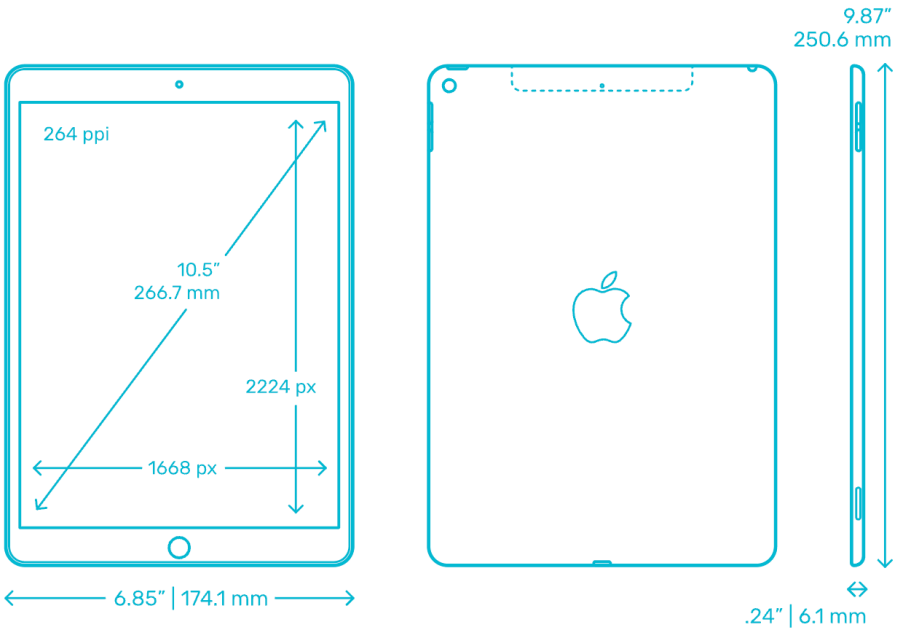

Figure 4.2 *Dimensions of the Apple iPad Air (Dimensions.com, n.d.).*

A Rockjam RJ561 Digital Piano, often referred to as a digital keyboard, was initially used. It was purchased as a gift for learning the piano. However, a second instrument was purchased shortly after this research study began; full details of why this occurred can be found in the findings. The new instrument was a Yamaha PSR-E373 digital keyboard.

Figure 4.3 *Yamaha PSR-E373 digital keyboard.*

There may be questions about why a digital keyboard has been chosen over a traditional standing piano. This is because there is some disproportionate burden with obtaining a piano for lessons. Firstly, cost; an upright piano can cost thousands. Secondly, regarding size and weight, a minimum area of 2x2 metres would be needed to store a piano. Lastly, a piano needs regular tuning and maintenance by a specialist to keep it in good working order. Therefore, it is impractical to learn on a real piano. Learning the piano on a digital piano or keyboard is possible and a good alternative (School of Rock, 2019).

You can purchase a digital piano or keyboard with the same number of keys as a standard piano, of which the layout is identical. A traditional piano typically has 88 keys, although you can learn with fewer (the RockJam digital piano and Yamaha PSR-E373 have 61 keys). To transfer from a keyboard to a piano would take some adjustment. The width of piano keys and the pressure needed to depress the keys can differ. While a digital piano or keyboard may sound different from a traditional piano, many modern instruments are designed to replicate the sound of a grand piano as closely as possible.

4.1.2 Software

I chose to use the Simply Piano app, created by JoyTunes, as the app for learning the piano. I purchased a one-year subscription, which cost £89 and included a promotional discount. After some initial research, I chose to use the Simply Piano app as, at the time, it had scored a 4.5-star rating out of five on the Apple App Store. Simply Piano is a popular app and has won several awards. Personal preference was also a deciding factor; I signed up for a free trial and liked the format, look and feel. It is aesthetically pleasing, easy to learn, and intuitive to use.

4.1.3 The Simply Piano App

The Simply Piano app is available to download from the Google Play Store or the Apple App Store. It is only available for mobile devices running Android or iOS operating systems. The app uses note recognition to identify which notes have been played, and there are two connection methods for using the app with an instrument. The first method assumes a digital piano or keyboard is being used and works by physically connecting the mobile device to the keyboard using a musical instrument digital interface (MIDI). Not all keyboards have built-in MIDI, so this method can only be used if the equipment is compatible. MIDI provides a direct connection between the instrument and the mobile device, so when a key is pressed, a signal is sent to the app, which tells it which note has been played. This direct connection is a very reliable method for note recognition.

The second method uses the mobile device’s microphone for note recognition. In this method, the app "listens" for audio and detects which notes have been played. This method can be unreliable as the software does not always recognise notes, recognises notes incorrectly or recognises background noise as notes. Using headphones is one way to eliminate background noise as it sends the music and audio feedback from the app through the headphones rather than the speakers of the mobile device. However, there is still potential for other background noise to cause interference. Another suggestion is to

increase the keyboard's volume or to press the notes harder. This projects the audio, making it easier for the microphone to detect and recognise notes. However, as before, this method assumes the use of a digital piano or keyboard.

4.1.4 The Interface

At the time of writing, there are 27 courses available within the app, consisting of two main streams: Soloist and Chords. There are also some special courses which are occasionally added throughout. When accessing the app via the Course option or the Songs option, the screen splits and mimics the setup of a piano with sheet music. When in Course mode, you are presented with a stave that displays a few bars of music, which you are prompted to play and complete three times. These bars are either random practice pieces or form larger songs. If you are unsure how the bar should sound, you can select the 'ear' icon, which plays what the bar should sound like. When a note is played, the software recognises this, and feedback is displayed on the screen. This feedback shows which key was pressed on the keyboard and which note it aligns with on the sheet music. The notes on the stave change colour depending on whether they have been identified correctly; notes played incorrectly turn red, while notes played correctly turn blue. If you pause for too long, the note turns yellow, and the app provides you with a hint and highlights on the screen which key should be pressed.

Figure 4.4 *Keyboard setup with the Simply Piano app displayed on the iPad.*

After the practice pieces have been completed, you are presented with a scrolling stave that moves from right to left, accompanied by a backing track, which you are prompted to play along to. The aim is to match the notes, speed and rhythm. If you get too many notes wrong, the app will stop and rewind and prompt you to start the section again. If you continue to make too many mistakes, the app will enter 'practice mode', where you play the bar slowly with a metronome. The scrolling window also stops and will not move to the following note until you have played the correct note. This ensures you correctly identify the note before moving forward.

All exercises within each course must be completed in order, and there is no skipping ahead. You can practice and play entire songs in Songs mode. Many of these songs are also used in Course mode. If you choose to practice a song, the session is broken down by chorus and verse or by specific parts of the song. When playing a whole song in this mode, the practice prompts do not interrupt you, meaning you can play the wrong notes without the app correcting you. There are also options to play songs at different speeds: 60%, 80% and

100%. At the end of the song, you are given a three-star rating, which tells you how accurately you played the song concerning speed and note recognition. You are awarded three stars if you play the song perfectly.

4.2 Data Collection Methods

Data collection aims to systematically gather and analyse information relevant to the research question or hypothesis. It is important to ensure that the method used is reliable and accurate for the intended purpose. In this section, I outline the methods chosen for this study and provide details of the equipment and instruments used to gather data and the data collection process.

4.2.1 Data Collection: Autoethnography

Narrative, reflection and observation data was captured as part of the data collection method relating to autoethnography. Two journals were kept: a handwritten journal, which took the form of a traditional notebook, and an online learning journal. The handwritten journal was kept first to capture quick notes and reflections. A more formal online learning journal was later created and designed as a form to be completed at the end of each session. The online journal was kept in Monday.com, an online Software-as-a-Service application that could be accessed using a web browser on any mobile device (see Appendix C).

The online learning journal consisted of eight questions (see Appendix D), two were prepopulated with different feelings, enabling quick selection. An overarching feeling was chosen first, followed by any feeling subsets.

Audio and video recordings of the researcher were also collected. A GoPro Hero 9 was used to capture audio and video, while an iPad was used to take screen recordings of the app. It was hoped that observation data would be recorded as some capabilities were available to plug the equipment into a laptop. The idea was that video, audio and a screen recording of several practice sessions could be recorded and combined. While this did occur occasionally, there were often technical difficulties capturing the different media

streams. At times, video was captured, but audio was missing, and vice versa. As a result, not many of these recordings were made as they became too time-consuming.

4.2.1.1 The Feel Wheel

The Feel Wheel prepopulated several questions in the online learning journal. While working as a psychotherapist, Willcox (1982) observed that people often had difficulty describing their feelings. As a direct result, the Feeling Wheel was developed, its purpose "to aid people in learning to recognise and communicate about their feelings" (1982, p. 1). The Feeling Wheel builds upon the ideas of therapist Joseph Zinker and psychologist Robert Plutchick. Roberts (2015) expanded upon the work of Willcox to create the Wheel of Emotional Words, also known as the Feel Wheel. Like Willcox, Roberts describes working with individuals with a limited emotional vocabulary and observed the difficulty that these individuals had in describing their feelings (2015). While the exact origin of the Feel Wheel is somewhat blurred and undocumented in academic literature, online references describe individual researchers and therapists adapting the wheel for their practice.

Feel Wheel consists of sectors containing the names of six primary feelings: mad, sad, scared, joyful, powerful and peaceful. The two outer rings expand on these feelings and include names of secondary feelings related to the primary feelings. The Feeling Wheel also contains blank sections interspersed in the outer ring, the intention being that individuals could add their feelings into these spaces if they wished. Roberts' Feel Wheel removes the blank areas and increases the overall feelings to 130. After researching several models relating to feeling recognition and identification, it was decided that the Feel Wheel would be used as the primary model due to its ease of use and comprehensive list of feelings. The researcher-participant also felt that the Feel Wheel was relevant and relatable compared to other models.

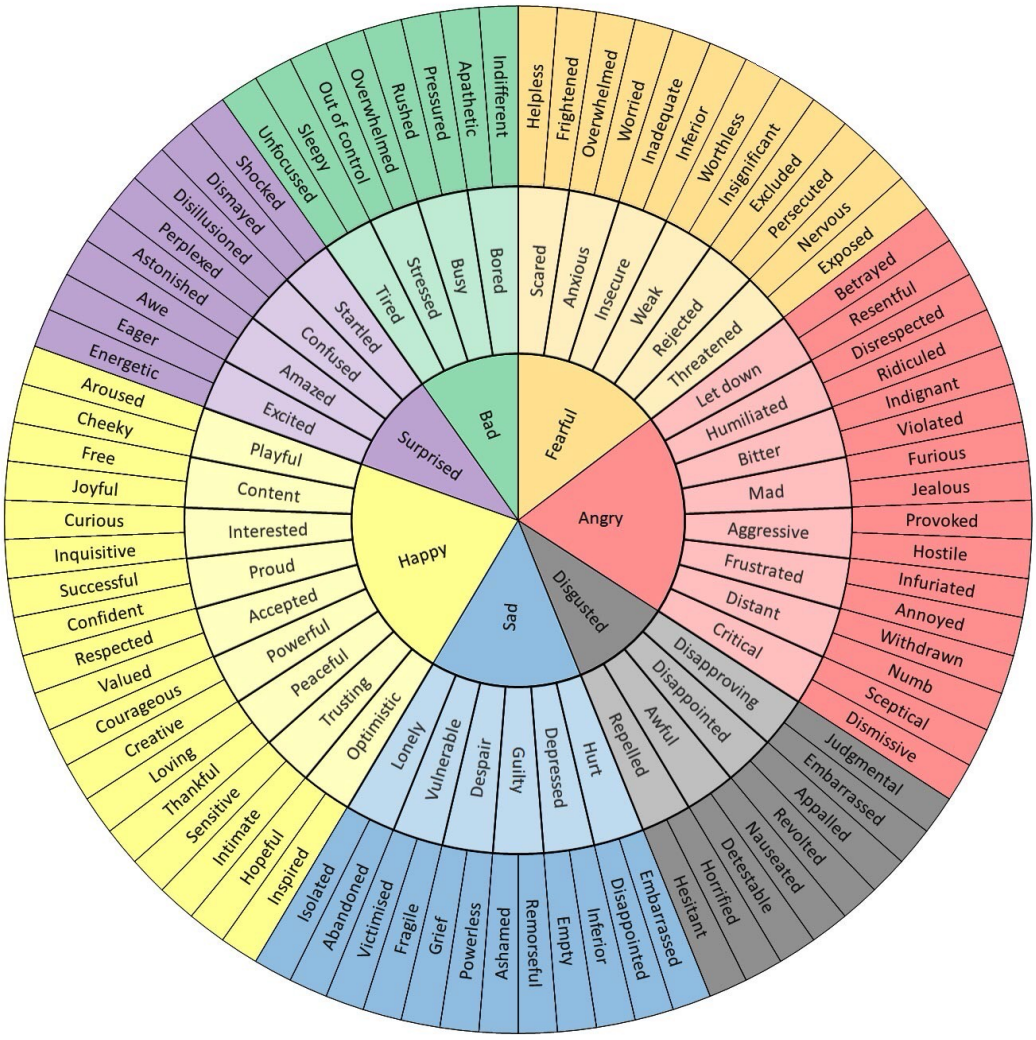

Figure 4.5 *Roberts, G. (2015, March 5). I Feel – Emotional Word Wheel – The Feel Wheel [Image]. Imgur. https://imgur.com/tCWChf6.*

4.2.2 Data Collection: Musical Instrument Learning App Self-Efficacy Scale

The Musical Instrument Learning App Self-Efficacy scale (MILASE) adapts SEDS and Bandura's Driving Self-Efficacy Scale. The MILASE scale keeps the original 5-point Likert scale and is presented as a questionnaire. To make the questionnaire more specific to the disciplinary area of my study, the overarching question was adapted to focus on learning an instrument using apps. These questions are similar to those in Bandura's Driving Self-Efficacy Scale. There are several issues to consider when choosing a questionnaire scale. Bandura's

Driving Self-Efficacy Scale uses a 100-point scale broken down into 10-point intervals, while SEDS uses a 5-point Likert scale.

Bandura suggests smaller scales are less reliable and should be avoided (2006), while Imperial College London recommends using at least five response options per scale. The Likert scale is a scientifically validated tool for measuring human attitudes and is extensively used in social science and educational research. I decided to use the 5-point Likert scale from SEDS because the survey was only intended to be completed by myself, making it sufficient to capture the necessary data for evaluating my self-efficacy. Adaptation rather than creation was chosen as the method of developing the questionnaires as it would ensure that a level of validity was kept within the questionnaire. The questions were created by analysing the learning outcomes of a beginner learning an instrument, and these were then captured and turned into discipline-related questions. The questionnaire was designed to be 'instrument-agnostic,' meaning it focused on skills and concepts applicable not only to learning the piano but also to other instruments and areas of music. This approach ensured the questionnaire could be reused with participants learning different instruments if needed.

When creating questions for measuring self-efficacy, the questions must encourage individuals to reflect on their present capabilities (Bandura, 2006). As such, the questions were phrased to encourage this specific introspection. The final version of the MILASE scale can be found in Appendix F. This questionnaire was completed with additional notes before and after the learning journey. These were later reflected upon and compared against the four areas of SET, to measure self-efficacy before and after the experience.

4.2.3 Data Collection: Interviews

Ten semi-structured interviews were conducted. The original plan was to use social media as the sole method for recruitment. Due to unforeseen difficulties, two stages of recruitment took place, which used two different methods. In the first stage, Facebook, X (formally known as Twitter), Reddit, and my blog were used as advertising platforms.

Direct messaging to groups and interested individuals were also sent. The second round of recruitment occurred on the User Interviews platform, an online research recruitment platform which acted as a gatekeeper.

Across all stages, participants were sent a participant information form and asked to complete a consent form. These were created and hosted digitally. Participants were sent a link to book a date and time that suited them for the interview. Interviews lasted one hour, took place remotely and were recorded using the video conferencing software Zoom. Early on, it was decided that participants should be offered an incentive to make recruitment and advertisement more appealing. A £15 gift card incentive was offered as compensation.

Five participants were recruited during the first round of recruitment, and five were recruited during the second round. Participants were chosen using purposive sampling techniques, as all individuals needed to be learning an instrument using an app. This took the form of an initial set of screener questions: What instrument are you currently learning? What mobile application are you currently using to learn? How long have you been learning an instrument using an app?

When the screeners had been completed, they were analysed for suitability. Individuals learning to play the piano for more than six months using the Simply Piano app were prioritised. This is because the criteria were similar to the researcher's experience at that time. Individuals learning the piano using different apps for any length of time were considered a possible fit. Individuals learning to play any instrument using any app were considered if the first set of criteria were not met or if no suitable candidates could be sourced.

Prior to conducting interviews, an interview protocol was developed. Burkholder et al. (2020) recommend using such a tool to ensure consistent interviews. This protocol included details such as the interviewee's name, the list of semi-structured questions (see Appendix G), possible probes to use to elicit more information, and short opening and closing instructions. These instructions

helped set interview ground rules and inform the participants what to do if they lost access to the internet or dropped out of the call.

4.2.3.1 Stage One: Recruiting Participants Using Social Media

The first stage of recruitment began on Facebook, where a search took place for relevant community groups. Initial searches focused more on learning the piano and keyboard, and terms included learning piano, learning keyboard, mobile piano, piano app and adults learning piano. Searches were also conducted for groups relating to similar apps, such as Simply Piano, Yousician, and Flowkey. It was unclear how the Facebook search algorithm worked; the platform displayed nine results initially, but hundreds of communities were displayed when the option to 'see all' was expanded. The search feature within Facebook did not show the total number of groups available. Searching for groups by member numbers or average daily posts was impossible as the search functionalities were limited. Communities were sorted into groups to filter those aligned more closely to learning an instrument using apps. The following groups were removed: private music groups, non-English groups, groups associated with schools, colleges, and music schools, groups selling instruments or sheet music, and groups for teachers. The final list was then analysed, and groups that appeared more aligned with traditional learning and teaching methods were omitted.

Six groups were chosen as initial candidates; four related explicitly to adults learning using apps, one of which was the Simply Piano Community. Many communities had rules that stipulated individuals should contact moderators before posting advertisements or messaging group members. The group moderators were contacted with information about the study, and all six communities denied the request to post a message about the study on the board. The reasons given revolved around the advertisement being classed as "self-promotion material".

A similar search was conducted on the social media platform Reddit. Three groups were identified, and moderators were messaged. One group approved the advertisement, and it was posted publicly.

The social media platform X was also used to advertise the study. Research was conducted into popular hashtags relating to the topic of the study, as well as previously advertised research studies on similar topics. With a 160-character limit per message, it needed to be short and succinct. Once the post was written, it was submitted with an accompanying infographic, and the hashtags #SimplyPiano #Yousician #flowkey #learnpiano #PerfectPiano #pianoapp #Research were used. Lastly, a blog post was written and advertised on the researcher's blog.

Out of the five participants chosen for interview in stage one, one responded to the blog post, while four responded to the advertisement on X.

4.2.3.2 X Recruitment Challenges

The internet provides an opportunity to recruit individuals from across the globe on a large scale; this is especially useful if a research study requires participants that fall into a niche category. A disadvantage of internet recruitment comes from data fraud, where individuals pose as genuinely interested participants (Hamilton and Bowers, 2006). While falsification is not unheard of when using traditional methods (Duffy, 2002), it has been suggested that it is easier for individuals to mispresent and mask their identities online (Hamilton and Bowers, 2006). Having an IT background made the researcher very aware of common scams that can be conducted online, particularly email phishing attacks. Automated messages, also known as bots, and email spam messages were among some of the issues encountered during stage one using the social media platform X. When the post was first sent, approximately one hundred emails were received from interested individuals over three days. Many of these emails appeared suspicious, and several identifying factors contributed to this. Many emails were sent and received in bulk; they arrived synchronously within a couple of seconds or minutes of one another. Messages were often short, containing one or two words, for example, "I'm interested". Content contained references that did not relate to the interviews, for example, "interested in your focus group" or "I would like to attend your meeting". The content of some messages was identical to others, which included spelling

mistakes and grammatical errors. Emails were sent from Gmail email accounts and contained lengthy usernames of alphanumeric characters, many of which appeared nonsensical.

4.2.3.3 Email Screening Framework

Because many emails contained criteria flagged as suspicious, an email screening framework was developed. This framework was based on cyber security best practices and was used to help guide the integrity and trustworthiness of communications. The framework consisted of checks that helped identify legitimate interests. Hamilton and Bowers recommend several steps to ensure data integrity, including screening methods or asking individuals to provide proof of address or identification (2006). As a result, once the framework had been applied to an email response, a follow-up screener was sent. This response was also subject to the same screening framework until it was determined that the interest was legitimate. The framework included the following questions.

1. Were messages received within minutes or seconds of one another?
2. Are the messages short? E.g. one word or line?
3. Does the message contain irrelevant or inaccurate information?
4. Does the message contain a lot of typos or grammatical errors?
5. Is the message content similar or identical to other messages?

If the answer to these questions was yes, proceeding cautiously would be advisable. Alternatively, if the answer was no, then additional questions were proposed that focused on the legitimacy of the email address.

1. Does the email address appear legitimate? (for example, a business email address or university address e.g. ac.uk?)
2. Does the message read like a genuine email? (Is it properly constructed and includes a greeting and sign-off?).

A follow-up screener was sent if the answer to these additional questions was yes. If the answer was no, it indicated a need to proceed with caution.

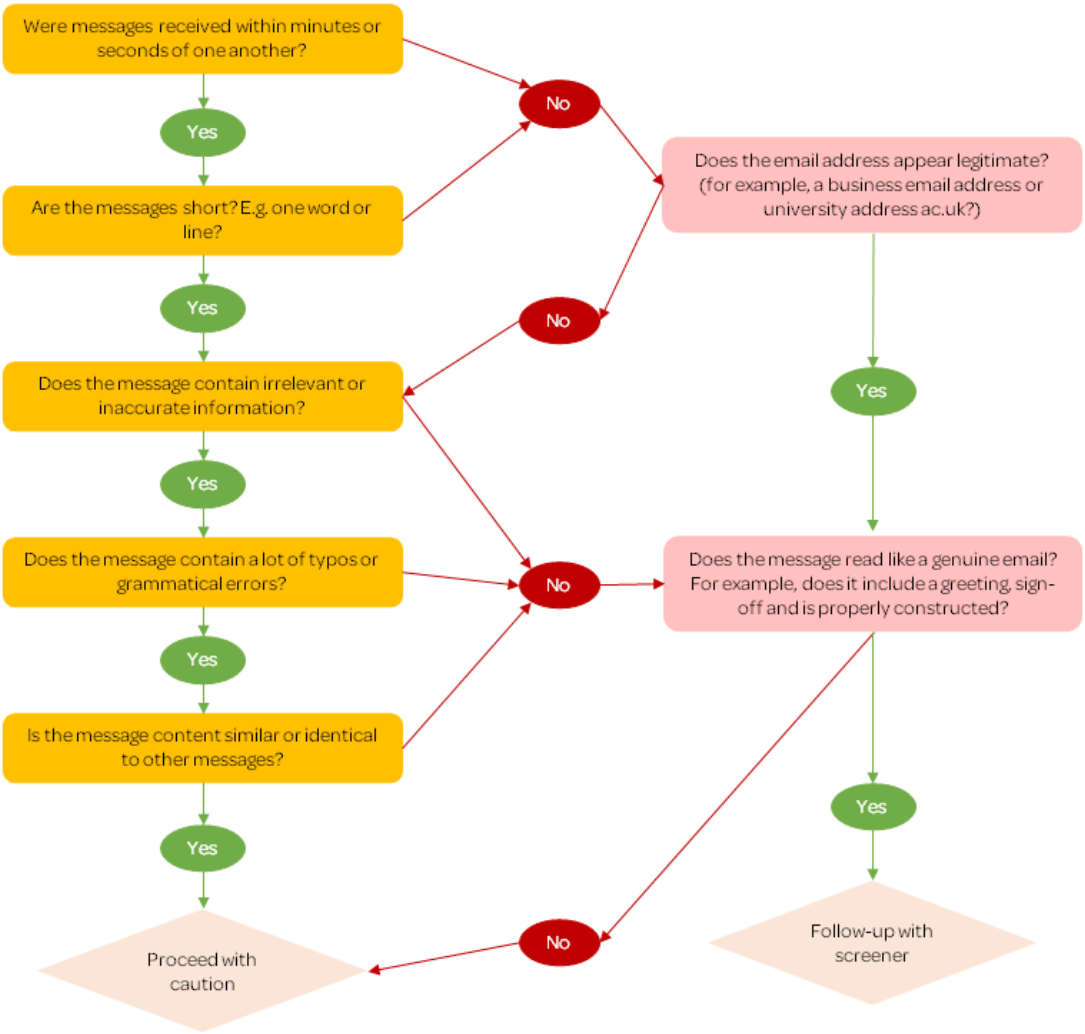

Figure 4.6 *The email screening framework.*

4.2.3.4 X Demographics

Demographics are integral to why a second recruitment stage and method was employed. Hamilton and Bowers (2006) state that the Internet can be a valuable recruitment tool if the participant's experience is of more concern than demographics. During stage one recruitment, participants were not asked to disclose their demographic information before the interview. Instead, demographic data was captured during the interview. This approach would help to reduce bias, create a fairer selection process and remove barriers to recruitment. After the interviews, it was discovered that all participants sourced using X were living in the United Kingdom. To widen the demographic and

ensure a more diverse sample, it was decided that a second approach using a different method should be explored.

4.2.3.5 Reliability

Reliability was another issue associated with participants sourced on X. Several participants turned up to interviews late, and many experienced technology issues. Internet connectivity issues were prevalent, with many participants dropping in and out of the call. Microphone quality was often poor, with the audio not being loud enough with lots of background noise. There was difficulty understanding some participants, which resulted in time spent clarifying and asking participants to repeat answers. X participants were also the least responsive. Interviews were often much shorter, and answers were not very descriptive, which meant that interview tactics were used to elicit more descriptive answers.

4.2.3.6 A Change to Interview Approach

Interviews conducted using X were very problematic. The experience was conducive to what Slowe (2017) outlines in a blog post, where it is recommended to combine recruitment approaches to offset potential issues that may occur. Slowe (2017) also recommends using a second recruitment method, as X may not reflect a wide societal demographic. Lastly, time was spent sifting and sorting through spam and messages from bots, which took the time away from identifying suitable candidates. If some initial screening could be done externally, it would save time, a crucial factor in changing the recruitment approach. After investigating other possible avenues for recruitment, it was decided that a gatekeeper in the form of a research recruiting website called User Interviews would be used.

4.2.3.7 Stage Two: Recruiting Participants Using the User Interviews Platform

The User Interviews panel includes over 350,000 vetted professionals and consumers (Abbamonte, 2021). Candidates for the panel are sourced in

different ways, mainly via LinkedIn and Facebook, which extends the reach of recruitment as it is not limited to individuals who may only use one social media platform, e.g. X.

Participant quality assurance checks are carried out in several ways; participants are asked to provide social media profile information (where possible), and anti-fraud systems are in place to help identify suspicious behaviour. There is a strict policy that flags individuals who do not show up for an interview and checks in place that scan responses provided in the screener questionnaire. Once an interview has been conducted, the researcher can give a rating and feedback on the session. Technology to monitor and reduce fraud ensures that individuals cannot create multiple accounts. User Interviews does not share how the system automatically flags fraudulent behaviour.

User Interviews is a paid-for platform that offers several ways of conducting research. As five interviews had already been conducted during the first stage, it was decided that five participants would be chosen for interview using the User Interviews platform. It should be noted that there was a special offer on the website at the time of recruitment, meaning the first three interviews were conducted for free (minus the incentive).

Once the project was launched, individuals who answered the screener questions were added to the list of participants. Participants could then be marked as *best fit*, *potential fit* or *not a fit*. This meant filtering could be completed quickly and easily. Individuals marked as Best Fit were invited to interview. Accessing a pre-vetted panel of participants was one of the benefits of using this platform. Other benefits include the ability to screen candidates before approving and inviting them for an interview and the ability to integrate different technologies such as Outlook and Zoom. Once participants were invited to interview, they could schedule a meeting and attend the interview using a single platform. The User Interviews platform also distributed incentives. Overall, there was more time to focus on choosing suitable candidates to interview than screening and administration.

Interviews with User Interview participants were less problematic and much more engaging. Participants were more demographically diverse and willing to share experiences and stories without additional probes. There were fewer technical difficulties related to internet connectivity and no audio quality issues.

4.2.4 Data Collection Mapping

Below is a table that outlines which data collection methods map to the research questions.

c	Mapped RQs
Self-narrative, reflection and observation	1.2, 1.3, 2.1, 2.2, 2.3
MILASE questionnaire	1.1
Interviews	1.3, 3.1, 3.2, 3.3

Table 4.1 *A mapping of how each method and participant relates to each research question.*

4.3 Data Analysis

Data analysis is critical, allowing researchers to make sense of the data collected to draw meaningful conclusions. Choosing an appropriate data analysis method is crucial for ensuring the validity and reliability of research findings and aligning the research with existing theoretical frameworks and empirical evidence. This section presents the framework chosen for data analysis and details of the analytic process.

4.3.1 Thematic Analysis

Thematic Analysis (TA) is an umbrella term for qualitative data analysis methods. TA involves highlighting data segments into codes and then organising and interpreting patterns of meaning. Coding data requires sections of text to be highlighted and given a code that describes the content. These

codes are then analysed for patterns and organised into themes; these themes are the outcomes of the coding process (Saldaña, 2021). This process allows researchers to explore phenomena in-depth by examining the identified patterns and themes. Characteristics of a TA method typically consist of three approaches: a coding reliability approach, a codebook approach and a reflexive approach (Braun et al., 2019). The coding reliability approach involves assessing the consistency of coding across multiple coders.

In contrast, the codebook approach involves developing a codebook that outlines the codes and themes used in the analysis. The reflexive approach focuses on the researcher's subjectivity and engagement with the data and involves a more interpretive and reflexive process. This involves critical and reflexive analysis, exploring how meanings are constructed and how the researcher’s assumptions influence them.

4.3.1.1 Reflexive Thematic Analysis

This study explores concepts related to the experiences and emotions of individuals. Therefore, the context of the data is complex. Reflexive Thematic Analysis (RTA) was chosen as the data analysis method of this study, and it is an interpretive approach that involves the researcher's reflexivity and engagement with the data (Braun & Clarke, 2019). RTA differs from other TA methods because it focuses on reflexivity and the process of codebook development. There is an emphasis on the importance of reflexivity as researchers are actively encouraged to critically reflect on their assumptions, biases, and experiences. Flexibility is another key area of RTA that allows for themes to be generated from the data, promoting creativity as researchers have more freedom in the analysis process, which can lead to richer and more nuanced findings. However, RTA has some drawbacks; it is time-consuming and requires several data analysis cycles. Subjectivity can also be an issue as there is a risk that the analysis can become too focused on the researcher's personal experiences and biases, leading to less objective findings. While RTA's flexibility and interpretive notions may be seen as a benefit, there is a danger that this also carries a lack of transparency, as it can be more

challenging to ensure the analysis process is replicable. These drawbacks were considered, but this method was chosen based on its compatibility with the methodology. RTA works well alongside autoethnography as both focus heavily on reflexivity and self-reflection. Alternatives, such as content or discourse analysis could have been used. Content analysis typically focuses on larger data quantities, whereas TA can analyse smaller texts.

The coding process in content analysis also tends to be more deductive, whereas RTA allows a mixed methods approach. Interpretive phenomenological Analysis (IPA) is a similar qualitative approach that aims to understand how individuals experience a phenomenon by exploring subjective perspectives. While IPA can be used as a methodology and a method, it comes with more rigidity in its application. RTA can only be used as a method, which is attributed to its flexibility; for example, it can be used across a range of epistemological and ontological paradigms, there are no sampling requirements, a range of theories can underpin it, and it can be used to answer a broad range of research questions (Braun & Clarke, n.d.).

4.3.2 Six-Stage Thematic Analysis Process

The six-stage thematic analysis process developed by Braun and Clarke (2021) was followed to analyse the data, which can also be applied to RTA. This process involved several rounds of analysis, beginning with familiarisation with the data and generating a draft set of codes.

There are benefits to the researcher conducting transcription as they become more intimately acquainted with the content (Burkholder et al., 2020). However, transcription is highly time-consuming; as a result, it was decided that a third-party service would be used in the first instance as a review of the documents would still be needed. When all interviews had been conducted, they were uploaded to Rev.com for transcription. Rev.com’s human transcription service was selected for its accuracy and reliability. To protect data privacy, all personally identifiable information, such as participants' names, was removed from the original audio prior to uploading. Rev.com adheres to strict confidentiality agreements to protect participant data.

Once the transcripts were received, each document was checked and read while listening to the interview audio recording; this is recommended to ensure transcript accuracy (Burkholder et al., 2020). The learning journal, notes, observations, and MILASE pre- and post-survey were all gathered and imported into the NVivo software tool. NVivo was used to store, organise and make sense of the data, although notes were often recorded on paper during the analysis process.

It is important to recognise how meaning is constructed from the coding process to understand how data has been interpreted. A deductive approach (or top-down approach) is where general principles or theories are used to make predictions or drive specific conclusions. An inductive approach (or bottom-up approach) uses observations or evidence to form conclusions or theories (Braun & Clarke, 2006; 2021). As the research questions drove the analysis, it takes more of a deductive approach. The questions during the semi-structured interviews were the starting point for coding and theme development. The following describes the RTA process and the approach to coding, generating themes and making sense of the data.

Stage One: Become familiar with the data

The first stage of the process is to become familiar with the data. While the interviews were transcribed externally, they needed to be checked and verified. The data was imported into NVivo, and the familiarisation process began with the transcribed interviews. The journal notes and reflections were then imported and coded. An Excel spreadsheet was created to analyse the data collected related to feelings. The familiarisation process consisted of reading the transcripts and making rough notes, cleaning up the data by correcting typos or misinterpreted audio and categorising the transcript into questions and answers. Once this process was complete, there were two datasets: Dataset one contained data from the participant interviews, while dataset two contained the data collected from autoethnography.

Stage Two: Generate initial codes

Stage two involves highlighting and labelling data related to the research question. Braun and Clarke (2021) describe two approaches to coding: semantic and latent. Semantic coding looks at data at the surface level and generates codes that are descriptive and representative of what the participant has discussed. This approach to coding captures explicit meaning. In contrast, latent coding aims to capture implicit meaning to uncover underlying meaning related to motivations and emotions. The approach to coding was to capture and code the interview questions in dataset one first, then code dataset two. Semantic codes were captured first; the approach was to code all the interview questions followed by the answers. The dataset was reviewed again to capture keywords and highlight meaningful sentences. More time was spent coding dataset two than one because the semi-structured interview questions more easily captured the data's overarching themes. Therefore, much surface-level data had already been split into relevant segments. Dataset two took longer to code, as the data was more reflexive and less structured.

Stage Three: Search for themes

Stage three involves looking for patterns and connections within the codes and grouping them into themes. During the semantic coding stage in dataset one, many of the codes generated included statements referencing time, so these codes were analysed to create a theme from the connecting patterns. In dataset two, most codes referenced feelings, so while grouping these into a feelings theme was helpful, this did need to be refined so these were coded into positive and negative feelings, then into the connecting patterns of what the feelings were directed towards. It should be noted that it is critical to avoid using the interview questions as themes; doing so is a common mistake and suggests that the data has been organised and summarised rather than analysed (Braun and Clarke, 2013). To avoid this, it was decided to analyse the data again but with the interview questions hidden, which helped to focus on what the participants said without additional context. This approach was beneficial, as it allowed the identification of additional latent codes and the development of a

more refined set of themes. Another approach to searching for initial themes was to group the data into categories related to the research questions. Conversation areas included participants sharing feelings about learning an instrument, specifically when using an app, themes related to challenges and obstacles, and themes related to motivation to learn using apps.

Stage Four: Review themes

Stage four is where themes are reviewed and refined to ensure they are accurate and distinct. During this step, the themes were split into sub-themes. It is important to mention some of the outliers within this study; however, they will not form the focus of the final findings. It was during this stage that theory was incorporated into the analysis process.

Codes were analysed and cross-referenced to identify themes related to SDT, specifically autonomy, competence, and relatedness. The same process was repeated with self-efficacy theory, and the data were analysed to identify themes related to vicarious experiences, physiological feedback, verbal persuasion, and mastery experiences. During this stage, ten initial themes were identified.

Motivation and Passion. Motivations for learning an instrument, interests, and passion for music.

Learning Experiences. Experiences learning an instrument using an app, including challenges, successes, and frustrations.

Self-Efficacy. Beliefs and confidence in learning and playing an instrument using an app.

Obstacles and Challenges. Difficulties encountered while using an app for learning, such as technical issues, lack of time, or external distractions.

Satisfaction and Enjoyment. The level of satisfaction, enjoyment, and fulfilment derived from the learning process and progress.

Support and Resources. Availability and effectiveness of support systems, resources, and learning materials within the app and from external sources (such as YouTube or social media).
Autonomy and Control. Sense of autonomy and control over the learning process, including the ability to choose songs, set goals, and customise their learning experience.

Social Connection and Interaction. Experiences of social connection, either through virtual communities, sharing progress with others, or seeking guidance from peers or instructors.

Progress and Achievement. Perceived progress, milestones, and achievements in learning an instrument using an app.

Adaptability and Flexibility. Experiences with using an app for learning, including the convenience, accessibility, and adaptability of the app concerning needs and preferences.

Stage Five: Define themes

Stage five involves refining the themes further and ensuring that they are named clearly and concisely and that the key ideas and concepts are expressed accurately and relate to the research themes. Once the initial list of themes was drafted, it was decided that three overarching themes would be used to directly connect to the research questions: Motivations behind wanting to learn using an app, feelings and emotions experienced while using an app and the motivations behind wanting to learn using an app. After data analysis, each overarching theme's two most common themes were defined.

During this stage, data was also analysed and compared against theory; each dataset was analysed to see which theory most applied to the experiences, focusing on how the data related to the following core concepts and principles.

For SDT, the following areas were examined: a*utonomy—t*he need to experience a sense of choice and control over actions and decisions—c*ompetence—t*he need to feel capable and competent in performing tasks and

achieving outcomes—r*elatedness—t*he need to connect, interact, and experience meaningful relationships with others.

For SET, the following areas were examined. *Self-Efficacy Beliefs.* An individual's belief in their ability to successfully execute specific tasks, challenges or goals. *Mastery Experiences.* Past experiences of accomplishing similar tasks that contribute to building self-efficacy. *Vicarious Learning*. Observing others' performances and achievements to build confidence. *Social Persuasion.* Receiving feedback, encouragement, and support from others to enhance self-efficacy beliefs. *Physiological Feedback.* The influence of emotional and physiological factors on self-efficacy, such as anxiety or stress.

Stage Six: Write-up

The last stage involves the final analysis and write-up of the themes and sub-themes that have been identified. This stage sees narrative and data extracts interweaved between context and analysis of literature and theory. The results can be found in Chapters 5 and 6. The approach to writing up included sections of a narrative taken from the learning journal and quotes from interview data. The data analysis findings against SDT and SET are also examined in more detail. Braun and Clarke (2021) emphasise that the write-up should not just be a reiteration of the data; it should provide an interpretation of the different themes and details on how they relate. Stage six is where the researcher should analyse their role in the research study. The write-up includes quotes and personal narratives which connect to the theme.

4.4 Research Design Limitations

In this section, I will outline the research limitations and their potential impact on the study's findings.

Sample Size and Generalisability. One of the primary limitations of this study is the small sample size. While the interviews and autoethnographic narrative provide rich, qualitative data, the findings may not be easily generalisable to wider society.

Bias. The participants were selected based on their willingness and availability, which may introduce selection bias. Autoethnographic data also poses an additional risk of bias. Participants may have provided socially desirable responses or unintentionally misreported their experiences and perceptions which could influence the validity of the findings.

Technological Constraints. The technology used in this study presented certain constraints. App functionality and device performance changes may have impacted the user experience and, consequently, the research outcomes. Additionally, any app updates or changes during the study period may have introduced inconsistencies.

Time Constraints. The duration of the study was limited to a specific timeframe, which was insufficient to capture long-term learning outcomes and sustained motivation levels. These constraints may have affected the ability to observe changes and developments over an extended period.

4.4.1 Strategies for Mitigating Limitations

Several strategies were used to mitigate research design limitations.

Triangulation was used to cross-reference data from multiple sources, including autoethnographic narratives, semi-structured interviews, and reflective journals, providing a comprehensive understanding of the research topic. Methodological triangulation, involving various data collection methods, minimised the risk of relying on a single source, while theoretical triangulation applied SDT and SET frameworks to guide the analysis and interpretation of the data. Member checking invited participants to review and validate the themes and interpretations generated from their data, ensuring the findings accurately reflected their experiences. Two participants accepted the invitation to participate in this process.

Anonymity and confidentiality were upheld by using pseudonyms and securely storing data, fostering trust with participants and encouraging honest information sharing. Reflexivity was practised through maintaining a journal to

document personal reflections and potential biases, supplemented by regular discussions with supervisors for critical feedback. This approach helped enhance the credibility and dependability of the study.

Purposive sampling was used to select participants most likely to provide rich and relevant data, focusing on diversity to capture a comprehensive understanding of the topic. Detailed documentation of research procedures and adherence to ethical considerations ensured methodological rigour.

To support transferability, detailed contextual descriptions of the research setting and participants were included to provide a foundation for understanding how the findings may be relevant in similar contexts. In the autoethnographic narratives, verisimilitude was achieved by presenting narratives that evoke authenticity and resonance with the reader.

These strategies collectively strengthened the credibility, dependability, and transferability of the study's findings.

Chapter 5: Findings Part One: Personal Journeys and Experiences

The research study's findings are presented in two chapters. This chapter focuses on personal journeys and experiences. It begins with the researcher's experience, followed by the participants' experiences shared through a series of short vignettes. This chapter addresses the second sub-question of RQ1 and the primary sub-questions of RQ2.

RQ 1.2. What motivates adults to adopt mobile apps for learning musical instruments? This question is addressed through personal narratives and participant interviews.

RQ 2.1. What are the main benefits and rewards perceived by adults when using mobile apps for learning musical instruments? The chapter highlights the positive outcomes and benefits experienced by the participants.

RQ 2.2. What challenges and obstacles do adults face when using mobile apps to learn musical instruments? Finally, this chapter also identifies the key challenges and obstacles encountered when learning using apps.

Chapter 6 introduces the themes and sub-themes identified through RTA.

5.1 My Experience Learning the Piano Using a Mobile App

Reflecting on the experience of learning piano with an app, I feel both achievement and failure. I can play introductory notes and chords, feeling confident in the C position but less so in F. I recognise finger placements moving from C to F, am familiar with the C major scale, and can read sheet music. However, coordination, especially with my left hand, remains challenging. It feels like my brain gets it but doesn’t know how to coordinate and move my fingers. I can play basic single bass notes to complement the music I play with my right hand. My left hand handles the piano's lower register, providing bass notes or supporting harmonies, while my right hand plays the melody or higher harmonies. I can recognise and play some major and minor

chords. I am primarily familiar with C Major, D Major, E Major, and G Major. Although I know F Major and A Major, I struggle to remember them, along with A Minor, D Minor, and E Minor. I still struggle a lot with coordination and rhythm.

While I can play a handful of verses from several songs, I cannot play any full songs from memory, and I cannot improvise. I find it difficult to play a song all the way through without making a mistake. I think back to Sudnow's account of learning jazz piano, his initial awkwardness when learning chords, and the need to look down at his hands. "I would find a particular chord, groping to put each finger into a good spot, arranging the individual fingers a bit to find a way for the hand to feel comfortable, and, having gained a hold on the chord, getting a good grasp, I'd let it go, then look back to the keyboard—only to find the visual and manual hold hadn't yet been well established" (p. 12). I relate to this account, while Sudnow did not use technology to learn.

Having to look down at my hands to make corrections was something I had to do quite often, especially when introducing the left hand into practice. I found it very difficult to incorporate my left hand into practice and ended up sticking stickers on my keyboard with the names of the keys to help me identify the notes. The Simply Piano app does not provide any technological workaround, but technology may tackle this in the future. For example, augmented or virtual reality could overlay information on top of a keyboard while the learner is playing.

When I opened the music books my husband bought me a few years ago and examined the notes, I recognised some, but not all. Reading sheet music feels intimidating. I attempt to play but get stuck and decide to stop. It's been a while since I sat at the piano to play for more than a few minutes—over six months, in fact. My Simply Piano subscription has elapsed, and I no longer have access to the features I used to. There was a time just before the subscription ended when I returned to the app and found picking up where I left off challenging. The app offers warmup sessions when you haven't played for a while, but the difficulty level appears based on the last course you completed. This is

problematic because it was difficult to remember my progress. I had to judge my ability, navigate to a specific course and review the material again. I even went through the entire song library to practice all the songs until I achieved a three-star rating. It would have been helpful if there was a way for the app to assess my ability and make a recommendation for me. I feel that advancements in technology will make this possible in the future. This would help better assess learners' abilities and provide a more personalised approach to learning instruments.

I hope to resubscribe to the Simply Piano app again when everything has settled down. Even though I don't feel like the app covers all my learning needs, I will use it again. The app helped me to begin my learning journey and to learn the basics. The app feels familiar, and I enjoy using it. However, it is only now, when I reflect on the app, that I have realised that it has a downside. When I don't have access to the app, I feel lost without it. The same notes are on the sheet music versus the app, so it should feel similar in theory. But it doesn't. The flat piece of paper doesn't tell me when I've pressed the wrong note, and it doesn't turn the page itself when I play to the end. The experience feels very different. I feel like I must think more and make my own judgements when I make a mistake.

I sit and ask myself questions constantly. "Was that wrong? Was the timing correct? Which note is that?". It worsens when I try to play sheet music to a song I have never heard. When using the Simply Piano app, there was a feature that allowed me to listen to a song before playing it. This is helpful as it gives me an indication of what the song sounds like. I find this difficult to do with sheet music, and, on most occasions, I would search for the song on YouTube for a preview. This has been more of an observation than anything, as it wasn't an important goal to be able to do this. Practising with sheet music without the app takes a lot longer. I don't recognise notes immediately when I see them; I just sit there for a long time, thinking about what to do. In the app, I would receive a hint if I was waiting on a note for too long, which helped me to progress. Without this, it's so much more challenging to progress, and I find the

concentration level I need to be tiring and frustrating. This has highlighted that perhaps an important gap in the literature needs to be addressed.

While apps provide many advantages, there is a lack of investigation into the dependency on technology when transitioning away from apps. The dependency I have seen in my learning journey could be related to the fact that the app has created a different environment for learning the piano that is too different from the experience of playing using sheet music. This could be problematic and indicates that it's likely that someone who has solely relied on technology to learn the piano may need a conversion course or series of practice lessons focusing on playing in a real-life situation.

My piano has become a permanent fixture in the living room, but most of the time, it sits alone with a newly purchased dust cover pinned to it. I am disappointed that I haven't been able to turn my practice into a regular habit. The fact of it is, I couldn't make learning the piano a priority. My practice stopped abruptly in the summer; it was too hot to practice. I then caught COVID, and I was too sick to practice. I adopted a dog, I started a new work project, and other competing hobbies took priority. These challenges fuelled excuses not to play. I relate this feeling to Kruse's reflection in that he was only accountable to himself, which he felt reduced his motivation to excel (2013, p. 302). However, I enjoyed the experience and have an ambition to continue learning. I still feel excited when I sit down to play. I still feel excited about playing but have struggled to incorporate regular practice into my life.

5.2 Participant Experiences of Learning Using a Mobile App

The following vignettes introduce ten individuals who participated in the semi-structured interviews. They have been given pseudonyms to protect their identities. Although demographic data is shared, ethical considerations have been considered to ensure that no participants are identifiable from their stories. I aim to share these stories to build context and provide a foundation for the discussion chapter of this study.

The participant demographic showcases a diverse group of participants spanning different ages, nationalities, occupations, genders, and ethnicities. The participants come from various countries, including the United Kingdom, Ireland, USA, Canada and Germany. Their occupations range from students (who were also working) to professionals in industries such as fashion, sales, mechanical engineering, application security, healthcare, learning and development, human resources, and technology. The genders represented include six male participants and four female participants.

5.2.1 Vignette One: Alex

Alex is a 25-year-old man who lives in the UK. He is currently a student and a freelancer. Alex participates in various freelance projects while pursuing his academic goals. He is exploring different fields, taking time to refine his skills, and networking to determine the professional direction he wishes to take. Alex is learning to play the piano on a keyboard using the Simply Piano app, which he accesses on an Android phone. He practices seven days a week for approximately one hour and has been learning for three months.

As a child, Alex had some experience with musical instruments, learning the recorder and undertaking basic keyboard lessons. However, as he grew up, he had to focus more on other aspects of life and could not pursue his interest in music. Alex expressed his interest in music to a friend who recommended the Simply Piano app, which reignited his passion for music. Due to limited space and money, he had to share a keyboard with family members, which made practising challenging.

During the interview, Alex reflected on the dynamics between independent learning and more conventional F2F instruction. He feels that by learning independently with the app, he can learn at his own pace. Alex expressed moments of feeling triumphant and frustrated and emphasised the need for dedication, consistency, and patience. Sharing progress with friends played an important role in Alex’s learning journey. Playing hymns from a church book drove his desire to learn and reflected communal support values.

5.2.2 Vignette Two: Sarah

Sarah is a 28-year-old woman who lives in the UK and works as a fashion designer. Sarah has been passionate about playing the piano since taking lessons at school. As with most of the participants in this study, Sarah found it difficult to learn through F2F lessons during her adolescence, which led her to stop playing. However, as an adult, she decided to start learning again independently and took it more seriously. Her progress was initially slow, and it took her about three to five months to get started. She is learning the piano on a keyboard with the Piano Academy app, which she accesses on her Apple iPad. She has a paid subscription to the app and especially likes the feedback she receives, favouring this app over others she has tried.

Initially, she had trouble getting the app to work with her keyboard, but over time, she figured it out by referring to the app's help and support guide. Sarah practices seven days a week for approximately one hour. At the time of the interview, she had been learning for 18 months and was one of the participants who had been learning the longest.

Sarah dreams of playing the piano around the world in different places. She feels good about her progress, which makes her feel accomplished. Despite her initial experiences of F2F lessons, she expresses missing the interaction of in-person learning but admits that learning with an app is more convenient. Sarah recommends practising the piano regularly to achieve personal goals.

5.2.3 Vignette Three: Katie

Katie is a 29-year-old woman who lives in the UK and works as a sales representative. Katie took violin lessons at school as a child, but her interest in piano playing was sparked during her time in a choir. She felt motivated to learn the piano after being inspired by watching others play. Despite being discouraged by people around her who claimed she was too busy to learn, Katie took the initiative by downloading piano apps and practising on her cousins' keyboard. Initially, Katie felt she was progressing too slowly and had to

keep reminding herself of her goals to improve, viewing it as a way to improve herself.

During Katie's exploration of digital resources, she found the Real Piano app to be most helpful as it offered a range of information about keys, notes, and hand positioning. She also tried Flowkey, which provided structured beginner classes that supported her learning, but this was only a trial version of the app, and once it had finished, she did not want to pay to continue using it. Friends suggested that she try Simply Piano (also a paid app), but at this point, she decided to stick with Real Piano to improve before exploring other options. Katie accessed the Real Piano app on her Android phone and connected it to the keyboard without much trouble. Katie found that the app did not have all the information she needed and occasionally had to access supplemental resources. Katie practices two to three times a week for approximately one hour, but practice sessions vary depending on her mood and availability. Katie describes the emotional impact of playing music and highlights its role as a means of escape and emotional expression.

Although Katie recognises the potential benefits of in-person training with a professional, she values the independence offered by the app, which allows her to learn at her own pace without feeling rushed or pressured. She has enjoyed playing at family gatherings, seeing feedback and enjoying the communal aspect of music.

5.2.4 Vignette Four: Nathan

Nathan is a 47-year-old man who lives in the UK and works as a mechanic. Nathan was not exposed to music as a child and described himself as having no music experience. As an adult, Nathan stumbled upon a mobile game called Magic Piano. This somewhat casual encounter with music through gaming ignited an unexpected interest and fostered a profound desire to explore piano playing. While the game was not intended to be a piano learning app, Nathan was fascinated by the interactive keyboard, where keystrokes formed musical notes. The transition from a casual game to a dedicated piano learning app called Piano Chords and Scales marked Nathan's evolution. Initially, Nathan

started to learn by using a virtual on-screen keyboard on his phone, but he soon transitioned to learning on a real keyboard.

Nathan now learns the piano on a keyboard using the Piano Chords and Scales app via his Android smartphone. His music preference is centred around contemporary tracks, particularly enjoying the challenge of mastering "Rockabye” with a preference for playing modern hip-hop music.

Nathan described the simplicity of the app and how it facilitates learning. He was lucky that he had not experienced any technical difficulties, but he described the frequent app updates as annoying. He misses gamified elements of Magic Piano and expressed a desire for the Piano Chords and Scales app to incorporate song tutorials like the game.

At the time of the interview, Nathan had been playing for 24 months. He tries to play every day, seven days a week, for an hour. The absence of a structured schedule allows him to embrace spontaneity, and he opts for learning using an app over F2F lessons due to its freedom and flexibility, enabling him to learn at his own pace. Nathan’s goal is to learn a new skill as a gateway to leisure and social engagements that he can improve on and gain enjoyment from when he retires.

Nathan described feelings of frustration and joy and finds solace and stress relief through piano practice, describing emotions of happiness, relief, and frustration. He emphasises the need for perseverance and self-belief.

5.2.5 Vignette Five: Rahul

Rahul is a 32-year-old man who lives in Canada and works full-time as an application security specialist. As a child, he had access to a keyboard at home but no formal lessons. For Rahul, learning an instrument is a hobby and an avenue to express heartfelt sentiments, such as creating personalised birthday songs for friends. His engagement with music provides a much-desired solitary pursuit and a distraction from his regular work life. Rahul is learning to play the

piano with a keyboard and uses the Simply Piano and Piano Keyboard apps on his Apple smartphone.

His initial exploration of piano learning apps began with Piano Keyboard on iOS, but a shift to an Android device prompted a transition to Simply Piano. He appreciates the distinct features of Simply Piano, which offers comprehensive lessons, while the Piano Keyboard app enables freestyle playing with highlighted keynotes for popular songs. Additionally, Rahul uses YouTube tutorials for guidance, often following along with popular Bollywood songs. He prefers focusing on playing songs rather than learning new notes and chords. When he first started, he was frustrated with the technology, particularly screen size and the accuracy of note recognition, which led him to switch to a smartphone with a larger screen.

Rahul practices flexibly, engaging with the app in his free time two or three times a week for about an hour. At the time of the interview, he had been learning for roughly a year. Without a structured schedule, he often plays before bed or when inspired by a particular song, recently focusing on learning "Girls Like You" by Maroon 5.

In the future, Rahul would like to explore the possibility of learning other instruments, such as the guitar, and may even consider taking more formal in-person music lessons. However, he values the autonomy and cost-effectiveness of learning using apps as they allow him to learn at his own pace and convenience.

5.2.6 Vignette Six: Tom

Tom is a 23-year-old man who lives in Germany. He is a full-time student working as a part-time sales analyst. He had music and singing lessons at school as a child but became disinterested in music due to a lack of engagement from the instructor. As an adult, Tom wanted to play an instrument for social engagements and to impress friends. He is learning the guitar with the Simple Guitar app, which he accesses on Android and Apple smartphones.

He has been practising for about two years, once or twice weekly for approximately half an hour. Alex rediscovered his interest in playing the guitar using the Simply Guitar app during the pandemic. His goal was to showcase his new skills to friends once the COVID-19 lockdown restrictions eased. He admits that since the restrictions have lifted, he has been going outside the house much more, reducing his practice sessions.

Tom chose the Simply Piano app because of its emphasis on popular songs, which he feels has made the learning process more enjoyable. Tom likes how the app focuses on the practical aspect of learning the guitar over theoretical concepts, as learning by doing is how he prefers to learn. Tom feels that the gamified elements of the app, such as progress tracking and earning stars for good performance, are essential for keeping motivated. He also appreciates how the app guides finger placement and strumming techniques, as he feels this was missing from his formal music lessons.

Tom recalls experiencing many challenges, especially when transitioning to more complex songs or dealing with finger strain due to metal guitar strings. Nevertheless, mastering songs, especially those of Ed Sheeran, brought a sense of accomplishment, as did playing in front of friends.

In addition to the guitar, Tom has a diverse range of hobbies, including 3D printing, painting, and learning languages. He likens learning a language using an app, to learning the guitar, again emphasising the effectiveness of gamification and practical, enjoyable approaches over traditional lessons. He finds greater value in apps that transform learning into a fun, game-like experience. Tom acknowledges his limited theoretical understanding of music but takes pride in playing familiar songs and the enjoyment it brings.

5.2.7 Vignette Seven: Daniel

Daniel is a 43-year-old man who lives in the USA. He is married with children and works full-time as a registered nurse. Daniel's journey into learning music began without a strong musical background; he had access to drums and a

guitar as a child but had no formal lessons. He has a deep desire to connect with his children, particularly his son, through learning an instrument.

Daniel has been learning to play the guitar with his son for approximately four months. They practice together twice a week for about one hour. They access Yousician on an Android smartphone, which they use together when practising. Their practice routine involves propping the smartphone on a stand while sitting and playing together.

Their learning process began with single-string notes and progressed to chords, aided by the app's guidance and scoring system, which particularly appealed to his son's competitiveness.

The learning journey has not been without challenges, as Daniel's son's guitar uses nylon strings, which he feels impacts the accuracy of note detection. Other imposed limitations, such as the recommended use of headphones, affect the app's usability as it struggles to differentiate between the notes that have been played and external sounds. This constraint impacts their practice sessions, which are already constrained by the demands of family life. Despite this, their shared enthusiasm for progressing through songs like "Kissed by a Rose" by Seal created moments of joy and accomplishment. The desire for a broader selection of songs became evident as they sought more diverse musical experiences beyond the app's pre-set choices.

Daniel feels quite a lot of guilt that his son cannot use the app on any other device, for example, a laptop. His son has to wait until he is home as the app is installed on his phone, which he takes to work.

In particular, Daniel appreciates the progress tracking features of the app but suggests that it could benefit from more personalised interaction, instant feedback, and an expanded song library. Despite acknowledging the challenges and limitations, Daniel would recommend using apps for learning instruments due to their flexibility. However, he would like to explore the possibility of in-person lessons, but the convenience of the app is currently

preferable for their dynamic lifestyle. Father-son bonding through music is a cherished aspect of their learning experience with apps.

5.2.8 Vignette Eight: Beth

Beth is a 37-year-old woman who lives in Ireland and works full-time as a Learning and Development Manager. She is learning the piano on a keyboard using a course she purchased on the Udemy app, which she accesses on her Android smartphone. She describes herself as having no musical background, although she did play the recorder at school as a child. At the time of the interview, Beth had been learning for three months and was practising three to four times a week, with sessions lasting between 20-30 minutes.

Beth's learning journey began as a personal challenge. Her motivations were twofold: a desire for personal fulfilment and the ambition to surprise her loved ones with her newfound talent, particularly playing at her sister's wedding.

Initially, Beth's learning journey began with a blend of uncertainty and enthusiasm, which she says is reminiscent of learning to drive. Frustrations arose from the struggle to coordinate finger movements but were countered by her determination to progress. Music became a source of personal enjoyment and a desire to surprise family and friends. Mastering simple tunes brought Beth a sense of achievement. Beth chose to learn using an app because of its flexibility and affordability compared to traditional F2F lessons.

Joining a musical community intrigued Beth, but past experiences made her cautious about safety concerns in unfamiliar groups. As a result, Beth has continued her solitary journey, seeking comfort in individual progress. Throughout this journey, Beth found satisfaction in incremental improvements and highlighted the importance of kindness and consistency in learning.

5.2.9 Vignette Nine: Mia

Mia is a 22-year-old woman who lives in the USA and works full-time as a Human Resources professional. She describes herself as having no musical

background but took some singing lessons at school as a child. During the pandemic, she developed an interest in learning an instrument as a hobby to take a break from binge-watching Netflix. With in-person classes off-limits, she turned to musical apps, starting with Simply Guitar and later exploring Simply Piano. To complement her learning, Mia uses TikTok and YouTube tutorials for visual aids and guidance. She currently switches between learning the piano and the guitar and accesses both apps on her Apple smartphone. Initially, she would access the app using her iPhone 11, but the small screen posed a challenge, which resulted in her upgrading to an iPad for a larger screen and improved performance. She currently practices two to three times a week for approximately 40 minutes.

Despite her dedication, technical glitches disrupted her practice sessions. The app's insistence on headphones, occasional crashes, and background noise interference created hurdles, testing her patience. Like Beth, Mia was motivated by her desire to perform at a friend’s wedding. She claims that this has helped her remain focused and motivated amidst the challenges she has experienced.

5.2.10 Vignette Ten: Evan

Evan is a 29-year-old man who lives in Canada. He is married with children and works full-time as a Technical Account Manager. Evan has Attention Deficit Hyperactivity Disorder (ADHD) and struggles to focus for long periods. As a child, he had guitar lessons at school but described this as a distant memory. The pandemic encouraged him to learn a new skill, and he decided to try learning the piano. He practices on a keyboard and uses the Simply Piano app, which he accesses on his Apple smartphone. He found that the app did not provide all the learning materials he felt he needed, and watching YouTube tutorials at a quarter of the speed became his preferred method of learning songs.

Evan admits that he struggles to learn visually and would rely more on auditory prompts in the app. However, he found joy in the vibrant colours and straightforward app interface, which he felt was free from overwhelming complexities.

Evan describes his life as a daily grind with waves of exhaustion. He comes across as a very frustrated man. For Evan, learning was not about formal lessons; it was a battle against frustration, a journey of self-discovery. Evan's reluctance towards formal lessons stemmed from a stubborn determination to figure things out independently.

His practice sessions were sporadic, often lasting an hour, depending on Evan's energy and frustration levels. He would practice twice a week, and at the time of the interview, he had been learning for two months. The theme tune from "Up" became a favourite, but playing it proficiently remained challenging. External distractions, such as his wife asking questions or the dogs barking, often interrupted his sessions, causing him to storm away in frustration.

Evan's determination to succeed remained unshaken. It was not about quitting but taking breaks, leaving things "for now", intending to return later. Beneath his frustration lay a determination to surprise others with his newfound piano skills. Evan's journey was not about perfection but about finding joy in learning despite the anger it occasionally brought.

5.3 Context and Demographics

In this section, I provide context and demographics. I start by discussing musical background and experiences, exploring practice patterns, and examining the devices, technology and equipment used to learn.

5.3.1 Music Background

I do not remember much of my experience learning the violin, but I recall having mixed feelings. I remember the instrument feeling awkward in my hands and having difficulty playing in the correct posture. I remember feeling a sense of achievement when I learnt something new, but I was frustrated when I made persistent mistakes. I remember crying when I snapped a string, thinking I had damaged the instrument beyond repair. I remember parts of my Grade 1 exam. I remember what I was wearing and being nervous, but I do not remember what songs I played. I remember not getting my results immediately and had to wait

for a letter to arrive in the post. I don't think I cared very much about the results; I was just relieved that I had passed. When I left primary school, my lessons stopped. I did not miss playing the violin; it felt more like a burden as I had to use my free time to practice it. I think I was happy to stop playing.

Similarly, Alex, Sarah, Katie, Tom, Beth, Mia and Evan were all exposed to music as children at school with formal lessons in various instruments, such as recorder, keyboard, piano, recorder, violin, and guitar, as well as singing and music theory lessons. Tom shared a childhood experience of learning the guitar at school, which shaped his perception of formal lessons as an adult.

> The teacher was not the most motivated guy. He was a little bit depressed about the world. When we went into his room, we'd practice, and he taught me some stuff. And then I had homework to do at home to practice. When you have homework, you don't really want to do it. So it went from something I really wanted to do to something that felt like an obligation. So, I started skipping lessons. At that point, my parents were like, this is not working; we're stopping the lessons.

There was a general feeling that music lessons were never taken seriously and quickly abandoned, as in Evan's case.

> I learnt guitar at school but once I left, everything went out one ear.

Those with a music background struggled to remember specific notes or the ability to read sheet music, although Beth recalled remembering some basics from school but nothing tangible.

> I learnt some recorder, but it wasn't reading music. It was more like "Do a B" or that. I knew that there was a difference in terms of notes and that there was a reason why they were called different things. But things like

> majors and minors, I wouldn't have had a concept of, and I wouldn't have known how to read music before doing this.

Nathan was the only participant who described himself as having no musical background. He had no musical instruments at home and did not have music lessons at school as a child.

Rahul and Daniel did not receive formal music lessons at school, but they had access to instruments at home. Rahul had access to a keyboard, while Daniel had access to drums and a guitar.

A memory was jogged when I reflected on this as I realised I also had access to several instruments as a child. My sister had several recorder lessons at school; I remember trying to play this when she brought it home but was horrified at the high-pitched whaling sound it made and threw it back to her. We also had access to a small 37-key toy keyboard but only dabbled in playing the instrument, focusing more on cycling through its built-in pre-recorded tunes. No one in my family could remember why we had this toy keyboard, as no one asked for it as a present or expressed a genuine interest in playing it. I asked my mum about this, and she thinks it was given to us by a family friend who no longer wanted it. My sister learnt a few songs on the keyboard from a friend, and we would take turns trying to play a song called Chopsticks. I spoke to my sister about this, and while we laughed and reminisced, neither believed this was the song's real name.

5.3.2 Technology and Equipment

In Chapter 3, details of the equipment used in this study were provided. I began practising on a RockJam keyboard, followed by a Yamaha digital keyboard connected via USB. Initially, I used the Simply Piano app on a 6.5-inch Android smartphone but later switched to a 10.5-inch Apple iPad. The smaller screen on the smartphone proved too challenging, and unfortunately, the Simply Piano app does not offer any settings to adjust the screen's resolution. Switching to the iPad made a big difference straight away. Not only could I see the notes on

the screen better, but I could also see more content on the screen overall. Sarah was the only other person to use an iPad and connect it directly to their keyboard using a USB cable. Everyone else used audio recognition to detect and provide feedback. Mia expressed the desire to upgrade due to technical constraints.

> The bigger screen would be so much more helpful. I'd probably be able to get more RAM on a tablet, so maybe it wouldn't crash as much as it does on my phone because my iCloud storage is low as I have a lot of photos and other apps on my phone.

Alex, Katie, Nathan, and Daniel accessed their chosen app using an Android smartphone, while Rahul, Mia, and Evan used various models of Apple iPhones. Tom was the only one to use both, having just recently upgraded from an Android smartphone to an Apple iPhone.

While there is a focus in this study on learning the piano, I interviewed Tom and Daniel, who were both learning the guitar, while Mia was learning both. Mia inspired me to consider those learning the guitar as I found her experience of the piano similar to learning the guitar. She was also using Simply Piano and the sister app, Simply Guitar. The Simply Guitar app uses the same format as the Simply Piano app, using note recognition as its primary feedback mechanism. The app's layout is similar but has a guitar string layout instead of a keyboard layout. So, while the instrument is different, the app is similar.

While I preferred to interview those using apps by JoyTunes, as that was the app I was using, I did not want to limit myself to these apps, so it was not a strict requirement. Making sure that the apps were chosen wholeheartedly by the participants was the most crucial feature because so many of the studies used apps selected by the researcher. Alex, Rahul, and Evan were all using the Simply Piano app, Sarah was using the Piano Academy app, Katie the Real Piano app, Nathan Piano Chords and Scales, and Beth purchased a course in the Udemy app. Everyone was using a keyboard to learn the piano, although

Nathan began by learning with an on-screen keyboard on his phone before later upgrading.

5.3.3 Rationale for App Choice

As highlighted in Chapter 1, various apps are available for individuals looking to learn musical instruments. I chose to use the Simply Piano app because it has a good rating online and has won several awards. I also enjoyed the trial and liked the app. Personal preference was also a deciding factor for Sarah and Rahul, who had both tried several other apps before choosing one they liked based on their personal preference. On the other hand, Daniel chose his app based on what his son liked the most. Nathan made his decision based on personal preference after trying just one app. He decided he liked it enough and did not need to try anything else. Alex's choice was based on a recommendation from a friend. Tom and Mia discovered their apps through promoted Google ads and high ratings. Katie started using a different app initially, but when the trial ran out, she did not want to pay to continue using it as it was out of budget. Instead, she switched to a different app, which was free. Evan and Beth discovered their apps through advertisements on Google; however, they were more concerned with cost. While Evan specifically looked for free apps, Beth purchased her course when she noticed it was on sale. Evan had strong opinions when asked if he would pay to use an app.

> No, Hell no. Definitely not. There are so many things out there where I can get things for free. I'd rather spend the extra five minutes on YouTube than pay for something.

This highlighted the factors for app choice, such as personal experiences, recommendations, pricing, advertisements, and ratings.

5.3.4 Practice Schedule and Duration

When launching the Simply Piano app, a message on the screen suggested that ten minutes daily is enough to improve your skills. After doing some informal research, I found a blog post by a pianist who recommended that

“playing for 10 minutes a day, six days a week, is FAR BETTER than playing for 1 hour, one day a week” (Fernald, 2022). However, other sources suggested 45 minutes to an hour. I chose a time based on what would fit into my daily routine. I decided that practising for 90 minutes a week in three 30-minute sessions would be a reasonable amount of time. I would set a reminder on my phone to let me know when it was practice time, but I did not always stick to the schedule, and it started to slip towards the end of my journey. At this point, I decided to adopt a more ad-hoc approach to practice. I hoped this would mean my practice sessions could be more frequent during the week, with the overall session duration lasting longer or shorter. e.g. a 20-minute session or a one hour session. Mia described how she mostly practices during the weekend.

> Practice typically occurs more on the weekends since I don't have work and I have just a little more time. But yeah, no solid practice schedule.

This approach was similar to that of Alex, Katie, Nathan, Rahul, Tom and Evan, who practised when they found time. Sarah, Beth and Daniel planned their practice sessions. However, Daniel struggled to stick to the practice schedule with his son.

> We try to plan them. Because of so much stuff going on with the kids, a lot of times, it's probably 75% not planned, 25% planned.

5.3.5 Practice Patterns

My learning journey was split into two: January 2021 to April 2021 and May 2021 to August 2021. During the first period, I did not formally log my practice sessions because I was unsure what I wanted to capture. Instead, I wrote handwritten notes and recorded my reflections in a journal. I also took several video recordings. This was a good start, but I needed to make these notes more focused and purposeful. Using the iPad was a good way of capturing practice duration as it came with a built-in application that tracked the use of apps such as Simply Piano. During this period, I averaged three practice days

weekly and completed 88 sessions over approximately 44 hours (2,668 minutes).

In May 2021, I created the online learning journal and began capturing data against specific questions while still using the iPad to capture practice duration data. In this period, I averaged two practice days per week and completed 30 sessions over approximately 15 hours (877 minutes). During this period, I questioned myself and recorded more detailed data about my feelings and motivations.

While my practice period spanned over eight months, the total average experience of the interview participants was approximately ten months, with Tom and Nathan using apps to learn for approximately 24 months and Mia being the least experienced at one month. Throughout my eight-month learning journey, from January 2021 to August 2021, I completed 118 practice sessions and spent approximately 59 hours (3,545 minutes) playing the piano. My average practice session lasted approximately 29 minutes; the shortest session lasted approximately 15 minutes, while the longest lasted approximately 60 minutes.

Comparing this to the others, the average number of practice days recorded was much higher, 3.9 days per week, with each session lasting approximately an hour. However, this is not the most accurate data. My practice sessions were recorded accurately at the time of each session, whereas participants had to rely on memory during the interview. This presented a minor challenge when analysing the data. Still, the figures are not crucial for answering the overall research questions, and they have been provided to build context for the findings.

5.3.6 Course Content

When learning in Course mode with the Simply Piano app, you must complete two initial courses, Piano Basics and Essentials I. The app then splits into two tracks, Soloist and Chords.

On the Soloist track, you focus on learning techniques such as sheet music, sight-reading and coordination. You then begin to move through different courses, starting with Essentials II and III, by which you will have mastered the C and F positions, flats, sharps, and the C Major scale. The path then continues to Classical I, where you learn to play famous classical pieces. You continue to Intermediate I, where you learn syncopated rhythm, thumb techniques, and the D position. After this, you move to Intermediate II through IV. The learning style then changes to focus on mastering several famous pieces of music, Fur Elise, Bohemian Rhapsody, and Taste of Bach I & II, before moving to Pre-Advanced I, where you learn key signatures and 16th Notes. You continue to learn two more famous pieces of music, S. Joplin's The Entertainer and Mozart's Turkish March. Finally, there are Pre-Advanced II and III, Major Scales and Minor Scales.

On the Chords track, you learn popular groups of chords to accompany pop, rock and jazz songs. You begin with Pop Chords I and Chord Styling I. At this point, you will have learnt five chords and three soft rock stylings before moving to Pop Chords II. Two new paths appear between Soloist and Chords: Theory 101, where you learn the basics of music theory, and Lead Sheet I, where skills from the Soloist and Chords track meet. I should note that the Theory 101 course was unavailable during my learning journey and has been introduced as part of an update to the app.

You then continue to Chords III, where you can play seven chords, classic rock styling, and ballad styling. Chord Styling II is next, followed by Pop Chords III, by which you'll be able to play ten chords and have learnt the alternative bass and ballad styling. The course then changes direction, and you begin to learn swing, blues and rock'n'roll music with Blues Chords I, Jazz Chords, I and II, Slash Chords, Arpeggios I and finally, you learn to play Someone Like You by pop singer Adele.

At the end of both tracks, there are two courses: Touch Intro and Stay in Touch, a course for using an on-screen keyboard. On the Soloist track, I completed up to Intermediate II. On the Chord track, I completed up to Chord Styling III. Even

though I switched between tracks and progressed between the different styles at a similar pace, overall, I enjoyed learning on the Chords track the most. I just found the style of playing the piano in this way a lot more enjoyable.

The Simply Piano song library contains a library of popular music songs which you can choose to play at any time. Several songs are available to play at different difficulties. The app does not summarise this section very well, but I appeared to play more songs from the Essentials and Pop Chords library, which makes sense as this matched my skill level from Course mode.

Play Mode was also added halfway through my learning journey, and while I did not access this area too much, this is where I spent time playing songs from my favourite band, as well as Disney music and music from films and TV.

The conversation dried up when I asked the interview participants about their progress through their respective apps. Many did not remember the exact name of the course or how far through the app they had progressed.

There was a preference for learning songs over engaging with course materials. Participants enjoyed selecting songs they liked to listen to and found that the course materials did not offer the flexibility to choose the content they wanted to learn when acquiring new skills. Sarah did not have a song or music preference, while Alex and Katie liked playing hymns. Nathan preferred hip-hop music, while Tom, Rahul and Mia preferred pop songs. Tom described how he liked to play songs that captured the essence of simplicity and versatility, like Ed Sheeran's.

> His songs usually just use an acoustic guitar, meaning that it sounds like the song. Many of his songs are really straightforward and have different difficulties. Meaning that the same song can be played with harder chords.

Mia described how she likes to play pop songs, especially the ones she hears on the radio.

> Songs I can recreate myself are my favourite, for sure. Of

> course, they have classics, but I think when the app releases a song that is more recent by an artist I like, something I hear on the radio, and I can recreate it, that's probably my favourite.

Daniel, Beth, and Evan had varied musical tastes. Beth's song preference resonated with Tom's in choosing enjoyable and simple songs.

> There was a Beatles song that I learnt at the start. I was like, "This is quite simple, and I enjoy it," which was quite nice. Then, other ones were folk songs or Three Blind Mice.

Evan liked to play songs from film and TV, noting a particular liking to the theme tune from the Disney film Up.

> I really like that song. It's just an interesting song to play.

Daniel expressed concern when playing certain music with his son and, as a result, tended to play more classic pop music.

> We played some Beatles music. We like stuff like that—some country. I try to get him to listen to music that I like and music that is also more relaxed. I'm cautious when I'm with him because I don't want to play anything with poor messages or anything like that.

Chapter 6: Findings Part Two: The Overarching Themes

This chapter presents the overarching themes. It also builds upon the individual experiences detailed in Chapter 5 and aims to address the research questions focused on the initial perceptions and broader impacts of using apps for learning musical instruments.

This chapter presents findings directly related to answering RQ1, RQ2 and RQ3.

RQ 1.1. How do adults perceive their ability to learn musical instruments before using mobile apps? This question is addressed using data from the MILASE questionnaire, which indicates self-efficacy prior to learning.

RQ 1.2. What motivates adults to adopt mobile apps for learning musical instruments? Extending the discussion from Chapter 5, this chapter further analyses the motivational factors.

RQ 2.1 What are the main benefits and rewards perceived by adults when using mobile apps for learning musical instruments? This question is addressed through qualitative data analysis from participant interviews and survey responses.

RQ 2.2 What challenges and obstacles do adults face when using mobile apps to learn musical instruments? As with RQ 1.1, This question is addressed by analysing data from the MILASE questionnaire and participant interviews.

RQ 3.1. How do mobile apps impact adults' self-efficacy and self-determination in learning musical instruments? This question is addressed by examining the influence of mobile learning on learners' confidence and autonomy.

RQ 3.2. What factors influence changes in adults' self-perception when using mobile apps? This chapter identifies and analyses the factors contributing to shifts in learners' self-perception.

6.1 Key Themes from Reflexive Thematic Analysis

Three overarching themes were identified, each including two sub-themes. The analysis process was iterative, and new potential themes were discovered each time the data were analysed.

These initial themes provided a helpful starting point, helped narrow down the most prevalent overarching themes, and ensured that the themes aligned with the research questions.

Theme One: Motivations for Learning an Instrument using a Mobile App

Personal Development
External Validation and Social Connection

Theme Two: Challenges and Obstacles when Learning to Play an Instrument using a Mobile App

Learning and Instructional Limitations of the Apps and Technology
Personal and External Factors

Theme Three: Feelings and Emotions Experienced when Learning to play an Instrument using a Mobile App

Frustration
Satisfaction and Achievement

6.2 Motivations for Learning an Instrument Using a Mobile App

This section looks at the researcher's motivations and self-efficacy and explores the primary motivators for wanting to learn an instrument using apps, which were personal development, external validation, and social connection.

6.2.1 Music Instrument Learning App Self-Efficacy Findings

A questionnaire was created to measure self-efficacy to show a connection between feelings and motivations. While the initial enthusiasm for learning with

apps was apparent, the result indicates that challenges and issues impacted self-efficacy, motivation, and overall progress. Examples include a perceived decline in learning ability, troubleshooting technical issues, and maintaining motivation.

The questionnaire indicates a shift in self-efficacy from the initial pre-questionnaire, conducted just before the practice sessions were documented, to the subsequent post-questionnaire completed at the end of the study.

In Figure 6.1, the Y-axis represents the ratings from the questionnaire, ranging from 1 to 5, while the X-axis indicates the specific questions from Q1 to Q10. The graphs' bars represent these ratings for each question, distinguishing between the pre-questionnaire (bars on the left) and the post-questionnaire (bars on the right).

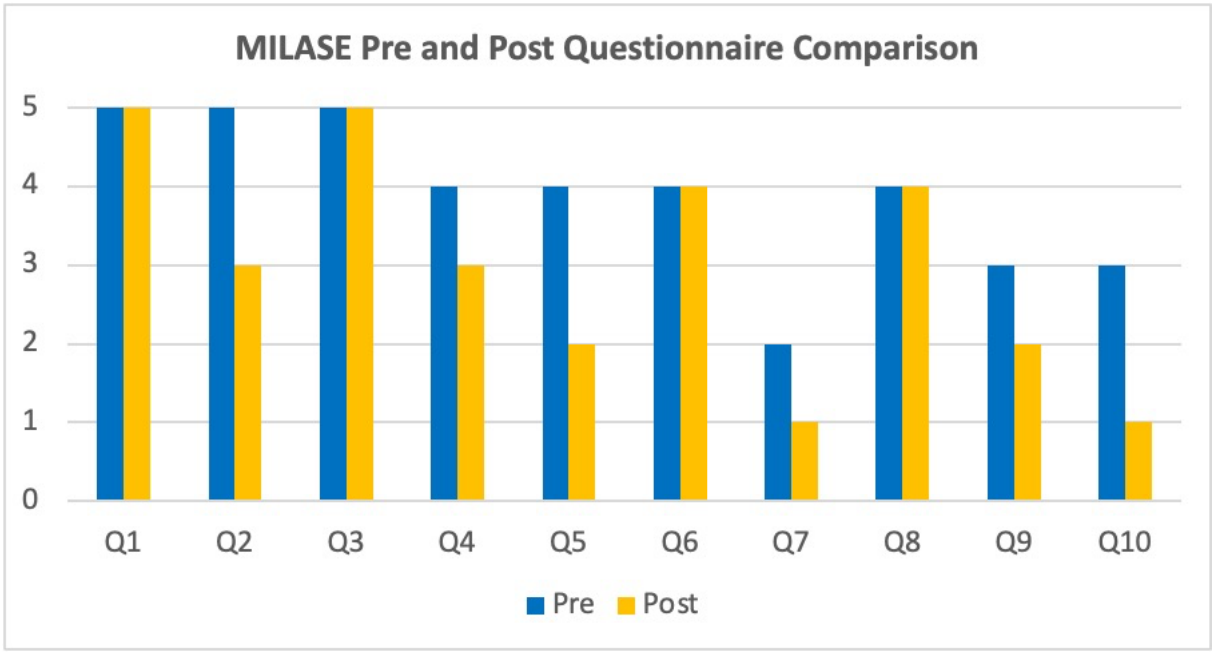

Figure 6.1 *A comparison of the MILASE pre- and post-questionnaire.*

The following outlines the findings from the questionnaire.

Q1: Navigating the app to find lessons and tutorials

The ability to navigate the app for lessons and tutorials was rated consistently high in pre- and post-questionnaires. This indicates that the app's interface for accessing course content was easy to navigate and user-friendly.

Q2: Learning and practising skills using the mobile app

There was a slight decrease in perceived ability to learn and practice skills using the app from pre- to post.

This area of concern could warrant further investigation into the perceived decrease in the ability to learn and practice skills.

Q3: Understanding and using the app's interactive features

Like Q1, consistently high ratings were recorded for understanding and using the app's interactive features, suggesting that these features are intuitive and easy to use.

Q4: Adjusting settings and preferences within the app to suit your needs

There was a slight decrease in the perceived ability to adjust settings and preferences within the app. It might be helpful to explore whether changes in the app's interface or functionality contributed to this decrease.

Q5: Troubleshooting technical issues or challenges while using the app

The perceived ability to troubleshoot technical issues or challenges decreased from pre- to post. This suggests that more difficulties with the app may have been encountered over time or technical support needs were not adequately addressed.

Q6: Setting goals and tracking progress within the app

Setting goals and monitoring progress remained consistent from pre- to post, indicating that the ability to set goals and monitor progress did not change significantly.

Q7: Using online resources and communities (e.g., forums, social media) to enhance learning through the app

The perceived ability to use online resources and communities for learning through the app decreased. This could indicate a need for better integration of such resources or improved guidance on leveraging them.

Q8: Adapting to new features or updates introduced in the app

Consistent ratings were recorded for adapting to new features or updates, suggesting comfort with changes introduced in the app.

Q9: Staying motivated and consistent in your learning journey using the mobile app

A decrease in the perceived ability to stay motivated and consistent in the learning journey using the app was noted. This could indicate a decrease in engagement or the effectiveness of motivational features.

Q10: Overcoming distractions and managing time effectively while using the app to learn

The perceived ability to overcome distractions and manage time effectively while using the app significantly decreased. This is an important area, suggesting struggles with focus and time management.

6.2.2 Self-Efficacy Indications

The questionnaire provides valuable insight into the researcher's experience and how learning using apps affected self-efficacy. Notably, the ability to use and navigate the app remained consistently high. However, there were slight

declines in the perceived ability to learn and practice skills, adjust settings, troubleshoot technical issues, maintain motivation, and manage distractions. Decreased use of online resources for learning through the app was also observed. These findings indicate areas within the app that require further attention and improvement.

6.2.3 Personal Development

The goal of learning an instrument and the inherent satisfaction it brings were popular topics among participants. The semi-structured questions were created to understand the participants' continued motivation, particularly what factors kept them practising. The answers to these questions often overlapped with those concerning goals, and participants who had set goals seemed more motivated to achieve their personal objectives.

Those who did not specify a goal aligned their motivation with the desire to learn an instrument or the enjoyment they experienced when practising. Enjoying music and the desire to possess a new skill as a means of personal development was evident in the case of Alex and Evan, with Alex describing a strong desire to improve. Sarah's passion for the piano inspired her to learn.

> I really wanted to learn it right from when I was in high school, but I didn't really have that opportunity.

After watching others play, Katie was inspired to learn.

> I was in a church choir. I got to see people playing, so I think that was what motivated me.

Mia described wanting to learn a new skill during COVID-19.

> I wanted to find something to keep me occupied without just watching Netflix. I'm guilty of it, for sure. But I've always kind of wanted to learn an instrument, so this felt like the perfect time to do it.

This was similar to Nathan, who had become bored with his usual hobbies and

interests.

> I’m always free in the evening. I don't play video games and I went off social media. Right now, I just feel learning the piano is the only thing I do for fun.

Daniel wanted to learn a new skill alongside his son.

> Part of the reason was COVID. The other part of the reason was the flexibility of not having to go to something regimented, not having to take a child to something else.

The accessibility of apps also appeared to play a significant role in facilitating personal development as it enabled people to learn at their own pace and time, as Alex explains.

> I feel more confident learning at my own pace, at my own time.

While Rahul shared a more profound desire.

> I have an inner urge to learn something new every day.

6.2.4 Recommendations to Others

Apart from Daniel, who was learning with his son, none of the participants reported knowing anyone else using an app to learn an instrument. While several suggested they had friends who had tried in the past, none were actively learning. This mirrored my experience as I did not know anyone else learning an instrument using this method.

Participants were then asked if they would recommend learning an instrument using an app to other people. Everyone responded positively to this question and would all recommend it. Particularly if individuals are concerned about time, money and flexibility, as Beth explains.

> Yes, I would recommend it, particularly if the person is

> maybe time-poor or maybe not necessarily time-poor but maybe not time-flexible so that you can use it around your schedule.

Tom shared this opinion.

> I would definitely recommend using an app to learn an instrument.

Evan followed up on the question with an added caveat.

> Yes, depending on who they are as individuals, though. I would not recommend it to my partner because she would get extremely angry at it.

Mia suggests that for those who can afford it, in-person piano lessons with a teacher are preferable.

> I would recommend it because you can do it in your own time, and it's cost-effective. I wouldn't recommend it if you have the means to take an in-person lesson, as that always trumps learning with an app.

These responses resonated with my reflections; I would also recommend learning to play an instrument using an app, as I also found it very cost-effective and flexible. However, if you are not motivated to stick to a regular schedule, it is easy to forget about practice and focus on something else. There are also times when I would have considered an in-person lesson or at least some time with a professional so I could just ask questions. For example, I wanted to find out if my posture was correct, if my finger positioning was good, if my goals were realistic, and if there were any tips and tricks to improve. At times, I craved something more personalised. While the app could hear me playing the piano, it could not see me doing it.

6.3 External Validation and Social Connection

A common motivation was impressing others, connecting with friends and family, and playing in social settings. In this section, I share the narrative of an experience I had with a friend, then share the experiences of the participants who have also found external validation and social connection to be powerful drivers.

6.3.1 A Conversation with a Friend

The following narrative has been created as part of the autoethnographic data reconstructed from the researcher's memory.

"I used to teach piano to kids." I didn't know this about Abby. We were at dinner when the conversation turned to my research project. "I'm not familiar with music apps. How does it all work?" She bit into a slice of pizza as I gulped down a mouthful of water a bit too enthusiastically. "Well.." I choked and cleared my throat. "My keyboard and headphones are all hooked up to my iPad. The app shows me a couple of music bars with notes on the screen, and when I press a key on the keyboard, I hear it through my headphones. The app tells me if I've played the right note and if I pause for too long, the app shows me what key I need to press."

"So, how are you finding it?" Abby inquired. "Frustrating", I sighed. "Sometimes I feel the app goes from zero to one hundred. You practice a song at a slow speed, a couple of bars at a time, then you move on, and you're expected to play it at full-speed perfectly. If you want to practice a particular bar again, you can't, and the only way to go back is to restart the practice session again." I took another sip of water, more slowly this time. "There is another mode called Play Beta, which feels a bit more traditional. The music is displayed like sheet music, and the screen moves horizontally across the page, then moves vertically to show more of the sheet music. In Course mode, you scroll horizontally the whole time. In Beta mode, you can control what you play, how the screen moves and how you practice. It's much more flexible, but not all songs can be played in this mode."

“So, does the app give you lots of praise? When I was teaching, there would be times when a kid would play something with so much emotion, and I’d tell them, ‘Wow, you played that part really beautifully’.” I thought for a moment. “Well…it’s quite gamified, like, you get a three-star rating when you finish a song. It tracks your accuracy and timing.” Abby paused. “Oh…that sounds very….mechanical?” I was intrigued by the comment. I’d never really thought about how “robotic” the experience was. “Well, I guess the app is logic-based; you either meet all the criteria and do well…or you don’t.” I thought about this momentarily and realised that she was onto something. I might be able to play the app perfectly, but the app doesn’t know if I play something beautifully, powerfully or emotionally. “How do you tell if something has been played beautifully?” I asked before realising that this perhaps was a stupid question. “Well, I guess a lot of it has to do with pressure and sensitivity, if the keys are played softly or loudly, if the pace is slow or fast.”

My keyboard had sensitivity and pressure functionalities, so it knew when I pressed a key hard to play it loud and quietly when I pressed a key softly. “That’s ironic. I turned all those features off.” I grinned. “Why would you do that?” Abby chuckled. “Because it’s hard enough listening to the notes and knowing it was the right one you pressed while watching a screen! Let alone having to think about how hard or soft I’ve pressed them.”

“I guess that’s something you can’t just turn off when you play on a real piano. There’s something so powerful about a real piano, something powerful and wooden.” I wasn’t quite sure what she meant by “wooden”, but I think I understood what she was getting at. Even though the sound of my keyboard was apparently one of the better-sounding keyboards, I didn’t really like the sound of it. It sounded sterile, static, electric. “So, are all your participants using the same app as you?” Abby had finished her pizza by this point, and I realised I was lagging behind. “There are more apps than I first thought.” I took out my phone, quickly searched for piano apps in the Play Store and showed Abby the results. “How does someone know the app they are using is any good?” Abby scrolled down the list. “Well, you don’t really know. You sort of trust the app. I’ve tested a few but always came back to Simply Piano. I suppose there is a

danger that a different app might be more pedagogically sound, but if it's harder to grasp or the learner doesn't like it, they might return to their original app because it feels safe and familiar." I'd experienced this firsthand. I tried several apps before choosing Simply Piano. I chose Simply Piano because I liked it, and it felt right, but perhaps the real reason was that it was the first app I tried, and I felt more comfortable using it.

"So when will I get to hear you play?" Abby grinned enthusiastically, and I suddenly felt hot and a mixture of excitement and panic. "Err, well, I have recorded a few videos. Maybe I could send you some of those?" I wasn't ready to play in front of anyone, but I felt much more comfortable sharing a pre-recorded video. "That would be great!" She smiled, folded her napkin, and placed it onto her plate. "Shall we order dessert?"

When I got home, I sent Abby a recording of me playing via WhatsApp, "I uploaded a video. I probably look like a right newbie, and I made some mistakes". The video featured a split screen, with my performance shown on the left and a close-up of the Simply Piano app on the right.

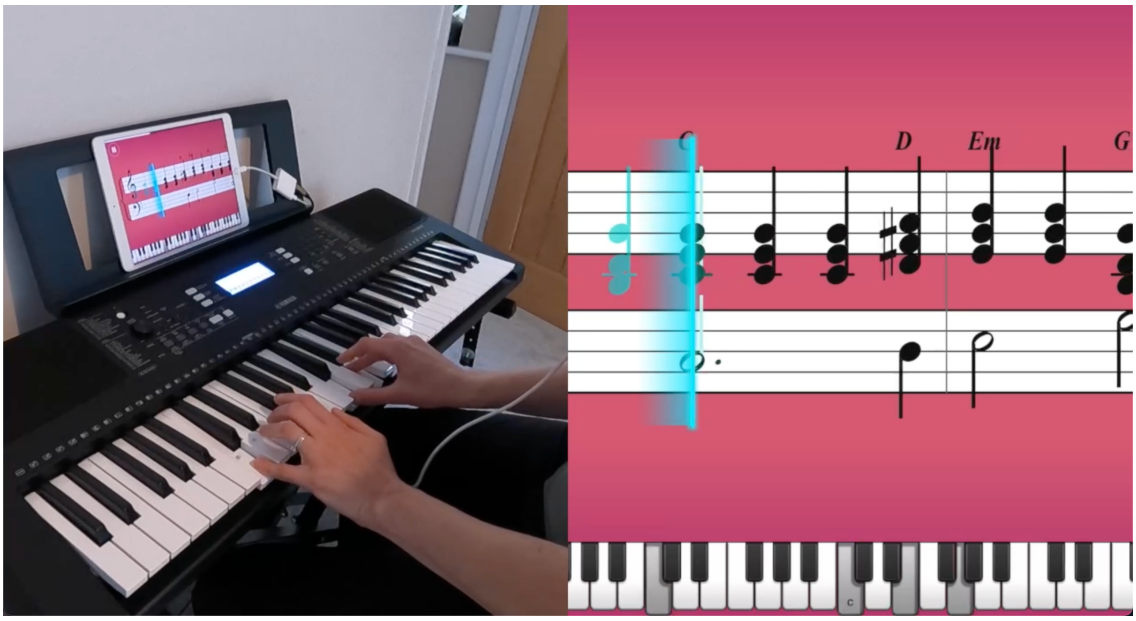

Figure 6.2 *Screenshot from a recorded video performance.*

Abby responded shortly after.

> Bravo, Amy!!! That's fantastic! I hadn't realised you'd be playing moving chords in your right-hand or have some rhythmic parts in the left - that's difficult stuff. I thought you kept to time excellently - well done! The piece does not resemble anything I'd have associated with the starter piano. It's totally different, way harder in some areas and less intuitive in others, but you totally smashed it! Well done!

After our conversation, I found myself feeling more motivated. Initially, I was hesitant to share my progress with loved ones and even felt embarrassed at times. However, private sharing with close friends and family can be quite motivating. Although I still feel nervous about playing in front of strangers or larger groups, sharing with those close to me has been beneficial.

6.3.2 Impressing Others and Connecting with Family and Friends

The desire to be able to play songs that friends and family would enjoy played a significant role in maintaining motivation. Apps facilitated this motivation by offering a wide range of songs and the potential for self-paced learning. Beth wanted to surprise her family with the ability to play particular songs and play at her sister's wedding, similar to Mia, who wanted to play at a friend's wedding. Daniel and Evan both expressed the element of surprise as a goal as Evan explained.

> I like the idea of being able to surprise people that I can play the piano.

Daniel wanted to surprise his wife by playing a song with his son. Sarah expressed a desire to travel to places and play in front of an audience, while Nathan dreamed of playing the piano when he retired and possibly joining a choir. Rahul and Tom described wanting to play songs they liked. This was very similar to my own goals, as I had wanted to be able to play music by my favourite band and music that brought about nostalgia from when I was a child. Tom explains.

> My main goal is if I like a song, I want to be able to learn it. I started with Ed Sheeran's songs first because me and my friends like them. I also had some One Direction songs. So old songs that I wanted to learn because I liked One Direction when I was a kid.

Katie reflects on the motivation influence of observing others.

> Seeing people playing, seeing people being good at it, I'm like, "Okay, yes, I can also be like this. That alone is enough motivation for me.

6.3.3 Communities of Practice

Because social connection was such a strong theme, I wanted to touch on the topic of communities of practice to investigate the participants' views further. I had expected the participants to feel strongly about this topic, but that was not the case. While participants appeared keen on sharing their skills with friends and family, the thought of playing with strangers or new connections was not as appealing. From my perspective, I had no plans to join any musical groups, online or offline, when I began learning the piano, and this feeling did not really change. Every time I opened the Simply Piano app, a notification would pop up informing me of the community group on Facebook that I could join. I had never really loved social media, so I did not feel inclined to join. I joined several community groups for exploratory and discovery purposes as part of this research study. What discouraged me from actively participating was what I felt was the perceived lack of truth; I would scroll through pages of people posting their positive experiences and achievements, and it was wonderful to see so many people learning and enjoying the piano. However, what was lacking for me was the sharing of knowledge, talking through difficult situations and experiences and general questions and answers. There was one group that I found to be very informative; this was a group on Reddit. However, I still never wanted to connect with others or share my experiences. Instead, I became a ghost in the machine, silently visiting these groups and watching from afar.

Only Mia and Tom were part of a musical community when participants were asked about community groups. Mia describes the Facebook community she belongs to.

> The JoyTunes help group. It often gives out notices if some of the software is down or if somebody else is having issues. It's typically software-related.

Tom described his community as a group of friends who get together in person to play.

> It's a piano with an acoustic guitar with a rapper. It’s a lot of fun. Each one of us plays something, something basic, repeating music. That's the closest I get to a community.

When I asked those who were not actively part of a community if it would be a consideration in the future, I received mixed responses. While Sarah appeared optimistic and interested in playing music with others, Alex was more hesitant.

> Maybe when I'm better or have learnt more, and I feel like I can actually take on a challenge like that, I will definitely join.

This feeling shared by Daniel, who was apprehensive.

> I don't have the time to have casual conversations. I need to get to the point. And so I would only use that to probably ask very specific questions. “Hey, do you guys advise someone doing this? Have you seen videos about this? Do you have a tip for this?” It would be very specific, very to the point. And then that's about it. So, I would use it. I think that if something like that was embedded in an app, where you could chat with people in the app, and you could get feedback, and things like that, I think that would be more beneficial for me not having to leave, to go to some blog somewhere.

Beth was worried about her safety if she joined a group that met in person.

> Having gone through a similar experience, I'm just a little bit…well….is it safe? Maybe if I were male, I wouldn't necessarily worry about it if it was an in-person meetup. Suppose it's online, whatever, grand. I don't have to see you, don't have to deal with you.

6.4 Challenges and Obstacles Experienced When Learning to Play an Instrument Using a Mobile App

RTA identified challenges and obstacles associated with learning to play an instrument using an app as theme two. Issues relate to instruction, technology, physical comfort, and the overall learning experience.

6.5 Learning and Instructional Limitations of Apps and Technology

Struggling with the apps' teaching methods or instructional limitations was a common theme. Some found the visual learning methods challenging, others felt the lack of detailed instruction, and some were frustrated with the lack of feedback on their performance. The transition from learning notes to playing actual songs was particularly challenging for a few. Limitations were also highlighted as the lack of musical variety in free versions, difficulty understanding and translating musical notation into key presses, and complications with the app interface or technical issues.

6.5.1 Limitations of Apps

While I found the app satisfactory most of the time, I often recorded some limitations and a lack of control. I also faced obstacles relating to inconsistent instructional elements within the app. As I navigated through the lessons, I encountered moments where visual guidance, such as finger number positions, would change.

> Sometimes the app will show the finger number position, then halfway through a song, the number will disappear.

Navigating the app's interface proved challenging at times.

> The way the app works is the notes move along the screen automatically, and I have found it difficult to keep rhythm and look at the screen at the same time to learn the new notes.

This observation highlighted a struggle to synchronise my learning with the pace of the app. In addition, this phenomenon also occurred during the final song, and I felt like this hindered my progress and caused unnecessary setbacks.

> The app yet again removed some of the note signposts during the final song practices.

A notable limitation of the app was its lack of flexibility in song selection and practice sessions. Despite my desire to tailor my learning experience to my preferences, I found myself constrained by the app's rigid structure.

> If I am playing a song that I am really not enjoying, I am forced to play it to the end.

While the app offered some utility in enhancing my musical skills, its shortcomings in consistency, control, and customisation felt like it hindered its effectiveness as a comprehensive learning tool.

> I wish I could use the app to create my own practice sessions.

This highlights the need for features that could empower users to personalise their learning experiences and overcome some of the limitations of the app.

On the contrary, while there were changes and features I would have liked to access, some participants did not feel the same way. Alex and Sarah expressed satisfaction with their apps and did not suggest any changes, while others had various improvements they would like to see implemented. Nathan, Daniel and Evan would like to see changes made to their app's music library. Daniel, in particular, described how the app restricted his access to specific songs.

> For me, I think it would be to offer a multitude of songs up front. I want to be able to go through and change from a country song to a classical music song and for it to be easy. The app makes you go through certain progressions in certain songs.

Katie and Mia expressed the desire for additional content in a variety of modalities. In particular, Mia wanted access to additional content.

> I would definitely have better tutorial videos, more tutorial videos, more realistic tutorial videos.

A lack of comprehensive music theory in the Simply Piano app challenged Rahul.

> If they could assign a personal tutor and make the class more interactive, then it would be good.

This ties into challenges related to the absence of personalised feedback and guidance. Unlike a traditional piano teacher who can offer tailored advice and correct mistakes, the app's current feedback mechanism can feel limited and generic. Tom shared his experiences.

> It would be nice sometimes to have a little bit more information because I honestly don't understand music. And if I'm shown a normal list with notes and so on, I have no idea how to play it or what to do. I just memorise, by

> heart, the songs and the movements that are for a specific song.

Tom preferred informal learning and, in addition, often liked to play music by ear, following YouTube tutorials. Similarly, Evan mentioned struggling with visual learning and felt that the app focused more on visual approaches.

> I really enjoy figuring something out and listening to it. Someone could be like, "All right, this is the A key, and it goes here. And this is the note for A key." Where I can figure, okay, this sounds like this, which matches up to this, so I need to press here.

Like Tom, he expressed a preference for listening and playing by ear. On a similar subject, Alex, Katie, Rahul, Mia, and Evan admitted to using other supplementary learning materials, such as books, YouTube, or TikTok, with Katie describing.

> The app doesn't have everything I need.

Lack of guidance in the apps resulted in difficulties reading music, finger positioning, and identifying chords, which led participants to rely on external resources to confirm chord and key positions.

6.5.2 Limitations of the Technology

Turning attention to technology, musical instruments, and equipment, I found limitations to using the app on a small screen, which Rahul and Mia also experienced. Rahul began his journey with a small iPhone, which he later upgraded.

> It’s a bit easier to touch the notes when using the on-screen keyboard. It was initially frustrating due to the screen size.

Mia recognised the limitations imposed by the screen size early on, making it difficult to interact with the notes comfortably. As she aptly puts it.

> It's definitely hard to learn an instrument on a small device.

Mia's frustration deepened when she encountered the strict requirement of needing to use headphones. This requirement became an obstacle, especially when she could not find her headphones or they were low on battery. Daniel shares a similar experience to Mia of needing to use headphones.

> The app does tell you that you should use headphones, so it's recommending it already. So, I already know that I'm not in the greatest scenario to have the best possible experience that I could have.

Regarding battery life, Evan was the only participant to mention battery as an issue, explicitly stating.

> The only challenge is if my phone is low on battery.

In addition, the participants were asked if there was anything that they would like to change about their instrument and technology setup. Sarah, Katie and Evan were satisfied with their setup and had no inclination to make any changes, while Alex described a lack of access and wished for his own keyboard.

> We own a keyboard, but most times, I can't use it.

Rahul wanted to change how his instrument connected and interacted with the app, while Daniel wanted the ability to access the app on different devices.

> I tried to set this up on a TV or laptop. My son had his school computer, and I thought we could set it up on his school computer. I thought I could say, "Hey, buddy, while I'm at work, you're on your lunch break for online school.

> Go ahead and play for half an hour." And he can't right. It's restricted. And I think that's a real shame… I wrote it off in my mind, so I haven't thought about it. But I think that's a real big downfall that it's only available in the app.

6.6 Personal and External Factors

Throughout my learning journey, I was confronted by multiple personal and external factors that shaped my overall experience. My own experiences related to COVID-19, environmental factors and physical pain. While these are uniquely mine, they are not isolated. My reflections resonate with several participants, who added a number of their own to the list. From external disruptions and distractions to the tug-of-war between learning and life's responsibilities, the stories of others add to the complexity and diversity of challenges encountered.

6.6.1 Impact of COVID-19 on Practice and Motivation

I woke up but felt strange. Even though I had just slept, I felt exhausted. I shrugged it off; perhaps I had just been overdoing things and not getting enough rest. As the day went on, my throat started to sting, and a familiar sense behind the back of my nose made it official, I was coming down with something. I was getting ready to go out when I decided I should probably take a COVID test. The pandemic was largely over, and all restrictions had been lifted. “It was unlikely to be COVID!” I told myself as I watched the first red bar on the test appear. Negative. I continued to get myself ready and went upstairs. I sat down on the bed for a while, and I felt like I was getting worse. I thought about going back to bed but really needed to finish getting ready to go out as we had plans in town. “It must be my imagination.” I shook my head and went downstairs to get a drink. As I walked past, I glanced at the test on the kitchen table. “Huh? Two bars?! I rubbed my eyes in disbelief. I had tested positive for COVID. I felt relief as it meant I could officially go back to bed and rest, but I also worried. Was I going to be okay?

I eventually made a full recovery, but my experience with COVID-19 was unlike

anything I had felt in the past. I had a fever, and my throat felt like I had swallowed knives that stabbed me in the neck every time I swallowed. But it was the exhaustion that was the worst. I thought that sitting down to play a couple of songs on my keyboard would cheer me up, but as I sat on the stool, I just could not face it. I had no energy, my hands were achy from fever, and my eyes were tired. No practice today. This feeling went on for nearly three weeks, and by the time I had recovered, I was excited to get back to practising. However, I felt like I had lost a lot of time and forgotten where I had left off. I noted a reflection in my learning journal.

> I had two weeks off playing as I caught COVID and was really unwell. Not feeling 100% and trying to get back to practice but feeling very unmotivated.

Unlike several of the participants in this study who used the COVID restrictions to learn a new skill, having COVID was a massive setback. I believe it was at this stage that my motivation began to dip. I started to ignore the practice reminders on my phone, dismissing them when they popped up in the evening. No practice today.

6.6.2 Influence of Environmental Factors

I enjoy hot weather. I like to visit hot countries and bask in the sunshine. However, the heat in the UK feels different, especially when you live close to a city. I watched the thermostat in the living room rise. At first, it was not so bad. 25 Celsius was bearable. Things became difficult past 30 Celsius. I sat at the piano, which had a leather stool. As I lifted my legs slightly to adjust my position, ‘Yuck,' I exclaimed, as my legs made an unpleasant sticking sound as I moved. I was sweating, sticky and generally felt unpleasant. I tried using a fan to cool myself, but it was noisy and interfered with my headphones. The headphones made my head and ears feel hot. My hands were sweaty and uncomfortable on the keys. I used a towel to wipe my hands and the keyboard, and while this improved my situation somewhat, it also dampened my motivation. This memory is stirred by a note in my learning journal.

> This sweltering weather makes it too difficult for me to practice. My hands are too sweaty, and I feel uncomfortable.

I was in no mood to play during hot weather. My physical state was affecting my mental state, and I lost concentration. External interruptions and distractions were also reported. This included noisy neighbours, interruptions, questions from family, and other responsibilities, as was the case with Beth.

> I have noisy neighbours; people are doing building work and stuff like that It would be helpful to have headphones in, and it's more my headphones rather than my phone or my keyboards, but my keyboard can't do Bluetooth. My phone can do Bluetooth. If I want to listen to the video and then look at my phone, it's a case of taking stuff off and putting it back on or swapping around headphones. So that's just a little bit annoying in terms of having to swap headphones around.

6.6.3 Impact of Physical and Mental Well-being

Physical pain was a common feeling at the start of my journey. The Simply Piano app warned that aching hands and fingers could occur and recommended regular breaks. I do not recall one single experience, but several experiences throughout my journey. I regularly recorded difficulty remembering finger positions.

> I’m finding remembering the finger positions on my left hand difficult.

In addition, I also recorded difficulty with note recognition.

> Sometimes I am not sure if I am remembering the notes by finger number rather than memorising the notes themselves.

I also recorded times where I felt physical discomfort related to posture while sitting.

> I found this session difficult. My hands and back both ache.

As well as aches and pains in my fingers and hands.

> Because of the way you play chords, it has meant stretching my fingers a lot, and they have started to ache.

I always felt awkward sitting at the piano. If I raised my stool, I felt too high; when I lowered it, I felt too low. I decided that perhaps the piano stand was the problem, but as I adjusted this, I experienced the same issue. My aching back was mainly the problem. I did not know if I was sitting right. I did not know how to sit. The app frustrated me as it did not provide much guidance. I did search the internet but never really found an answer that helped. In the end, I almost ignored the problem. It was not the worst thing in the world, but it was frequent and did cause me to stop when the pain got too bad.

For Evan, ADHD was a significant challenge in maintaining focus during learning.

> It can be very frustrating. It can be very annoying. But I don't know, maybe it's good that I'm getting rid of my anger. During one session, my partner was asking me a bunch of questions while I was trying, and the dogs were barking, and I just got really pissed off and walked away from the whole thing. I have ADHD quite bad. So for me to stay focused on something is quite challenging.

6.6.4 Time and Cost

Time and cost were also obstacles to learning. Sarah and Beth expressed that they had considered F2F lessons with a tutor, but time and cost were barriers. Sarah felt that apps made her more responsible for her own learning, but she

would have liked to have had F2F lessons.

> Face-to-face lessons don't come for free. Yes, I think I'd be more responsive if I were meeting a trainer face-to-face, and I'd probably be more committed and maybe farther ahead than I am at the present stage. But the online app is just good for now. And then it's my time. It's not that I have to rush, but if I do not go this week and I miss a session, I feel okay.

For Beth, cost, as well as the availability of piano teachers, caused an obstacle.

> I looked into piano teachers because I find that if I have a set time for stuff, I'm more likely to go for things. But I found trying to find a piano teacher was just not really possible at the times that worked for me and the cost at the time when I was initially thinking of doing it because I was kind of like, this might be a nice idea for my sister's wedding. Still, I don't know how feasible it will be for me to do it in terms of time and costs as well.

6.7 Feelings Experienced When Learning to Play an Instrument Using a Mobile App

Frustration, satisfaction, and achievement were the overarching themes related to feelings experienced when learning to play an instrument using an app. The conflicting feelings of satisfaction and frustration demonstrate a complex learning journey with moments of enjoyment, difficulty, and irritation.

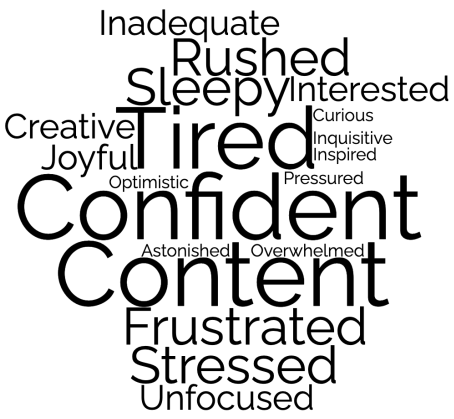

Figure 6.3 *A Word Cloud showing the frequency of words, visually representing the importance or prevalence of each word through size.*

During my learning journey, I logged my feelings from 30 practice sessions using the Feel Wheel to categorise and articulate my emotions, helping to identify patterns and changes in my emotional responses over time. My top five feelings were contentment and confidence mixed with frustration and tiredness.

While I feel that my experience was positive, the data collected from the learning journal provides a mixed picture. I considered positive sessions to be those where my feelings were generally uplifting and favourable, while negative sessions were considered challenging or draining.

Positive Feelings	Negative Feelings
Confident	Tired
Creative	Frustrated
Interested	Rushed
Joyful	Sleepy
Astonished	Stressed
Curious	Inadequate

Inquisitive	Unfocused
Inspired	Overwhelmed
Optimistic	Pressured

Table 6.1 *Feelings recorded from the online learning journal sorted into positive and negative categories.*

The sessions captured provided a very equal view, with 13 positive sessions and 13 negatives. Four sessions were categorised as positive and negative, as there were a handful of occasions where I felt confident but stressed and tired.

6.7.1 Frustration

During the first month of practice, I experienced several frustrating experiences. This was initially due to my technical setup. As mentioned previously, there are two methods you can use for note recognition: direct MIDI connection or the iPad microphone. The RockJam piano did not have a MIDI port, so I was constrained to using the app via the microphone note recognition method. I found this method extremely unreliable; the app would either not pick up on which notes I had played or would incorrectly recognise notes. As a beginner, I found that I would often look at my hands when playing, and if the app told me I had played the wrong note, it was difficult to know if it was an actual mistake or that the app had ‘misheard.’ This made me doubt the technology; I did not trust it.

The help and support webpage for the app contained helpful information on how to increase the reliability of note recognition, e.g., moving the iPad closer to the piano speakers and reducing the volume output of the app. Changing these settings did not significantly impact the reliability of note recognition. This was frustrating because the app constantly stopped and forced me to practice sections I had played correctly. Using this method also meant I could not use headphones to practice, meaning my sessions were audible to everyone in the house. This made me feel self-conscious as my husband could hear every

mistake I made. At this point, I decided a change needed to be made. I needed to be able to use headphones to practice. I also needed to use MIDI to connect the iPad directly to the keyboard.

I did some initial research, which resulted in purchasing several cables and an audio mixer. I found a YouTube video where someone connected similar equipment to the Simply Piano app. I followed the guide when the items arrived, but the app still did not recognise the audio. It was at this point that I almost gave up. It was incredibly frustrating to have all this technology at my fingertips but have nothing work together easily. I felt betrayed by the technology. “The adverts make it seem so easy,” I explained to my husband as he sat beside me, “I’m an adult, and this is frustrating. What if this was a gift for a child?” I started to unplug the equipment and package it to return to the shop. After several conversations, I concluded that the piano was the only piece of equipment I had not considered adjusting or replacing. After further research, I decided that the RockJam piano did not fit my purpose. I needed to purchase something with a MIDI port. I felt guilty at this stage; the piano was a gift, and I already needed to replace it. I explained everything to my husband, and he looked at me. “Don’t worry”, he said. “I didn’t know what kind of keyboard to buy. This one looked good for beginners and appeared to connect easily to the app. It wasn’t very expensive. How about I buy you the new one?” it was a lovely suggestion, but the fact that it was not expensive was not the point. After looking online at new digital pianos, the information was often misleading for a beginner; it was not always obvious what would and would not work seamlessly with the iPad and the app.

After hours of further research, I purchased a Yamaha PSR-E373 and connected it using the Apple adapter I had purchased as part of a previous experiment with the RockJam piano. I should also note that I did not need to replace the piano stand and chair gifted to me at Christmas as these items were still compatible.

When the piano arrived, there was again some initial confusion over how to connect everything, but with the help of my husband, I eventually got everything working. The new piano still had the same number of keys as the RockJam

piano but had several additional features that made the experience feel premium. For one, the sound quality was much nicer. Secondly, the touch-sensitive key feature made it feel like you were playing a traditional piano. For instance, if you pressed a key lightly, it would sound quieter than if you pressed a key hard. My headphones could now be connected to the piano, which was connected to the Apple adapter, which connected everything to the iPad. I could now hear the app and my piano playing through headphones while directly connecting the piano to the iPad. The experience was so much better; the app now precisely recognised which notes I was playing, making the feedback reliable; I could now trust the technology and move forward.

In relation to the participants, Mia mentioned facing similar challenges with the app's technical aspects. She referred to issues with the app not correctly registering specific notes or chords, which affected her progress and overall experience. Rahul described a similar experience with the limitations of his equipment.

> It would be good if there were a manual connection between the keyboard and phone via cable or something. That way, it would catch the notes correctly.

Rahul did not want to change his setup or equipment in this case.

6.7.2 Frustration with App Features and Functionality

In addition to frustration with connectivity, app frustration stemmed from various factors, such as usability, pace of learning, and perceived ability. I regularly logged feelings and emotions of dissatisfaction with my practice sessions.

> I didn't enjoy this practice session and felt like I played worse than usual.

I noted, expressing my disappointment with my performance. Another session left me feeling exasperated.

> Such a very frustrating session. I don't feel like the app

> lets me practice enough before moving on to the full-speed song. The timing is so fast, and I find it hard to keep up.

The transition from practice mode to playing the full-speed song felt abrupt and overwhelming, leading to a sense of being ill-prepared.

> The app has annoyed me as the practice and song sessions are becoming difficult.

I noted, articulating my growing frustration.

> During practice mode, I am confident, and then I move on to playing the real song at full speed without practice, which is really difficult.

This recurring pattern of feeling unprepared and frustrated undermined my motivation to continue using the app.

> I could have done with more information on the different keys earlier.

I felt like this hindered my progress and enjoyment of learning the piano. These challenges tested my patience and perseverance.

> While I enjoyed the session, I found the two songs difficult to grasp. I made quite a few mistakes which kept triggering 'practice mode' in the app, and there is no way to skip this!

I grappled with frustration but was determined to overcome the obstacles. Even though I struggled at times, I discovered new ways to express myself.

> While my 'usual' style of playing hasn't improved, I've learnt a different style of playing, which is fun and interesting.

The last question in the online learning journal asked whether the performance during the session was better, worse or no different than the previous session. This data provides a self-assessed evaluation of my performance over multiple practice sessions (see Appendix H).

After completing 11 sessions, I recorded that my performance had improved compared to the previous session. This showed that some positive experiences, such as increased confidence and improved note recognition, were consistent with the perception of improved performance.

After 17 sessions, I recorded my performance as stable and perceived that my performance was no different than the previous session. This aligns with my reflections, which mentioned feelings of having a good session and making progress. There were two sessions where I felt performance regression and perceived that my ability to play was worse than in previous sessions. This corresponds to reflections of difficulty and frustration related to finding certain songs challenging or experiencing frustration due to app limitations. This data corroborates my reflections from my learning journal and shows that feelings of improvement, stability, or regression align with my self-performance assessment.

Among the interview participants, frustration, stress, and occasional bouts of anger were described. These feelings were mainly associated with the inherent challenges of learning a new instrument, the limitations of the app's teaching method, difficulties in maintaining a regular practice schedule and managing external distractions. The struggle to master specific skills, combined with self-imposed expectations, appeared to lead to high levels of emotional distress. Alex describes the overwhelming impact of frustration on his learning journey, stating.

> I know when I feel frustrated, I can't even learn anything. Sarah reflects on moments of doubt and irritation, expressing, it seemed like it wasn't working like I wasn't going to get it, and at that point, I felt annoyed and thought I would give up.

Tom recounts his struggles with consistency and the frustration of making repeated errors, stating.

> I have frustrated myself. For example, I do something ten times, and I move my fingers wrong, or I do it right. And then, I start with the next song that incorporates this movement inside the song. And then I started doing it wrong again.

Beth recalls the early stages of her learning journey, grappling with the challenge of acquiring muscle memory.

> I felt frustrated at the beginning when I just didn't have muscle memory or didn't know what they were doing. I couldn't quite get it right.

Evan articulates the desire for perfection and the frustration of falling short.

> The frustration of not getting it right. It's just wanting to get everything right, and wanting to be good, and just messing up. It's just annoying.

In addition, several other areas of frustration were highlighted. For example, Alex described an issue with accessing a course that had already been purchased.

> I went to access my app and found out that I had to buy the course again.

At the start of their journey, Sarah and Rahul experienced confusion, leading to frustration. Sarah describes feeling ignorant at the outset, especially when it came to connecting and using the app.

> I wasn't really sure of some things about the app, and my friend wasn't around to teach me how to make use of the app. It was a bit difficult for me, but I was able to get through all of that.

Mia described how the app occasionally crashes, disrupting her practice sessions and erasing her progress.

These stories highlight the emotional struggle individuals have to navigate when learning using an app. This highlights how quickly you can become discouraged when learning using an app. In my experience, the app is very black-and-white regarding feedback and performance, indicating what has gone wrong and what has gone right. I feel that there are times when I would have benefited from some encouragement during times of frustration so I could acknowledge what I had done wrong and reflect on what I am doing well.

6.7.3 Satisfaction and Achievement

Moments of satisfaction and achievement related to improved progress and enjoyment contributed to my confidence. There were times when I looked to alleviate feelings of stress and tiredness by playing the piano and engaging with music.

> I thought I'd just try to relax a bit by playing a few songs.

I recognised areas of growth and challenge, particularly with my left hand technique.

> I feel like this session had more left hand practice, which was good. I am still finding it hard when I have to play more than two notes with my left hand.

I observed, acknowledging both progress and areas needing further attention. Even though I encountered difficulties, I noticed an improvement in my note recognition. This small victory contributed to a sense of fulfilment.

> A good session. I really enjoyed playing these songs a lot.

From the participant’s perspective, many shared feelings of satisfaction, accomplishment, and excitement, particularly when they successfully learnt a song or a new skill. In many cases, feelings were linked to the perceived ability to play and the success of a practice session, as described by Katie.

> When I get it right, I feel happy and confident.

These feelings seem tied to visible progress or the ability to play a song they like.

There were feelings of happiness and confidence related to the ability to play something accurately, quickly or both, which was the case for Alex.

> When you have a successful session and when you strike fast. You learn two or three keys at a time, and you feel, wow. Yeah, I'm getting this thing fast enough. I'm learning.

As well as Sarah.

> I feel happy and confident whenever I'm able to make corrections and when I'm able to play very nice.

Like my own experience, Nathan at times found the process somewhat therapeutic, using practice sessions to relax, unwind and vent frustrations.

> I always feel relieved. I feel less stressed. I feel relieved because I come back with all the work stress, and I can actually get some sleep. I feel very relieved and happy.

Katie reported feeling very emotional at times.

> I find myself sometimes playing some emotional songs and then find tears dripping out of my eyes simply because it's just emotional. So I feel mostly, most times, good. Even if I'm annoyed and I just try to play, I tend to forget my worries. I feel it is a means of escape for me.

These experiences show that while learning an instrument using an app can be frustrating and challenging, it also provides moments of happiness, joy, gratification, and personal achievement.

Chapter 7: Discussion

This chapter explores the theoretical concepts and their application. It examines research findings to establish connections with existing literature and theoretical frameworks. The discussion considers the practicalities of using an app to learn a musical instrument, particularly in the context of mLearning. It then examines motivations through the lens of SET and SDT, analysing how perceptions of autonomy, competence, and relatedness impact motivation when learning using apps. This analysis further aims to unpack the findings of RQ3.

7.1 Music mLearning: Practice and Application

Technology mobility has erased the boundaries between formal and informal learning, helping to democratise learning, especially when learning a musical instrument. Apps help provide structure and feedback at a convenient time and place. While mobility highlights the freedom to learn in different locations, ubiquity is the idea that mobile technology is becoming increasingly integrated into our daily lives. Sharples et al. (2009) describe mobility in physical space as "individuals taking time out of their schedules to learn and reflect, with the location being either relevant to the learning or simply a backdrop" (2009, p. 235). This study's findings highlight the practicality of mobility in mLearning, as participants learn in their own time at their own pace and in their chosen environments. This feeds into the concept that mLearning fosters opportunities for learning beyond the confines of physical classrooms and schedules.

From this study, we can see that this is one of many reasons that individuals choose to learn using apps. It is apparent that even though technological devices are mobile, a fixed space is required for musical instrument equipment, such as a keyboard, stand and stool. In the researcher's case, the keyboard was reasonably large, not easily transported and required power. This soon restricted the ability to learn anywhere. Conversely, the literature views this differently, and despite feeling static, mLearning can be seen as learning that takes place in various contexts and locations, whether physically static or mobile, beyond the traditional classroom setting (Sharples et al., 2009, p. 246).

Many keyboards cannot use batteries, and devices used to access apps, such as smartphones or tablets, eventually require a charge. Therefore, it would be impractical to be physically mobile.

Focusing for a moment on where traditional lessons occur, the home of a student or teacher, many environments for learning are physically static due to the nature of learning the piano. This situation is the same whether the student is learning using an app, although this challenge is more applicable to piano learners, compared to the guitar, who are not bound so much by the size, weight, or power requirements. As a result, while mLearning allows for flexibility in terms of timing and location, the physical mobility of the learner is not a critical factor for music mLearning, as individuals will likely use a stationary setup.

Arnedillo-Sánchez (2024) highlights how the pervasive reliance on mobile devices in daily life impacts various activities, a theme reflected in this study's findings. Moving away from the app was challenging as there was a lack of support and immediate feedback. A similar phenomenon can be seen in the classroom and private tuition. According to De Villiers (2018), teachers may hinder learning by providing too much guidance, such as adding finger numbers to sheet music or demonstrating the sound of music. This relates to some of the challenging experiences felt when learning with the Simply Piano app, as finger numbers were often included in guided lessons but randomly removed at different stages of practice. While the app initially made learning more accessible, learners can become reliant on features, resulting in a lack of confidence and frustration when playing using different methods. This frustration can affect self-efficacy, which is detrimental to motivation. Technology, in this context, could be seen as a double-edged sword. While it initially facilitated and enhanced the learning experience, its absence reveals a dependency that makes moving away from the app more challenging.

As mobile devices become more integrated into our daily lives, the line between mLearning and traditional learning blurs. Richards (2019), Crompton and Traxler (2015) have sparked debates over whether mLearning warrants the

development of a distinct theoretical framework, given its unique characteristics, including teaching methods, technology use, learning environments, and social interactions. However, it could be argued that these terminologies will converge with the overarching construct of learning, leading to the obsolescence of the term mLearning. This is because the affordance of mobile technology, including accessibility, personalisation, and flexibility, are increasingly recognised as essential attributes of effective learning environments.

A device’s capacity to support individualised learning pathways, provide immediate feedback, and facilitate collaborative learning experiences mirrors the demands of 21st-century education. As such, the features that distinguish mLearning are increasingly becoming prerequisites for all learning experiences, suggesting that mLearning is not a separate mode of learning but an integral aspect of contemporary educational practice. Nevertheless, it could be argued that mLearning supports contextual and situated learning, setting it apart from traditional forms of education. For example, learners engaging with mLearning may benefit from its potential for physical mobility, such as practising guitar while travelling. However, it is important to note that participants in this study did not prioritise physical mobility in their learning. This suggests that the benefits of mLearning, such as mobility, may vary depending on the learner's specific context and situational factors.

7.2 The Impact of Apps on Adult Learners' Self-Perception

This study highlights how apps democratise access to music education, lowering barriers to acquiring basic musical instrument skills. These findings align with those of Yun Yi and Thiruvarul (2021) and Liu and Shao (2022), who have documented the transformative impact of apps in enhancing learners' engagement and technique when learning instruments. With each app that is developed, a new set of challenges appears. While technological advancements have transformed device portability, new challenges have emerged. Small screen sizes were once a solution for portability but now hinder

the learning experience, particularly when using apps to learn musical instruments.

Many affordances, constraints, barriers, and issues appear to amalgamate within the literature. While they all represent elements that impede or limit progress, they differ in nature and impact. Constraints specifically limit progress in a particular aspect, while barriers encompass broader challenges hindering overall advancement.

As identified in the findings, one of the main themes relates to the instructional limitations of apps and technology. Challenges and obstacles experienced within this study align with those identified in the literature, many of which are issues similar to those identified almost a decade ago. This indicates that app developers have not adequately addressed these persistent challenges. It is essential to tackle these issues in order to better accommodate learner's needs and create more conducive and supportive environments for practical learning experiences, enhancing their efficacy and ensuring a more enriching learning journey.

When comparing constraints highlighted by Orr, 2010 and similarly by Criollo-C et al. (2021b) to the findings in this study, we can see that several areas are not directly applicable because much of the literature relates to classroom environments. While it may seem that teacher and institutional changes are not directly relevant, a different relationship appears upon closer examination. For example, if there is a significant update to the app the learner is using, they may face difficulty adapting to the changes. Depending on the extent of the change, they may need to update their knowledge of how the app works. In addition, this becomes further blurred when a blended approach is used, as teachers conducting private tuition may be more reluctant to suggest or keep up with the latest technology (Sochor, 2020). While this study's findings indicated some difficulty accessing apps after an update, it did not form a common theme. Lastly, while teachers are concerned with distractions in the classroom, distractions also affect individuals learning on their own. This manifests as environmental distractions, noisy neighbours, construction noise, interruptions

from individuals and pets and difficult weather conditions such as heatwaves. There are also health-related challenges related to physical discomfort, illness such as COVID-19, or challenges maintaining focus related to neurodivergent conditions such as ADHD.

Another significant area related to challenges and obstacles was the app's teaching methods and the lack of detailed instruction. Several studies assessed the effectiveness of music learning apps in teaching fundamental music theory, basic skills, and providing feedback. These evaluations identified strengths, weaknesses, and areas for improvement in available apps and provided the basis for creating new apps (Elfaki et al., 2012; Ng, Lui & Kwok, 2015; Zhou, 2016). This relates to the findings that highlight a desire for personalised content and additional features, which suggests a potential rigidity in the current approach that could negatively impact user engagement. While this may contribute to motivation and engagement, it can become a challenge and an obstacle when individuals become bored or frustrated.

Furthermore, this study found that independent adult learners often used other materials or multiple apps to support their learning. Learners are more likely to turn to the internet or use other apps when they feel they are not progressing or do not understand the content. Many learners felt that a single app did not sufficiently support their needs, which is consistent with the literature (Cherylyn, 2020; Alm, 2021). Conversely, app developers' lack of guidance on suitable equipment and connectivity burdens learners to conduct further research, which hinders the learning process, engagement and overall progress. It was also suggested that F2F lessons with a teacher may prove beneficial for further progression. This aligns with literature that looked at a blended use of apps in the classroom where external assistance positively impacted the students' experience when using apps outside the classroom (Akkara et al., 2022). In these instances, the teacher provides the necessary support to learners when required. As a result, this shows that apps do not always adequately support independent learning, leaving individuals disadvantaged when facing content or technical difficulties. In addition, Heath-Reynolds and VanWeelden (2015) state that apps should not replace teachers but be used as supplementary materials.

In addition, device limitations, connectivity and sound recognition issues are common occurrences. Similar experiences were identified within the literature, where some apps had difficulty recognising notes accurately and registering sounds correctly (Ng, Lui, and Kwok, 2015). This could be further compounded as it has been identified that learners often struggle to identify notes and patterns (De Villiers, 2018); therefore, if the apps cannot identify notes correctly, learners can become confused and frustrated. This reiterates that issues identified in prior research continue to persist in modern apps, despite advancements in technology and design. While the literature broadly covers these difficulties concerning device functionality (screen size, battery life, text input), this study highlighted technical issues more specific to the app's functionality (interface issues, connectivity problems, device compatibility).

Lastly, this study distinguishes itself by focusing on individuals using self-selected apps in their environments. Much of the literature focuses on using apps in the classroom and operates within a highly controlled setting. In some cases, the apps are chosen for the research participants, such as in the case of Cherylyn (2020). While advantageous for scientific rigour, it does not mirror real-life experiences. Not allowing freedom of choice forces the participant to use an app they may not like or feel is unsuitable for their needs. As previously stated, one app does not fit all needs. This lack of learner choice is a limitation in many studies as the experience shared by participants will differ from those who have freely chosen their apps. Although the study by Sochor (2020) looked at the use of apps at a high level, the study focuses more on their use as a supplementary resource. However, it was suggested that mobile technology can motivate students to learn outside of private piano tuition.

7.2.1 The Factors that Influence Learners' Perceptions of Apps in Music mLearning

The findings show that several key factors influence a learner’s perception of music apps. These factors include usability and interface design, content quality and relevance, feedback and progress tracking, personalisation and customisation, accessibility and flexibility, social interaction and community

features, cost and subscription models, technical performance and reliability, learning outcomes and effectiveness and pedagogical approaches.

Ease of use and intuitive design significantly affect learners' experiences and willingness to engage with the app. User-friendly interfaces that simplify navigation and learning tasks positively influence learners' perceptions. High-quality, diverse, and relevant content tailored to the learners' musical interests and skill levels enhances satisfaction and the app's perceived value. This includes the availability of a wide range of music genres, clear instructional materials, and adaptive learning paths. Immediate, actionable feedback on performance and progress tracking features are crucial for motivating learners and fostering a sense of achievement.

The ability to personalise learning experiences, such as selecting songs to learn or adjusting the difficulty level, influences learners' engagement and persistence. These factors collectively influence learners' attitudes and satisfaction towards apps, shaping their decisions to adopt and persist with this learning method. Features that enable interaction with other learners, such as community forums, can enrich the learning experience.

The cost of app subscriptions and the availability of free content impact learners' decisions to use and continue using an app.

The app's technical reliability, including accurate note recognition, is critical for a positive learning experience as these issues can significantly detract from the app's perceived effectiveness. Perceptions of the effectiveness of apps in improving musical skills and achieving learning goals are influenced by personal experiences of progress and achievement.

Lastly, incorporating pedagogical principles, including structured learning pathways, theoretical knowledge integration, and skill-building exercises, impacts learners' perceptions of the app's educational quality.

These factors are key when designing apps for music education. Collectively, they influence learners' attitudes towards and satisfaction with apps, shaping their decisions to adopt and persist with this mode of learning.

7.3 SDT: Motivations for Learning Using Apps

The researcher had several motives for wanting to learn using an app. As seen in the Chapter 1, there was an intrinsic motivation to learn the piano after being gifted some sheet music and an interest in playing the piano and learning an instrument for self-development. There was a desire to learn differently, which was influenced by a general interest in technology. The thought of learning with apps brought about feelings of excitement and interest. While these motivations appear positive, they have not been enough for a habit to form; engagement dropped, and while the desire to continue to learn persists, the application has not. Although new skills have been acquired, the failure to incorporate regular practice into a daily routine has had a negative impact.

Looking at the experience and the motivations through the lens of SDT, the motivations are intrinsic and are driven by internal satisfaction and enjoyment. SDT postulates that three innate and universal psychological needs motivate people to grow and change (Ryan & Deci, 2017). These needs are a sense of competence, relatedness, and autonomy. In Chapter Three, a hypothesis was put forward that suggests that when an individual perceives that they have no control over the learning process (autonomy) and that they are not progressing well (competence) or receiving support and encouragement (relatedness), they are likely to experience feelings of frustration and are likely to become disengaged with the learning process. Conversely, if an individual feels that they have control over the learning process of learning to play the piano using an app (autonomy) and feels they are progressing well (competence) while receiving support and encouragement from others (relatedness), they are more likely to be motivated, engaged, and persist in their learning journey. In this instance, they are more likely to experience a heightened sense of self-determination, which fosters greater motivation and satisfaction by fulfilling their psychological needs for autonomy, competence, and relatedness.

Looking at the findings explicitly related to the researcher's motivation, some areas indicate issues within each of the three psychological needs. The hypothesis considers the importance of psychological needs in driving motivation and engagement. Autonomy allows individuals to control their learning and choose methods and strategies that align with their preferences. Competence refers to progress and mastery in learning, which boosts confidence and motivation. Relatedness emphasises the social aspect of learning, where support and encouragement from others contribute to a sense of belonging and motivation (Ryan & Deci, 2017). Although the intrinsic motivations remain consistent, external factors such as weather, illness, and competing priorities have hindered the ability to engage in practice consistently.

When exploring SDT within different educational contexts, MacIntyre et al. (2017) provide a broad theoretical model that shows the psychological needs of musicians and their influence on motivational processes. Unlike this broader application, this study looks specifically at the use of apps in learning musical instruments, highlighting how technology impacts autonomy, competence, and relatedness. The importance of apps is particularly relevant in modern education, where technology mediates many learning experiences (Sharples et al., 2009; Crompton and Traxler, 2015; Traxler, 2021). While MacIntyre et al. (2017) lays down a foundational model, it does not explicitly address the complexities introduced by digital and mobile technologies. In contrast, the findings from this study not only update SDT's applicability in the context of contemporary educational tools but also provide practical guidance for optimising mLearning platforms. This research highlights critical design and functional features that significantly impact user engagement and learning outcomes by detailing how apps can specifically satisfy or fail to meet the BPNs.

7.3.1 Autonomy, Competence and Relatedness

Although learning using an app provides a sense of perceived autonomy over the practice schedule, external factors impacted this. Instead, health, work, and competing tasks became a priority. This perceived lack of choice could have

made dedicating regular time to practising the piano more difficult. When using apps to learn, providing choice supports autonomy, and the findings of this study show how choice and control over the learning process enhance motivation. The autonomy afforded by choosing an app and learning path aligns with Evans's (2015) emphasis on autonomy support. On the contrary, excessive control over the learning process or imposing strict rules without explanation can thwart autonomy. The constraints related to the prescriptive use of specific apps or the lack of customisation options when learning using apps could reflect thwarting behaviours, restricting learners' sense of control and choice.

Learning an instrument using an app can introduce frustration and feelings of inadequacy, yet finding a balance between challenge and skill is vital for developing competence. Perceived incompetence might stem from the frustration and clumsiness felt during mistakes. Despite seemingly beneficial practice sessions, analysis reveals a balance of positive and negative experiences, highlighting a gap between immediate emotions and later reflections on performance. This demonstrates the range of emotions encountered while mastering an instrument, where negative feelings often contrast with stable or improving skills. This contrast shows the importance of recognising progress beyond initial setbacks to foster a more objective perspective on improvement.

Many reflect positively on their practice sessions over time, suggesting that engaging in complex challenges is ultimately rewarding. This illustrates the importance of acknowledging progress to fulfil the need for competence. Developing a growth mindset and focusing on effort rather than innate ability is key to perceiving progress and achieving mastery (Evans, 2015). Nonetheless, obstacles like app limitations, note recognition errors, and a push for perfectionism and competitive success over personal growth can hinder development, particularly for those lacking support or resources.

Regarding relatedness, the findings suggest that an app’s limited capacity to support meaningful social interactions may adversely affect relatedness. While several apps encouraged community collaboration, findings showed that many

participants did not engage in this area, which could thwart the need for relatedness, which is crucial for sustained motivation and engagement in learning (Evans, 2015). This suggests that apps are not fully satisfying the need for relatedness. This gap presents a critical area for app developers and educators to consider integrating social features that foster community engagement and support without compromising the autonomy that learners value. Features facilitating peer interaction, mentorship, or progress sharing could offset this. Additionally, integrating mechanisms for positive reinforcement from peers and instructors could enhance the learning experience, making it more fulfilling and socially connected.

7.3.2 A Comparison of the Motivations to Learn Using a Mobile App

When comparing the researchers' motivations for wanting to learn using an app to the motivations of others through the lens of SDT, there are some differences. The researchers' motivations stemmed from personal enjoyment and satisfaction, driven mainly by the desire to learn music from their favourite band and an interest in technology. It has been determined that the variety of motivational factors derived from the participants outweighed those of the researcher because of the larger sample size. The main differences were that the participants were motivated more by factors of relatedness such as social connections, the desire to impress others, and a way to use time productively during the COVID-19 lockdown. Most motivations were intrinsic, which was beneficial as it has been suggested that extrinsic motivation is not a successful motivator and can undermine intrinsic motivation (MacIntyre et al., 2017). External factors impacted the ability to practice consistently. These are considered personal as they are related to health, sense of control, and emotional state. In contrast, the difference between my motivations and those of the participants was that the participants appeared to be more affected by typical challenges associated with the learning process.

There was a discrepancy between the researchers' emotional state during practice and perceived performance. Despite immediate frustrations, recognising progress post-practice sessions showed a more objective view of

advancement. On the contrary, participants' goals were often aligned with playing well, learning new skills, or performing at specific events, indicating a goal-oriented approach to their progress. These differences highlight the motivations' uniqueness and the researcher's challenges. While motivated by diverse reasons, the participants appear to have faced fewer obstacles and challenges, which aligns with the idea that extrinsic and intrinsic regulation can affect one’s perceived competence and willingness to play music (MacIntyre et al., 2017, p. 8).

Autonomy was a significant driver for all participants. Apps were chosen against personal preferences, which reflect autonomy in decision-making. Learning specifically using apps aligns with autonomy in that apps enable participants to learn at their own pace in their own time, which promotes a sense of autonomy.

Participants expressed motivation to learn a new skill, improve their musical abilities, and find personal satisfaction. Most participants felt competent when they could play a song correctly or noticed an improvement in their progress, which aligns with a sense of competence. This indicates that competence plays an important factor in motivation, as most participants felt frustrated when they could not make progress as quickly as they liked.

A benefit of mLearning is its capacity to encourage active learning processes within a group or community setting (Masero, 2023). Despite this, most participants did not engage or want to engage in a community group, either in-person or F2F. While many did see the benefits, and several had been members of communities in the past (to help with technical issues), they did not engage in this aspect and did not feel that it affected their ability to learn. However, several participants expressed an interest in playing for family and friends when they felt confident enough, which aligns with relatedness. However, this was not something the researcher could relate to. Participants felt a strong sense of self-determination, with the motivation to learn an instrument being largely intrinsic. Much of this was driven by a desire to gain competence and maintain autonomy.

7.3.3 Supporting and Thwarting Needs

In Evan’s (2015) research on SDT in music education, “supporting” and “thwarting" needs, refers to how environmental factors and interpersonal interactions can either facilitate or hinder the satisfaction of the BPNs.

Supporting needs are those conditions or actions that promote fulfilling these needs, leading to enhanced motivation, well-being, and personal growth. For example, providing choices, acknowledging feelings, and offering optimal challenges support autonomy and competence while establishing connectedness and caring relationships support relatedness.

Thwarting needs are conditions or interactions that hinder the satisfaction of the BPNs, potentially reducing motivation and well-being. This can include overly controlling behaviours, excessive pressure to perform, isolation from significant others, or neglect of the individual's perspective and feelings. Such environments not only fail to support the BPNs but actively undermine them, leading to negative outcomes like alienation, decreased motivation, and psychological distress.

While Evan's (2015) study primarily focused on F2F interactions in the classroom, the following demonstrates how his framework can recognise the BPNs of learners that may need supporting or thwarting, and how the use of apps can either facilitate or impede these needs. It should be noted that categories that relate directly to a classroom setting have been removed.

7.3.3.1 Supporting Competence

Encourage a growth mindset. A growth mindset considers learning an incremental process, focusing on effort and strategies rather than innate ability (Evans, 2015). In this study, participants frequently reported feeling a sense of progress and mastery when using apps that provided structured goals and feedback. For instance, several participants noted how completing app levels or achieving milestones enhanced their confidence and reinforced their belief in

their capacity to improve. These findings align closely with the principles of fostering a growth mindset.

Emphasise effort. When learning musical skills, effort and strategy should be prioritised over innate talent or outcomes (Evans, 2015). Participants in this study highlighted how immediate feedback from apps enabled them to identify and address mistakes effectively. One participant described how receiving real-time corrective feedback during practice encouraged them to persist with challenging exercises, reinforcing the value of sustained effort and deliberate practice.

Praise efforts and strategies. Recognising learners' achievements, such as mastering new pieces or overcoming technical challenges, can be a powerful motivator (Evans, 2015). In this study, participants valued structured feedback that acknowledged their effort, with one participant describing how completing exercises and receiving positive reinforcement from the app increased their motivation to continue practising. This finding supports the idea that acknowledging effort can boost learners' motivation and persistence.

Teach effective practice strategies. Providing learners with specific strategies to enhance skill acquisition is crucial for effective learning (Evans, 2015). In this study, participants frequently praised apps that offered structured learning paths and targeted exercises. For example, one participant noted how the app's progressive exercises helped them develop efficient practice routines, facilitating their skill development.

7.3.3.2 Thwarting Competence

Maintain perfectionistic standards. Enforcing high, often unattainable standards can pressure learners, potentially leading to frustration and disengagement (Evans, 2015). Although this study did not find direct evidence of perfectionistic standards being enforced by the apps participants used, such standards could become problematic without appropriate scaffolding, especially when learners transition to unassisted play.

*Emphasise norm-referenced evaluations***.** Focusing on competitive, norm-referenced outcomes as primary goals can undermine intrinsic motivation (Evans, 2015). Participants did not explicitly mention feeling demotivated by these aspects. However, Evans's (2015) critique suggests that heavy reliance on immediate and quantifiable success could shift learners' focus from meaningful progress to external validation. This area warrants further investigation to understand its implications.

Emphasise competition outcomes. Highlighting musical competitions and peer comparisons as indicators of success can shift the focus away from self-improvement towards outperforming others (Evans, 2015). This study did not explore the impact of competition-based features, such as leaderboards. However, Evans's (2015) findings suggest that such features might discourage some learners by prioritising peer comparisons over individual growth.

7.3.3.3 Supporting Relatedness

Facilitate peer interactions. Encourage interactions within learning environments, such as music studios or online forums (Evans, 2015). Apps that provide forums, include community collaboration features and multiplayer modes allow learners to interact and share experiences, fostering a sense of community.

7.3.3.4 Thwarting Relatedness

Maintain strict standards. Impose rigid learning standards without flexibility, hindering the development of warm student-teacher relationships (Evans, 2015). The structured and sometimes inflexible learning paths in apps can mimic strict teaching methods, potentially negatively impacting learner motivation.

Manipulate through guilt. Use guilt or shame to enforce learning discipline, which can harm the student-teacher relationship (Evans, 2015). The feedback mechanism in some apps may induce feelings of incompetence when learners fail to meet set standards, impacting emotional well-being. Although this study

did not find explicit evidence of guilt-inducing feedback mechanisms, Evans (2015) notes that such approaches can thwart relatedness.

7.3.3.5 Supporting Autonomy

Provide choice in learning. Offer learners autonomy in selecting what, how, and when to learn (Evans, 2015). Apps that allow learners to choose their pieces, set goals, and engage with content that aligns with their music tastes and learning pace can enhance autonomy.

Provide rationales for tasks. Explaining the reasons behind specific practice tasks and goals can help learners see their relevance and value (Evans, 2015). However, participants in this study observed that while some apps provided structured guidance, they rarely explained the theoretical underpinnings of exercises. This lack of rationale occasionally left learners needing clarification on the purpose behind certain tasks. Including such explanations could further support learners' autonomy by helping them understand the "why" behind their practice.

Encourage creative practices. Engaging learners in creative activities such as improvisation supports autonomy by fostering self-expression and exploration (Evans, 2015). In this study, few participants reported opportunities for creativity within the apps they used, as the focus was primarily on skill acquisition and replication. This suggests a gap in how apps currently support creative practices. Features enabling improvisation and composition could enrich the learning experience and enhance autonomy.

7.3.3.6 Thwarting Autonomy

Pressure to perform. Pressure learners to meet specific performance metrics, undermining intrinsic motivation (Evans, 2015). Performance metrics and progress tracking in apps can create pressure to achieve, potentially reducing intrinsic motivation and enjoyment.

Limit participation in planning. Exclude learners from participating in the planning of their educational paths (Evans, 2015). Apps that do not allow learners to modify the curriculum or sequence of lessons can limit their engagement and sense of autonomy.

7.3.3.7 Summary

The main takeaway shows that apps for learning an instrument can significantly support adult learners in developing competence, autonomy, and relatedness. Still, there are also potential challenges that could negatively affect these needs. Apps should strive to enhance personalisation, emotional recognition, and community features to maximise their positive impact on learners' competence, relatedness, and autonomy. Developers should investigate how integrating and supporting these needs could help improve user experience, effectiveness, and satisfaction.

7.4 SET: Feelings and Emotional Experiences in Music mLearning

Learning to play a musical instrument involves more than physical coordination. Individuals must also navigate the emotional challenges of self-criticism and comparison to others' proficiency. While apps try to provide guidance and instruction, they do not fully address the emotional aspect of learning an instrument, raising questions about individuals' innate emotions when learning an instrument without using apps. In Sudnow's (2001) account of learning the jazz piano, he describes frustrations and difficulties learning to coordinate both hands and feelings of inferiority compared to other musicians. The learning process still involves a human element, and there is an opportunity for technology to be applied in a way that eases negative emotions. As a result, recognising and understanding these emotional challenges and how technology can better support emotional well-being during the learning journey.

The MILASE questionnaire assessed the researchers' perceived ability to learn and practice skills using the app, set goals, and track progress. The questionnaire directly evaluated the perceived ability to stay motivated, manage distractions and stay consistent, which saw a decrease over time. It is difficult to

make a direct comparison between the researcher’s experiences and the participants’ experiences when looking at the data reflexively and objectively because the data was captured differently. Unlike the autoethnographic data that captured feelings and emotions during and after the researchers’ practice sessions using the questionnaire, the participants' emotions were not captured over time. Instead, participants were asked to reflect on their experiences. As a result, reflections of feelings naturally emerged as part of the interview conversations. When analysing and comparing participant data, frustration, satisfaction, and achievement were identified as the overarching feelings experienced while learning the piano using an app. These emotions highlight the emotional impact of learning an instrument using an app and the role this learning method played in the participants' overall experience.

The MILASE questionnaire could be considered technology-centric, emphasising app-related tasks and directly addressing how using the app influences self-efficacy related to technology-mediated learning. The questionnaire captured the researchers’ perceived ability to use apps and technology, troubleshoot technical issues, access interactive features, and adapt to updates or new features. While this is well-suited for evaluating the impact on self-efficacy within a technological context, it would not capture broader aspects of self-efficacy. As a result, the MILASE questionnaire offered a more targeted assessment of perceived abilities, focusing on technological proficiency and efficacy within the app. When analysing the results, the impact of technology on the researcher’s self-efficacy reveals a mix of positive and negative influences. SET was used to evaluate the data to determine if having a high self-efficacy affects the experience of adults. As previously seen, an individual’s belief in their ability to produce desired outcomes determines their behaviours, thoughts, and emotional reactions. This belief, or self-efficacy, can be derived from four primary sources: mastery experiences, vicarious experiences, verbal persuasion, and physiological and emotional states.

7.5 SET: The Impact of Piano Learning Apps on the Researcher's Self-Efficacy

As previously stated, the MILASE questionnaire assessed the researchers' perceived ability to learn and practice skills using the app, set goals, and track progress. The questionnaire was created to address RQ1, sub-question *1.1 How do adults perceive their ability to learn musical instruments before using mobile apps?*

The findings provide a personal narrative that explores both progress and achievements in music mLearning, showing the emotional experiences and complexities surrounding self-efficacy. This is demonstrated by how an individual's perceived capability to master specific tasks impacts their motivation, effort, and persistence. These observations support Bandura's (1977) theory that self-efficacy plays a central role in learning outcomes. Moreover, these personal experiences reflect the broader themes discussed in the literature review on SET, particularly emphasising mastery experiences, vicarious experiences, verbal persuasion, and physiological states as fundamental sources of self-efficacy.

This study finds that the researcher was perceived to have the motivation to learn the piano but did not continue learning. Bandura's theoretical frameworks and research on self-efficacy suggest that various factors might have contributed to this outcome.

7.5.1 Mastery Experiences

It is suggested that mastery experiences are the most influential source of self-efficacy, and experiencing success after persistent effort enhances one's belief in one's abilities, thereby boosting self-efficacy (Bandura, 1977). Conversely, failures can undermine self-efficacy, especially if they occur before a sense of efficacy is firmly established. The findings indicate that the researcher faced challenges without experiencing substantial progress in their journey to learn the piano. These difficulties likely contributed to decreased motivation and self-efficacy, crucial for sustained engagement and success in independent adult

learning. The lack of significant mastery experiences—key moments of achievement that boost learners' confidence and belief in their abilities—might have made it difficult for the researcher to perceive improvement. Such experiences are vital for enhancing self-efficacy (Bandura, 1997). Without these positive reinforcement moments, the researcher's belief in their capability to learn and succeed in playing the piano likely diminished. Given the complexity of learning music theory alongside practical skills, cognitive overload might have also played a role. Ng, Lui, & Kwok (2015), discuss the efficacy of apps in teaching basic music theory and skills. Their work suggests that such positive performance outcomes are vital for improving self-efficacy, thereby influencing learners' persistence and engagement. This contrasts with the researcher's experience, where difficulties in mastering piano skills contributed to decreased self-efficacy and ultimately led to discontinuation.

7.5.2 Vicarious Experiences

Vicarious experiences involve observing others, particularly those perceived as similar to oneself, successfully performing a task or skill. Seeing others achieve success can lead individuals to believe that they, too, can master the activities with enough effort. According to Bandura, vicarious experiences can significantly alter self-efficacy beliefs, especially when individuals are uncertain about their abilities or have limited experience with the task (1997). The impact of vicarious experiences on self-efficacy is enhanced when the observer sees the model overcoming obstacles through perseverance. The researcher did not explicitly access a community of learners or observe peers who successfully learnt the piano using the app. However, the MILASE questionnaire specifically addressed this perceived ability, which showed a decrease in this area over time. The absence of relatable role models or success stories could have negatively impacted the researcher's self-efficacy. Without witnessing others overcome similar challenges, the researcher's belief in their ability to succeed through the app likely diminished. The participants had limited exposure to others using apps to learn an instrument, akin to the researcher's situation. While unknown, the absence of a supportive community or observable models for overcoming learning challenges could harm their self-efficacy, paralleling the

researcher's experience where the lack of vicarious experiences undermined confidence in their ability to succeed. Yun, Yi, & Thiruvarul (2021) emphasised the potential of music learning apps such as Yousician in improving guitar skills through interactive feedback mechanisms. They observed that learners' self-efficacy can be significantly influenced by observing peers' successes or leveraging app feedback. The researchers highlighted the role of vicarious experiences in mLearning environments, which can help learners assess their capabilities and set achievable learning goals.

7.5.3 Verbal Experiences

Bandura identifies verbal persuasion as a significant source of self-efficacy, suggesting that encouragement from others can lead individuals to believe they can overcome challenges, thereby enhancing their effort and persistence (1997). The influence of verbal persuasion on self-efficacy is distinctly reflected in the findings of this study. Hartnett (2016) underscores the significance of motivation in online learning environments, pointing out how digital technologies and feedback mechanisms can profoundly affect learners' self-efficacy. The instances of receiving positive feedback from the app or engaging in constructive self-talk are examples where verbal persuasion is a pivotal factor in enhancing self-belief and motivation. The researcher recorded few instances of external verbal encouragement or support in the app's learning process, and the MILASE questionnaire did not directly measure verbal persuasion. The researcher sent a friend a video recording of a small performance, which was met with some positive feedback. In addition, the researcher's husband often gave positive praise after overhearing practice sessions. Although this did provide a confidence boost, further feedback was not actively sought. The lack of positive reinforcement or feedback from others could have adversely affected the researcher's self-efficacy. Supportive social interactions can play a crucial role in sustaining motivation and belief in one's abilities, and the absence of such interactions may have contributed to the decision to discontinue learning with the app.

7.5.4 Physiological and Emotional States

Bandura also highlights the role of physiological and emotional states in shaping self-efficacy beliefs. He argues that individuals' perceptions of their physiological states, such as stress, anxiety, or arousal, can influence their self-efficacy (1997). In addition, Hartnett (2016) suggests that learners' emotional states are integral to their self-efficacy levels and learning outcomes. The insights into the researcher's experiences highlight the challenges inherent in learning a complex skill like playing the piano using technology. This emphasises the importance of designing apps that provide comprehensive and adaptive learning materials and incorporate mechanisms for encouragement and support to help learners navigate the inevitable challenges and setbacks they will face. This connection between physiological states and self-efficacy demonstrates complexities between emotional experiences and learner self-confidence, reinforcing the literature's claims about the impact of emotional states on learning efficacy.

7.5.5 Summary

The findings show positive impacts are observed in app design, with new features, interactive interfaces, intuitive navigation, and effective goal setting contributing to a sense of competence and confidence. Conversely, negative impacts are evident in learning and practising due to technical issues and troubleshooting. Although there was only a slight dip in the ability to learn and practice, content and app functionality challenges hindered perceived proficiency. Issues adjusting settings, troubleshooting, maintaining motivation, and managing distractions negatively affected self-efficacy, emphasising the need for app usability and technical support enhancements. The overall impact on self-efficacy is mixed with positive and negative elements. Solving issues that contribute to these negative impacts would lead to more positive self-efficacy. To further support this and to perform a complete and direct comparison, a longitudinal study should be considered, in which participants also complete the MILASE questionnaire.

7.6 Theoretical Comparison

In conclusion, SDT and SET are both prominent in psychological frameworks for understanding motivation but serve distinct purposes and focus on different aspects of the motivational spectrum. Understanding these differences helps justify using both theories in a study concerning the motivational aspects of adult learners using apps to learn musical instruments.

SET primarily focuses on an individual's belief in their capability to execute behaviours necessary to produce specific performance outcomes and emphasises the relationship between self-efficacy beliefs and behavioural outcomes (Bandura, 1977). In this study, SET is used to assess the confidence levels of learners in their ability to use apps to learn musical instruments. It gauges how these beliefs influence their motivation to continue learning and their persistence in overcoming learning challenges. On the other hand, SDT emphasises three BPNs: autonomy, competence, and relatedness, which are crucial for fostering intrinsic motivation, psychological well-being, and optimal functioning (Ryan & Deci, 2017). This study uses SDT to understand how well apps fulfil these needs in the learning process and how this fulfilment translates into motivation and engagement.

When comparing the effectiveness of SET and SDT in measuring motivation, SET offers a clear, direct measure of motivation related to specific tasks (e.g. using apps to learn an instrument). It effectively predicts task persistence and achievement in narrowly defined activities but may not fully capture the broader motivational dynamics, such as learner autonomy or social interactions. SDT differs from SET as it provides a comprehensive framework that addresses the intrinsic motivation related to task completion and integrates the social and emotional dimensions of learning. It is particularly effective in environments where engagement and interaction are crucial. In addition, SDT's focus on autonomy, competence, and relatedness makes it adaptable to diverse learning contexts and user needs.

In conclusion, SET provides insights into specific task-related motivational aspects, while SDT offers a broader understanding of motivational processes

that include a range of psychological needs. If the primary interest is understanding how belief in an individual's capabilities affects learning outcomes, SET might be more directly relevant. However, for a more comprehensive view that includes emotional, social, and cognitive aspects of motivation, SDT might be better suited.

7.6.1 Comparison Conclusion

Addressing the challenges of learning independently is complex due to each learner's unique experience and environment. Many of the challenges and obstacles revolve around technology, and it is clear that there is a need for some advancement to provide more robust apps. App development costs and other factors may be a barrier for developers, but gathering user feedback via workshops or interviews could offer valuable app enhancement and improvement insights (Bobbe et al., 2021). Many apps are not transparent about the pedagogical methods they have applied, so it can be challenging to understand the lens through which the apps have been created. Keeping developers informed about current trends and ensuring their choices are based on evidence-based practices could fill some gaps.

While there appears to be a hurdle to overcome concerning customisation and personalisation, more advanced and experimental technology could help advance this area, especially regarding assessments within music mLearning, such as using adaptive learning algorithms. There also needs to be improved ways of connecting technology and getting help when things go wrong. Because there is no standardisation and apps are developed independently by different companies, this experience will vary between apps. Again, this area could potentially see advancement with AI by incorporating chatbots and knowledgebases built on user experiences and feedback that grow and develop over time.

Offering diverse learning methods and allowing learners to choose their preferred approaches could ease instructional challenges beyond relying solely on written text. Developers should aim to integrate various instructional materials, including interactive tutorials, thorough explanations, and a range of

learning paths. Creating direct connections within the app for community interaction, rather than relying on mainstream social media like Facebook, could make collaboration more appealing, especially for users averse to or disenchanted with popular social platforms. However, there is a danger that implementing new technological aspects would not address or solve the identified challenges and obstacles. As seen in the literature, this could also have the opposite effect, creating new obstacles and challenges, such as causing the learner to feel overwhelmed.

Putting app development aside, personal and external obstacles and challenges that cannot be controlled or adjusted fully by an app. For example, weather conditions, illnesses and interruptions. There are accessibility features that could be added to apps to help with some aspects, such as adjusting screen brightness for different lighting conditions or reminders to maintain focus during practice. These circumstances would affect individuals in the classroom and within formal learning. Perhaps these are more controllable in a classroom setting by a teacher (for example, distractions by individuals), but other more naturally occurring elements are not. Adults learning independently must understand and recognise this and take more ownership of the situation.

A potential solution could be to offer advice and guidance on how to learn and how to get the best out of apps when learning independently, but this would need to be offered in a way that does not affect the learner's feelings of autonomy. Many apps already include engagement features and motivational strategies, but these could easily be overlooked or dismissed in a world where everything is a notification and easily ignored. A review of gamification elements, milestone achievements, or social learning components could help identify which strategies are the most popular and effective, or giving the learners the choice to decide how they want to be motivated would help encourage a feeling of autonomy. Incorporating these practical strategies could help to address the identified challenges directly.

Chapter 8: Conclusion

This chapter summarises the study's findings, discussions, and theoretical contributions and outlines how the research goals have been achieved. It reviews the study's implications, strengths, and weaknesses and offers recommendations for future research in mLearning, ongoing academic inquiry, and practical advancements.

8.1 Summary of Research Findings

This study examined how adults use apps to learn musical instruments, focusing on their effects on motivation and learning outcomes.

The research addressed three main research questions: *RQ1: What are the initial motivations and perceptions of adults learning musical instruments using mobile apps? RQ2: What are the experiences of adult learners who use mobile apps to learn musical instruments? RQ3: How does using mobile apps for learning musical instruments impact adult learners' self-perception?*

Data was captured using analytic autoethnography over eight months to examine the researcher's piano learning experience. Autoethnography provided a personal insight into the learning experiences of apps and helped contextualise the theoretical findings within real-world experiences. In addition, ten semi-structured interviews were conducted with individuals who were also using apps to learn an instrument. By documenting and analysing personal experiences and reflections against wider society, this study provides insight into how individual and societal experiences and narratives, alongside technology, affect motivation and shape personal development.

RTA highlighted motivation-related themes, emotional experiences, and challenges and included positive and negative experiences. From this, it was identified that motivations for learning were aligned with personal development, external validation, and social connection. The primary challenges and obstacles were associated with the learning content and instructional limitations of apps and technology, as well as personal and external factors. The primary

feelings associated with these experiences were frustration, satisfaction, and achievement.

The findings show that apps provide interactive and flexible learning experiences that can enhance adult learners' self-efficacy by boosting their confidence and capability to learn musical instruments. Apps have played a significant role in expanding access to music education, enabling individuals to learn musical instruments even if they do not have access to traditional educational resources or financial means. Music education has become more inclusive and accessible to a wider range of people, effectively democratising learning.

Adults are motivated to use apps because they allow them to learn at their own pace and schedule, fulfilling lifelong aspirations. The ease and convenience of using apps appeal to these individuals, who often juggle responsibilities such as work and childcare.

While apps offer numerous benefits, such as accessibility and immediate feedback, they also present numerous challenges. From technical difficulties to maintaining motivation, apps did not always fully support independent learners sufficiently. Individuals often looked elsewhere for help and support, highlighting a need for additional or enhanced materials. As a result, learners frequently experienced a range of emotions that fluctuated between satisfaction, frustration and self-doubt, often related to app functionality, perceived learning pace and progress. Advancements in app development, such as better sound detection and improved hardware integration, are needed. However, technological solutions alone may not address all challenges, considering external factors that can also affect learning. Therefore, apps that effectively accommodate or mitigate these external influences would be highly advantageous.

The discussion looked at how the findings align with theory. Findings demonstrated that while learners maintained consistent confidence in interacting with the app's interface and its features, they experienced a decline in self-efficacy in areas critical to learning progression, such as learning and

practising skills, troubleshooting technical issues, and managing distractions effectively. This suggests that while initial interactions with the app were positive, sustained learning and the handling of more complex or frustrating aspects posed challenges that negatively impacted self-efficacy. As a result, self-efficacy fluctuated, particularly when struggling with technical difficulties and maintaining motivation over time, which are key factors for persistent and continuous learning and mastery.

Turning to SDT, the literature suggests that apps that support the three BPNs effectively promote intrinsic motivation, enhancing both the desire to learn and the educational experience. Moreover, apps designed with SDT principles tend to provide a more comprehensive support system, addressing motivational aspects from a broader psychological perspective. Findings from this study show that while there were intrinsic motivations for learning through apps, such as the desire for self-development and an interest in technology, these motivations alone were not always sufficient in sustaining engagement and a consistent practice habit. Negative aspects, such as technical issues and problematic learning content, can act as barriers and hinder learning. Autonomy was perceived in the initial choice and control over the learning process provided by the apps. Still, external factors and the rigidity of the app's structure sometimes hindered this autonomy. Competence was challenged by the lack of progressive mastery and feedback that was not always aligned with the learner’s personal growth or sufficiently detailed to foster a sense of improvement and achievement.

Regarding relatedness, although apps provide a means of engagement with the wider community, individuals did not feel the need to engage in meaningful social interactions or integrate community aspects. The gap between the theoretical application of SDT, app design and the actual user experience shows that not all three fundamental psychological needs are fully supported by apps. This suggests that while apps may initiate motivation through intrinsic factors and the novelty of the technology, they need to address SDT principles better to enhance the educational experience and sustain learner engagement. The observations align well with SDT principles, which emphasise the

importance of autonomy, competence, and relatedness in fostering intrinsic motivation, engagement and self-determined behaviour when learning musical instruments using apps.

Finally, a comparison between SET and SDT in fostering motivation concluded that each theory offers distinct perspectives on motivation. SET primarily examines how an individual's belief in their capabilities influences their behaviour, focusing on task-specific motivation and predicting task persistence. On the other hand, SDT emphasises the importance of autonomy, competence, and relatedness in fostering intrinsic motivation, encompassing a broader range of emotional and social aspects of motivation. When choosing between these theories, if the research focuses on understanding motivation within the context of completing tasks, SET is more suitable due to its task-specific nature and predictive ability regarding task persistence. However, for researchers seeking a more comprehensive understanding of motivation that includes emotional and social dimensions, SDT provides a more comprehensive framework adaptable across various learning contexts.

Understanding how adults use apps to learn is important because it helps us understand the effectiveness of digital tools and technologies in facilitating adult learning. This helps educators and developers improve educational technologies to better align with adult learning needs, ensuring these tools effectively support skill acquisition, maintain motivation, and enhance the overall learning experience.

8.2 Contribution

This research contributes to four domains of knowledge: technology-enhanced learning, autoethnography as a research method, mLearning and the conversation around SDT and SET. Contributions to knowledge revolve around a detailed understanding of how adult learners use technology to learn musical instruments and the impact of apps on their learning processes, motivation, and psychological needs.

The study provides empirical evidence on how adult learners interact with apps and how these interactions affect their self-efficacy and motivation. It integrates theories of self-efficacy and self-determination to explore how different features impact learners' motivation and perceived learning outcomes. This dual-theoretical approach provides a better understanding of the learner experience than studies focusing on a single theoretical framework. The study also examines learners' emotional journeys, including a range of emotions and how they relate to learning progress and app interactions. By examining the alignment of app features with the psychological needs stipulated by SDT, the study offers new insights into designing more effective learning technologies that support intrinsic motivation and engagement. Furthermore, the study identifies specific technological and pedagogical barriers that apps present. This aspect adds depth to understanding psychological impacts beyond mere behavioural outcomes.

8.2.1 Practical Contributions

This study contributes to technology-enhanced learning, offering practical benefits across several key areas: enhancements for app development, best practices for mLearning, addressing the challenges of mLearning, and enhancing learner engagement and motivation. It aims to improve apps' usability, functionality, and educational effectiveness, addressing core challenges like motivational support, technical reliability, and the need for supplementary educational guidance.

A balanced approach to mLearning that combines technology with effective pedagogical practices is required. This approach emphasises the importance of addressing the technological and content-related aspects of mLearning and learners' emotional and motivational needs.

Addressing challenges is crucial for enhancing effectiveness and accessibility, particularly for adult learners. The findings emphasise the role of immediate and effective feedback mechanisms, essential for helping individuals correct mistakes and experience a sense of progress and achievement. The focus should be enhancing feedback accuracy and responsiveness and addressing

technological limitations such as inaccurate note recognition. Providing robust technical and educational support, especially for those using externally connected music hardware like keyboards, is recommended. Moreover, offering additional resources and the option to seek professional advice can prevent learners from seeking external solutions. Lastly, the study finds that adult learners desire personalised learning experiences. Designers should incorporate features that allow learners to choose their learning paths, select songs, and adjust difficulty levels to match their interests and learning speeds.

The research provides empirical data on the use of apps in music education, which contributes to future research and development efforts. This could lead to more effective use of apps for adults. The findings can also help educational technologists, instructional designers, and app developers understand adult learners' specific educational needs and preferences, essential for designing pedagogically sound, user-friendly and motivating experiences.

Music educators and tutors, especially those involved in adult education, will find this research beneficial. It provides insights into how adults use apps outside the traditional classroom in learning scenarios. This knowledge enables educators to offer comprehensive support, particularly when technology supplements traditional learning methods.

Ultimately, findings from this study suggest that adult learners can greatly benefit from improvements in app design that address their specific needs. By prioritising emotional and motivational aspects, apps can make the learning journey more accessible, enjoyable, and effective. This study highlights how incorporating features that facilitate self-efficacy, reduce frustration, and encourage persistence can significantly enhance learners' experiences and outcomes, particularly in non-formal learning environments.

8.2.2 Knowledge Contribution

We now move away from this study’s practical contribution and focus on its contribution to knowledge.

One of the key knowledge contributions of this research lies in the detailed exploration of adult learners' motivation and emotional experiences. The findings show how apps facilitate skill acquisition and engage learners on a personal level, fulfilling lifelong aspirations and fostering a sense of personal achievement. This study contributes to existing knowledge by documenting the emotions involved in learning musical instruments via apps—from excitement and joy to frustration and challenge. These emotions help us understand the full impact of mLearning on adult learners and highlight the emotional depth and complexity accompanying the learning process.

A second contribution is identifying the unique attributes of mobile app-based learning experiences for music education. The study examines how apps uniquely shape the learning journey, characterised by enhanced accessibility, flexibility, and immediate feedback. These features distinctly set mLearning apart from more traditional, non-technological approaches to education, which may not always provide such adaptable learning experiences. Furthermore, the research identifies intrinsic challenges when using apps, such as the occasional lack of personal interaction and the absence of in-depth guidance that learners might otherwise receive in more structured educational settings. By documenting these unique attributes and inherent challenges, the research enhances our understanding of the use of apps and their specific advantages and limitations. This is crucial for the ongoing development of educational technology, offering a foundation for future research aimed at optimising mLearning environments for better educational outcomes.

Finally, the in-depth examination of the emotional and psychological impacts of learning using apps represents a contribution to knowledge as it uncovers how these emotional states affect learner engagement and influence their persistence and success. By highlighting how feelings of accomplishment and frustration alternate during the learning process, the research adds complexity to our understanding of SRL in informal settings. This view of the emotional journey helps educators and developers better support learners through experiences that consider these psychological elements.

In conclusion, this research contributes to the mLearning field by exploring adult learners' personal and emotional experiences with music education apps.

8.2.3 Theoretical Contribution

Theoretical contributions add to discussions around SDT and SET, specifically examining how apps impact adult learners' psychological and motivational needs. Additionally, the study contributes to methodological discourse by integrating analytic autoethnography, which deepens the understanding of research approaches in technology-enhanced learning.

Analytic autoethnography can be an effective method for researchers to gain theoretical insights into social phenomena by examining personal experiences. As seen in this study, analytic autoethnography is a method where the researcher engages in reflexive analysis to understand how cultural norms, societal structures, and personal perspectives intersect. Narrative storytelling aids in conveying complex experiences, making research findings more accessible and engaging. Analytic autoethnography may not align with all research paradigms and, therefore, requires a balance between personal narratives and scholarly analysis. However, analytic autoethnography can contribute significantly to theoretical knowledge, making it a valuable tool for researchers. This study provides firsthand insights into music mLearning, discussing motivations, challenges, and the impact of technology on learning, contributing to the discourse on leveraging technology in mLearning.

Through the lens of SDT and SET, the study demonstrates how the features of apps can positively or negatively affect an individual's confidence and perceived competence and how these factors contribute to an adult learner's belief in their ability to achieve their goals. The findings suggest that app features influence motivation and engagement and that technology can provide mastery experiences and vicarious learning. This research supports and extends SET by providing evidence of how it can be applied to mLearning and how it impacts adult learners' experiences in such environments. Furthermore, the research discusses the emotional and psychological impacts of using apps for learning, contributing to a theoretical understanding of how emotional states

influence perceived learning outcomes. Mapping these emotional experiences against theories like SDT and SET demonstrates the importance of emotional well-being in educational achievement and learner persistence. This emphasises the importance of considering the emotional aspects when designing and evaluating apps, which is often overlooked.

This study's theoretical insights contribute to educational technology by demonstrating how established theories can be applied to and expanded upon in the context of mLearning. The findings add to the theoretical understanding of how apps influence learning processes and suggest broader implications for designing educational technologies that better support adult learners' psychological needs. Therefore, this research lays the groundwork for future studies to explore the intersections of technology, psychology, and education theory in even greater depth.

8.3 Research Constraints and Weaknesses

All research studies include constraints and weaknesses associated with different research aspects, from methodology and methods to data analysis. Identifying and acknowledging this study's constraints and outlining the steps taken to address potential weaknesses proactively not only strengthens the justification of the research approach but also enhances the credibility of the findings.

Autoethnography captures rich, real-world experiences that contribute to knowledge, but it carries a risk that "telling one's story does not automatically result in cultural understanding of self or others" (Chang, 2008, p. 13). As a result, research can quickly become self-indulgent and may introduce subjectivity and bias, potentially limiting the objectivity and replicability of the findings. To mitigate any potential bias, interviews have been conducted and cross-referenced with other experiences to facilitate member checking, which also allows for contributions from outsiders. This helps to validate and enrich the findings by incorporating diverse perspectives.

The theoretical frameworks selected for this study were chosen based on their relevance to the research questions. However, it is important to acknowledge that these frameworks may not cover all possible perspectives relevant to the study. As a result, there is a risk of overlooking valuable insights into the phenomenon under investigation by solely focusing on these theories. Efforts were made to maintain openness to alternative theoretical perspectives throughout the research process.

Resource constraints such as time and money did impact this study. Due to financial constraints caused by tuition fees and participant incentives, the study had to be completed within a specific timeframe. Therefore, it was essential to conduct and complete the study on time. The timeline may not have allowed for an in-depth exploration of some aspects of learning piano via apps.

As this research is part of a PhD program, it may introduce bias. The researcher's motivation to complete the study on time and learn the piano might have influenced the study’s findings. This motivation could have affected the researcher's approach to overcoming challenges, possibly leading to pushing through difficulties that might deter others. Transparency and reflexivity were paramount throughout the research process. Methodological procedures and decisions were meticulously documented, and critical reflections were undertaken to acknowledge the study's limitations.

A final constraint of this study is the speed of technology evolution, particularly the frequency of updates to the Simply Piano app. These updates can introduce significant variations in app functionality, user interface, and content, which may affect the consistency of the user experience over time. Acknowledging this constraint emphasises the importance of developing robust methodologies to accommodate and critically assess the implications of technological change within educational research.

8.4 Considerations for Further Work

This section focuses on future possibilities and considerations that go beyond the scope of this study. It highlights areas that require further investigation, the

use of different methods, the application of other theories, and aspects that have not been fully explored in this research. The aim is to identify areas that can be expanded to contribute to a better understanding of an adult's experience learning instruments using apps.

The differences in participants' backgrounds, experiences, and learning styles during this study revealed some common themes. Still, it is essential to recognise that individual responses may vary. Given the focus on individual differences in learning preferences and experiences, a research study could be designed to investigate the impact of personalised learning approaches. This study could offer insight into the design and implementation of apps for learning an instrument, potentially leading to more tailored and effective tools that cater to a wider audience with diverse learning needs and styles. Building upon the influence of contextual factors in learning to play an instrument using apps, a research study could investigate the impact of technological and environmental variables on the effectiveness of apps in facilitating musical learning experiences. A study such as this could contribute to optimising app design by highlighting the importance of considering contextual factors such as device compatibility and internet access. Ultimately, this could lead to developing apps that accommodate diverse technological contexts, improving accessibility and effectiveness.

As outlined in the limitations section of this thesis, the sample size of this research study was small. Autoethnography followed the researcher's journey for six months. However, this could be extended to include participants. In doing so, the longitudinal effects of learning an instrument using apps could be examined more deeply by focusing on changes in motivation, skill retention, and user experience over an extended period. Participants could document their motivations and feelings during learning, offering insight into their experience and having valuable implications for instructional design.

Finally, a study on how the societal views, cultural choices, and financial differences affect adults’ learning or wanting to learn, an instrument using an app could help to inform designers on how to create more inclusive apps. By

exploring peer groups, family roles, and tech access in different cultures, a study could be conducted to improve app features and accessibility for a wider audience.

8.4.1 Topics for Future Research

Throughout the participant interviews, several topics were discussed that, while not substantial enough to develop into distinct themes, hold potential for deeper exploration in future studies.

Gamification. Three participants mentioned gamification, the integration of game-design elements into non-game contexts. They preferred apps that felt like games for practising specific songs. A study evaluating the impact of gamified learning experiences on learning outcomes in playing a musical instrument using apps could provide insights for designing more effective educational tools for music learners.

Commitment and Obligation. Participants felt that F2F lessons created a sense of commitment, while app-based learning offered more flexibility. Research on these perceptions could provide insights for improving educational approaches for both learning methods.

Community Participation. The perceived benefits of mLearning in promoting group or community engagement do not align with the actual participation of learners in these settings. This presents an intriguing area for further research, which could offer practical recommendations for optimising the design and implementation of these communities to better align with learners' needs and preferences.

Persistence and Consistency. The experiences showed a theme of persistence in learning despite encountering technical difficulties. Participants emphasised the importance of consistency and believed that learning through apps is accessible to anyone. A potential research study could investigate individuals' strategies to persist in learning despite challenges and explore different support

mechanisms, problem-solving approaches, or learning strategies for overcoming technological obstacles.

Affordability Concerns. Cost was a concern for all, and apps were found to be more budget-friendly than F2F learning. This often influenced the choice to use apps. Research into the long-term cost-effectiveness of app-based learning compared to traditional methods could provide insights into financial advantages, motivation, and learning progress over time.

8.4.2 Alternative Theories

While SET and SDT are highly relevant for understanding motivation and engagement in learning, other theories could be considered for future research studies on learning musical instruments using apps.

Flow theory. Mihaly Csikszentmihalyi proposed that individuals experience optimal engagement and satisfaction when fully immersed in an activity that matches their skill level with the challenge. Examining participants' experiences in terms of flow, such as the balance between perceived skill and app difficulty, could shed light on their engagement and motivation.

Cognitive load theory. Proposed by John Sweller, it focuses on the cognitive resources required to process information during learning. It suggests that an optimal balance of cognitive load is necessary for effective learning. Analysing participants' experiences in terms of cognitive load, such as the complexity of app instructions or the amount of information presented, could help understand the impact on motivation and perceived learning outcomes.

Goal setting theory. Developed by Edwin Locke and Gary Latham, emphasises the importance of setting specific, challenging, and achievable goals to enhance motivation and performance. Exploring participants' experiences in goal setting, such as their goal orientation, progress monitoring, and goal attainment, could provide insights into motivation and persistence.

These are just a few theories that could offer a unique perspective on motivation, engagement, and learning, and exploring them could provide a richer understanding of participants' experiences of learning to play an instrument using an app.

8.5 Closing Remarks

As I sit and make the final edits to this thesis, I glance back towards my keyboard, reflecting on the journeys of my research participants. I find myself curious about Beth and Mia—did they play at their respective weddings as they had planned? The thought brings a smile to my face. Yet, shame and guilt wash over me as I consider my musical progression. Life's relentless pace often sidelines our passions. I unfold the piano stool, lift the dust cover, and move my fingers across the cold keys. I turn on the iPad and reopen the Simply Piano app. A message appears on the screen: "Resubscribe today!" I pause, my finger hovering over the 'Continue' button, contemplating the irony of studying musical progression while grappling with my own. In this moment of hesitation, I feel it embodies the challenges we face in maintaining motivation—a central theme of my research. Can we really sustain engagement with learning in a world that never slows down?

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Appendices

Appendix A: Literature Matrix

The following table has been ordered for chronological flow and theme. Starting with mLearning, moving to motivation in online learning, and then exploring theoretical frameworks and practical application.

Author	Date	Title	Summary	Keywords	Methods	Major Findings	Themes and Implications
Sharples & Pea	2014	Mobile Learning	A book chapter that looks at mLearning and its potential for enhancing education by connecting learners across time and space.	mLearning, seamless learning, mobility, contextual learning, augmented reality, lifelong learning, personalisation, technology in education.	Review of literature and analysis of case studies, including large-scale mLearning projects, as well as theoretical explorations of seamless and contextual learning.	mLearning fosters a seamless blend of formal and informal learning, supports personalised learning experiences, and enables learning across multiple contexts. It also poses challenges in orchestration and data privacy.	Mobility, contextual learning, and lifelong learning. Implications are the need for equitable access to mLearning tools, teacher training for orchestration, and addressing ethical challenges in data use.

Author	Date	Title	Summary	Keywords	Methods	Major Findings	Themes and Implications
Traxler	2021	A Critical Review of Mobile Learning: Phoenix, Fossil, Zombie or . . . . .?	An article and critical review of mLearning which explores the need for a new paradigm in response to the changing realities and priorities of mobile technologies.	mLearning, paradigm shift, mobility, connectedness, inclusivity, learning theories	Discursive and critical analysis of the mLearning paradigm and its historical evolution.	mLearning has not adapted to the prevalence and social dynamics of digital technologies; it needs a shift towards inclusivity and societal relevance.	Addressing inclusion, equity, and epistemological challenges requires paradigm shifts. This calls for frameworks that tackle societal inequalities, support underrepresented communities, and promote learner autonomy.
Hartnet	2016	The Importance of Motivation in Online Learning	A book chapter about the importance of motivation in online learning. Explores the role	Motivation, online learning, mLearning, self-determination, intrinsic, extrinsic, learner	Review and synthesis of existing literature on motivation in online learning	Motivation is critical to online learning success but is underexplored. Theories like self-determination	The complexity of motivation, its situational nature, and the need for supportive learning environments. Implications stress

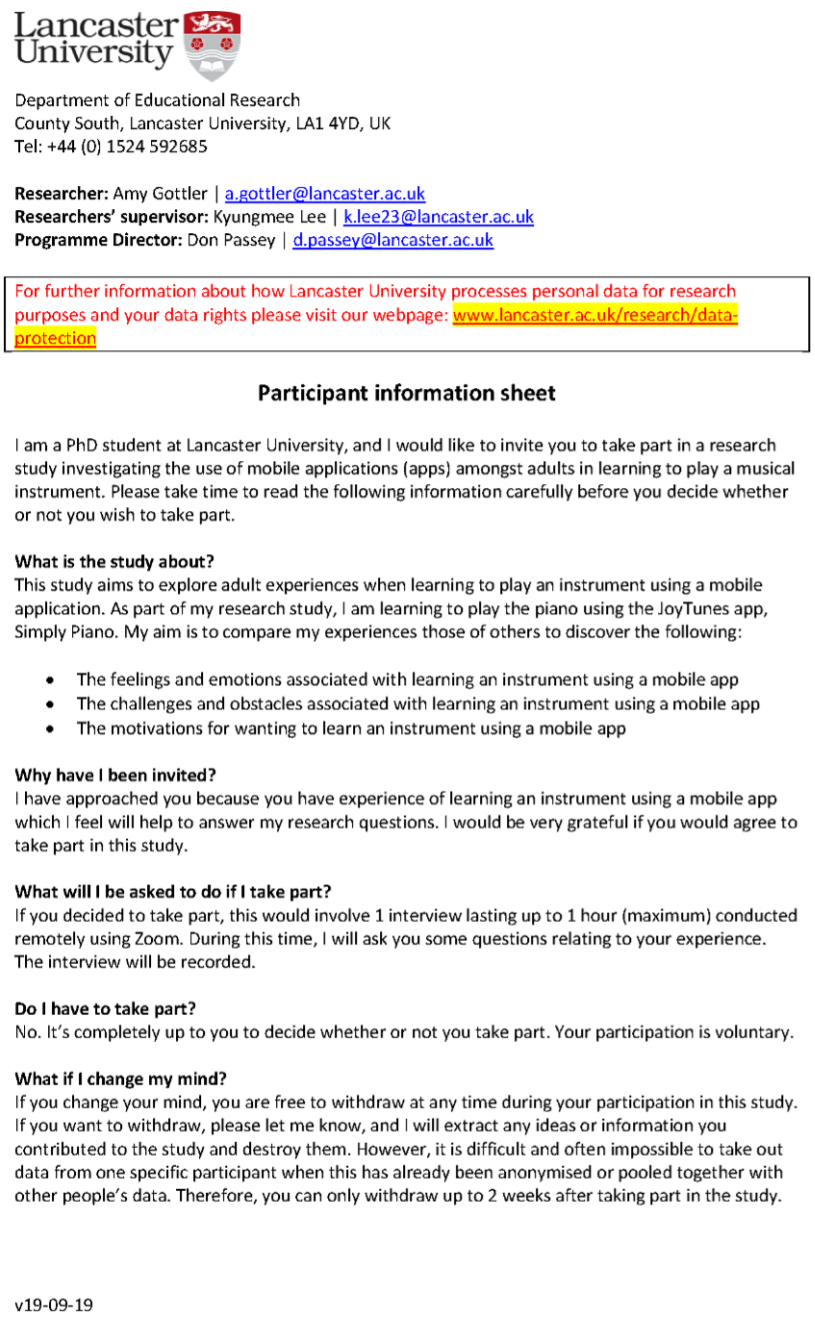
Author	Date	Title	Summary	Keywords	Methods	Major Findings	Themes and Implications
			of digital technologies, definitions of online learning, and learner autonomy.	autonomy, self-efficacy.	environments, including a discussion of theoretical frameworks.	highlight the importance of autonomy, competence, and relatedness in fostering intrinsic motivation.	designing courses to support learner autonomy and engagement through feedback, choice, and collaboration.
Evans	2015	Self-Determination Theory: An Approach to Motivation in Music Education	This article provides a conceptual overview of self-determination theory (SDT) in music education, focusing on the fulfilment of basic psychological needs—	Self-determination theory, music education, motivation, autonomy, competence, relatedness	Conceptual analysis and review of existing literature, integrating SDT into the study of motivation in music education.	SDT provides a comprehensive framework for understanding motivation in music education, with the fulfilment of psychological needs leading to improved persistence, engagement, and	The themes include support for autonomy, competence, relatedness, and the quality of motivation. The implications suggest designing teaching strategies that balance psychological needs to foster intrinsic

Author	Date	Title	Summary	Keywords	Methods	Major Findings	Themes and Implications
			competence, relatedness, and autonomy—and their relationship to motivation.			wellbeing among learners.	motivation and maintain long-term engagement.
Cherylyn	2020	Adult Learners' Motivation and Self-Determination Towards Independent Piano Learning Through	The study examines the motivations and self-determination of adult learners using a piano learning app. It identifies motivating factors, challenges in self-determined learning, and	Motivation, self-determination, self-directed learning, mLearning, music education, piano learning	Qualitative narrative inquiry involving interviews, participant journals, and self-reflexivity. Participants were working adults aged 24-37 in the Klang Valley, using the	Adult learners' motivation stems from intrinsic goals like personal growth and recreation. Self-determined learning is challenging due to self-management and external barriers. Apps can enhance	Themes include intrinsic motivation, the role of technology in learning, and self-determination. Implications suggest improving app design to support learner autonomy and tailoring strategies for adult

Author	Date	Title	Summary	Keywords	Methods	Major Findings	Themes and Implications
		Mobile Application	perceptions of self-directed learning with apps.		Simply Piano app over 10 weeks.	learning but require improved scaffolding.	learners' unique needs.

Table A1 *A sample of the literature review matrix.*

Appendix B: Participant Information Sheet



Lancaster University

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Participant information sheet

I am a PhD student at Lancaster University, and I would like to invite you to take part in a research study investigating the use of mobile applications (apps) amongst adults in learning to play a musical instrument. Please take time to read the following information carefully before you decide whether or not you wish to take part.

What is the study about?
This study aims to explore adult experiences when learning to play an instrument using a mobile application. As part of my research study, I am learning to play the piano using the JoyTunes app, Simply Piano. My aim is to compare my experiences those of others to discover the following:

- The feelings and emotions associated with learning an instrument using a mobile app
- The challenges and obstacles associated with learning an instrument using a mobile app
- The motivations for wanting to learn an instrument using a mobile app

Why have I been invited?
I have approached you because you have experience of learning an instrument using a mobile app which I feel will help to answer my research questions. I would be very grateful if you would agree to take part in this study.

What will I be asked to do if I take part?
If you decided to take part, this would involve 1 interview lasting up to 1 hour (maximum) conducted remotely using Zoom. During this time, I will ask you some questions relating to your experience. The interview will be recorded.

Do I have to take part?
No. It's completely up to you to decide whether or not you take part. Your participation is voluntary.

What if I change my mind?
If you change your mind, you are free to withdraw at any time during your participation in this study. If you want to withdraw, please let me know, and I will extract any ideas or information you contributed to the study and destroy them. However, it is difficult and often impossible to take out data from one specific participant when this has already been anonymised or pooled together with other people's data. Therefore, you can only withdraw up to 2 weeks after taking part in the study.

v19-09-19

Figure B1 *A screenshot of page one of the participant information sheet.*

What are the possible benefits from taking part?
Taking part in this study will allow you to share your experiences of using a mobile application to learn an instrument. sites. Your insights will contribute to our understanding of adults using mobile applications to learn.

What are the possible disadvantages and risks of taking part?
It is unlikely that there will be any major disadvantages to taking part.

Will my data be identifiable?
The interview will be recorded using Zoom. Audio and video will be separate as only the audio is needed. After the interview, only I, the researcher will have access to the ideas shared. Audio from the interview will be uploaded to Rev.com where it will be transcribed. If you wish to know more about how Rev.com handle security and privacy, you can visit their webpage for further information https://www.rev.com/security.

I will keep all personal information about you (e.g. your name and other information about you that can identify you) confidential, that is I will not share it with others. I will remove any personal information from the written record of your contribution.

How will we use the information you have shared with us and what will happen to the results of the research study?
I will use the information you have shared with me only in the following ways:

- I will use it for research purposes only. This will include my PhD thesis and other publications, for example journal articles.
- I may also present the results of my study at academic conferences

When writing up the findings from this study, I would like to reproduce some of the views and ideas you shared with me. I will only use anonymised quotes (e.g. from my interview with you), so that although I will use your exact words, all reasonable steps will be taken to protect your anonymity in our publications.

How my data will be stored?
Your data will be stored in encrypted files (that no-one other than me, the researcher will be able to access them) and on password-protected computers. I will store hard copies of any data securely in locked cabinets in my office. I will keep data that can identify you separately from non-personal information (e.g. your views on a specific topic). In accordance with University guidelines, I will keep the data securely for a minimum of ten years.

What if I have a question or concern?
If you have any queries or if you are unhappy with anything that happens concerning your participation in the study, please contact myself. If you have any concerns or complaints that you wish to discuss with a person who is not directly involved in the research, you can also contact the programme director Don Passey.

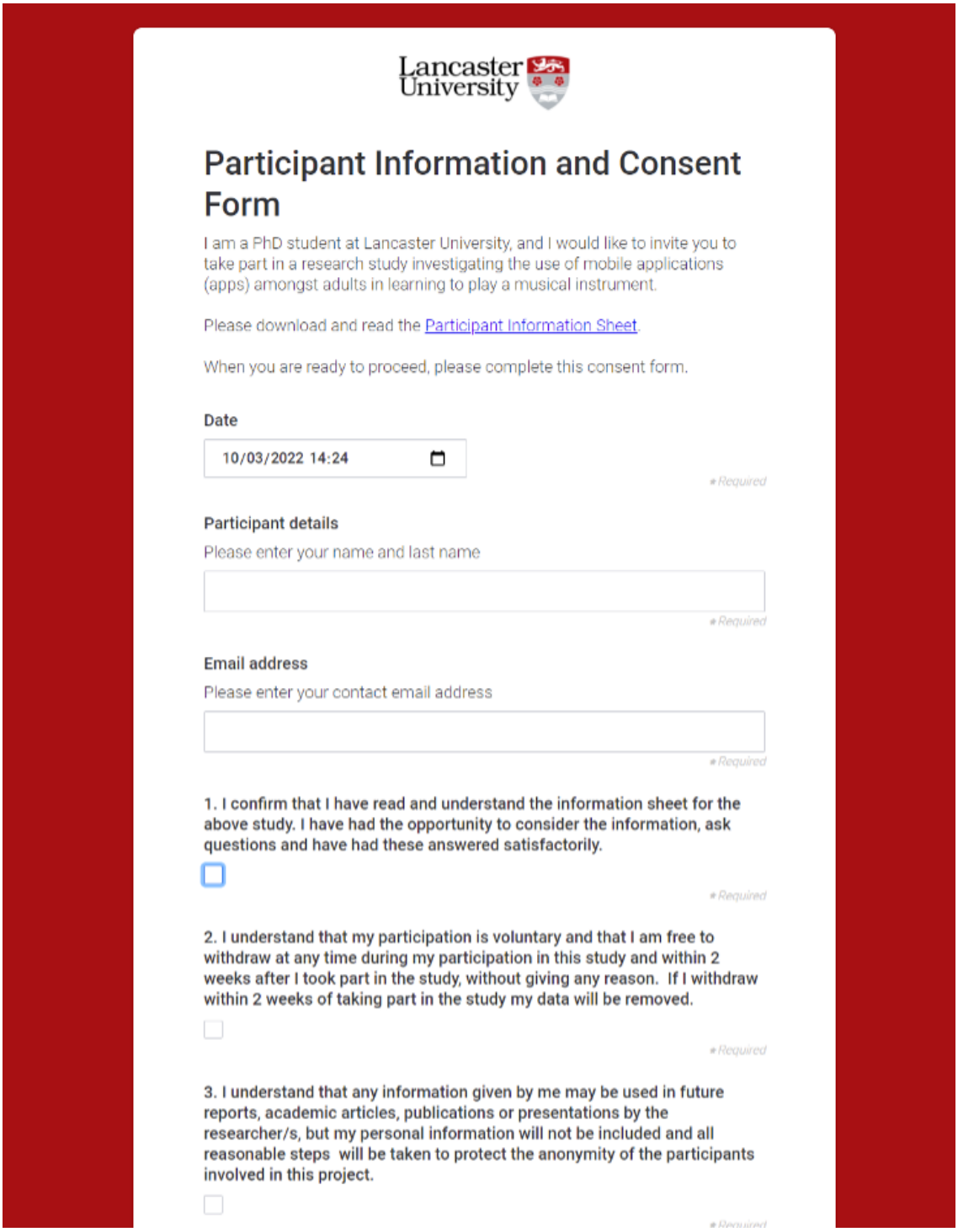
This study has been reviewed and approved by the Faculty of Arts and Social Sciences and Lancaster Management School's Research Ethics Committee.

Thank you for considering your participation in this project.

v19-09-19

Figure B2 *A screenshot of page two of the participant information sheet.*

Appendix C: Participant Consent Form



Lancaster University

Participant Information and Consent Form

I am a PhD student at Lancaster University, and I would like to invite you to take part in a research study investigating the use of mobile applications (apps) amongst adults in learning to play a musical instrument.

Please download and read the Participant Information Sheet.

When you are ready to proceed, please complete this consent form.

Date

10/03/2022 14:24

* Required

Participant details

Please enter your name and last name

* Required

Email address

Please enter your contact email address

* Required

1. I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

* Required

2. I understand that my participation is voluntary and that I am free to withdraw at any time during my participation in this study and within 2 weeks after I took part in the study, without giving any reason. If I withdraw within 2 weeks of taking part in the study my data will be removed.

* Required

3. I understand that any information given by me may be used in future reports, academic articles, publications or presentations by the researcher/s, but my personal information will not be included and all reasonable steps will be taken to protect the anonymity of the participants involved in this project.

* Required

Figure C1 *A screenshot of the first half of the participant consent form hosted on Monday.com.*

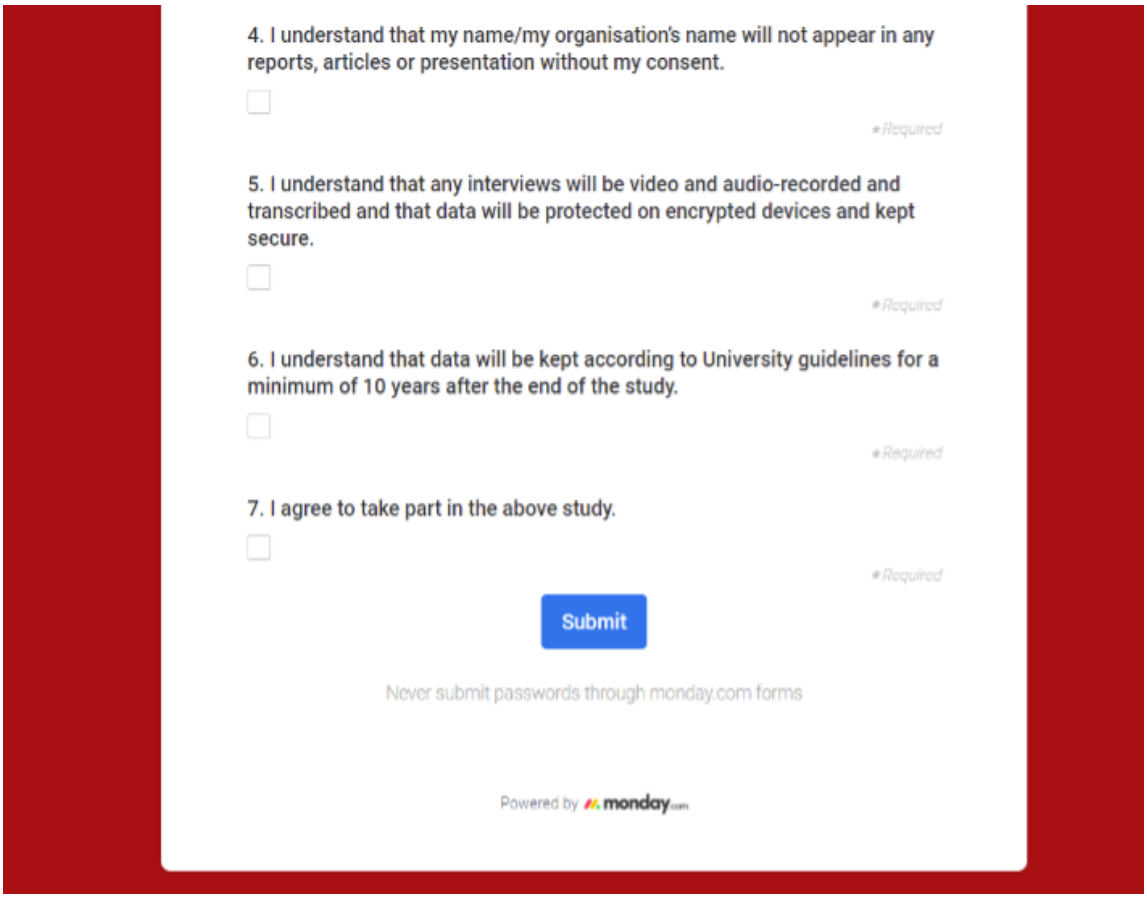


Figure C2 *A screenshot of the second half of the participant consent form hosted on Monday.com.*

Appendix D: Reflective Learning Journal

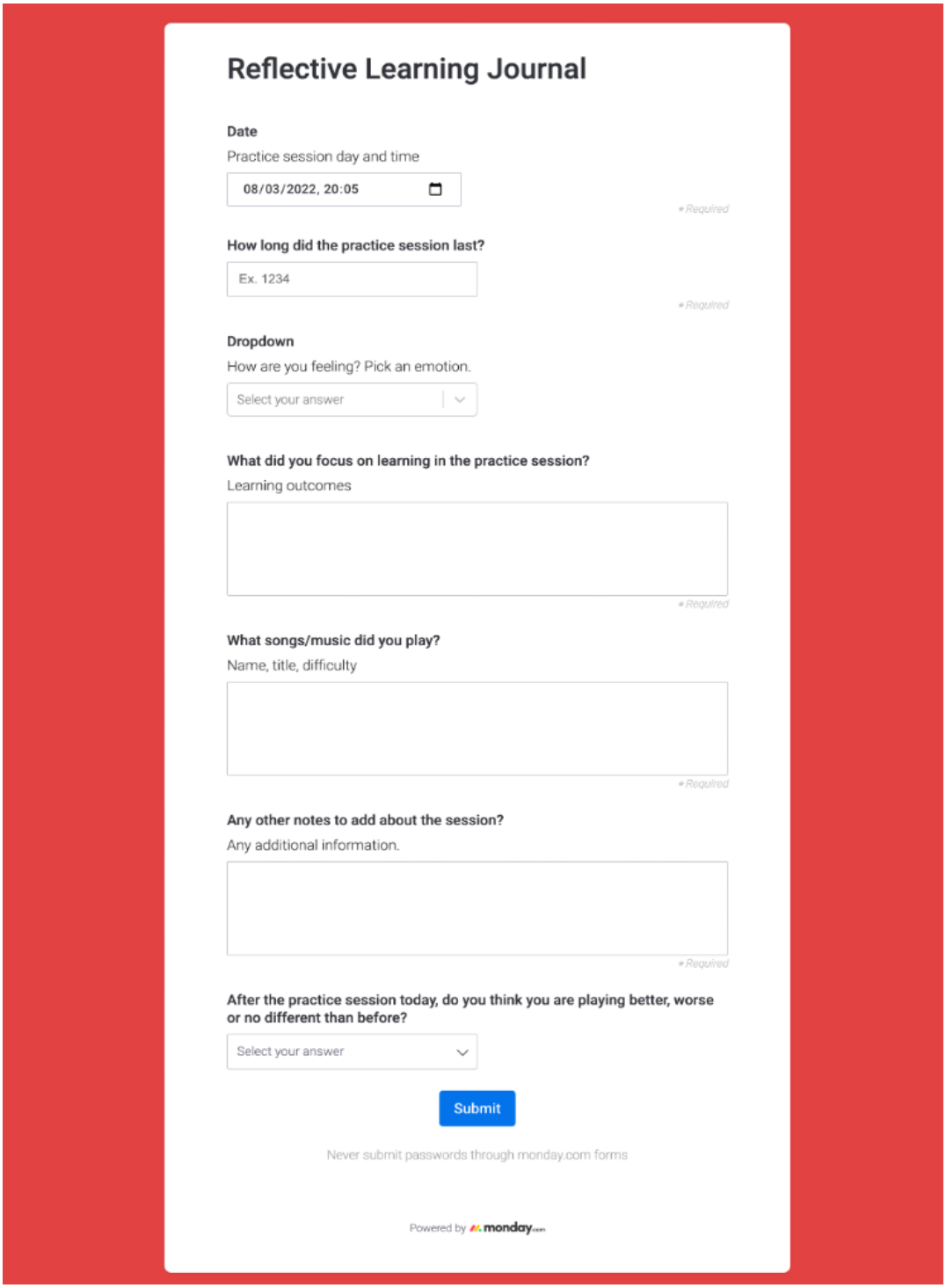


Figure D1 *A screenshot of the online reflective learning journal hosted in Monday.com.*

Appendix E: Reflective Learning Journal Questions

No.	Question	Details
1	Date and time	mm/dd/yyyy / 24hr.
2	How long did the practice session last?	Time in minutes.
3	How are you feeling?	Choose a feeling from the list.
4	How are you feeling subset	Choose a subset feeling from the list.
5	What did you focus on learning in the practice session?	Learning outcomes, Course mode.
6	What songs/music did you play?	Name, title, difficulty.
7	Any other notes to add about the session?	Any additional information.
8	After the practice session today, do you think you are playing better, worse or no different than before	Worse, better or no different.

Table E1 *A detailed description of the questions included in the online learning journal.*

Appendix F: The MILASE Questionnaire

When answering the following questions, think about your confidence when using a mobile app to learn a musical instrument.

How confident are you in…

1. Navigating the app to find lessons and tutorials.

1	2	3	4	5
Not confident at all	Slightly confident	Somewhat confident	Quite confident	Extremely confident

2. Learning and practising skills using the mobile app.

1	2	3	4	5
Not confident at all	Slightly confident	Somewhat confident	Quite confident	Extremely confident

3. Understanding and using the app's interactive features.

1	2	3	4	5
Not confident at all	Slightly confident	Somewhat confident	Quite confident	Extremely confident

4. Adjusting settings and preferences within the app to suit your needs.

1	2	3	4	5
Not confident at all	Slightly confident	Somewhat confident	Quite confident	Extremely confident

5. Troubleshooting technical issues or challenges while using the app.

1	2	3	4	5
Not confident at all	Slightly confident	Somewhat confident	Quite confident	Extremely confident

6. Setting goals and tracking your progress within the app.

1	2	3	4	5
Not confident at all	Slightly confident	Somewhat confident	Quite confident	Extremely confident

7. Using online resources and communities (e.g., forums, social media) to enhance your learning through the app.

1	2	3	4	5
Not confident at all	Slightly confident	Somewhat confident	Quite confident	Extremely confident

8. Adapting to new features or updates introduced in the app.

1	2	3	4	5
Not confident at all	Slightly confident	Somewhat confident	Quite confident	Extremely confident

1. Staying motivated and consistent in your learning journey using the mobile app.

1	2	3	4	5
Not confident at all	Slightly confident	Somewhat confident	Quite confident	Extremely confident

10. Overcoming distractions and managing your time effectively while using the app to learn.

1	2	3	4	5
Not confident at all	Slightly confident	Somewhat confident	Quite confident	Extremely confident

Appendix G: Semi-structured Interview Questions

Background & Demographics

- How old are you and where do you live?
- What is your occupation?
- Do you have a musical background? For example, were you already familiar with music theory or able to play any other instruments before you started learning?
- What was the reason you decided to start learning an instrument?

App and Technology

- What app are you using and how long have you been using it for?
- What made you choose this app over others?
- Can you describe your technology setup? For example, what equipment are you using, keyboard/piano, ipad, MIDI
- Did you experience any technical difficulties when setting up your equipment? If so, how did you resolve them?
- Similarly, did you experience any technical difficulties using the app? If so, how did you resolve them?
- Do you use any other apps or supplementary materials for learning?
- If you could change any aspect your setup, what would it be and why?
- If you could change any aspect the mobile app, what would it be and why?

Practice Sessions

- On average per week, how many days do you spend practising, and how long are your practice sessions?
- How would you describe your practice schedule? Do you plan your sessions, or are they more sporadic, for example, as and when you have time?
- Are there any particular songs you've enjoyed learning and why?
- How do you feel you are progressing?

- Do you have a specific goal in mind?

Motivations, Feelings and Emotions

- Why did you choose to learn using a mobile app over other methods, such as face-to-face lessons?
- Have there been any times where you considered swapping methods?
- What have you enjoyed most about learning using a mobile app?
- What have you enjoyed the least about learning using a mobile app?
- Have you always felt motivated to learn using a mobile app? If not, how have you stayed motivated?
- Do you feel your emotional state is different from when you start your practice session to when you finish the session? If yes, please elaborate.
- Have there been any experiences that stood out where you felt particularly annoyed or frustrated?
- Have there been any experiences that stood out where you felt particularly happy or confident?
- Would you recommend using an app to learn an instrument and why?
- If you could share a piece of advice to someone just starting out, what advice would you give them?
- How do you describe your ability to play the piano to others?

Community

- Are you part of any music groups or communities, either in-person or online for example, social media?
- What prompted you to join a community?
- What were the pros and cons of being part of a community?

Appendix H: Piano Playing Performance Across 30 Practice Sessions

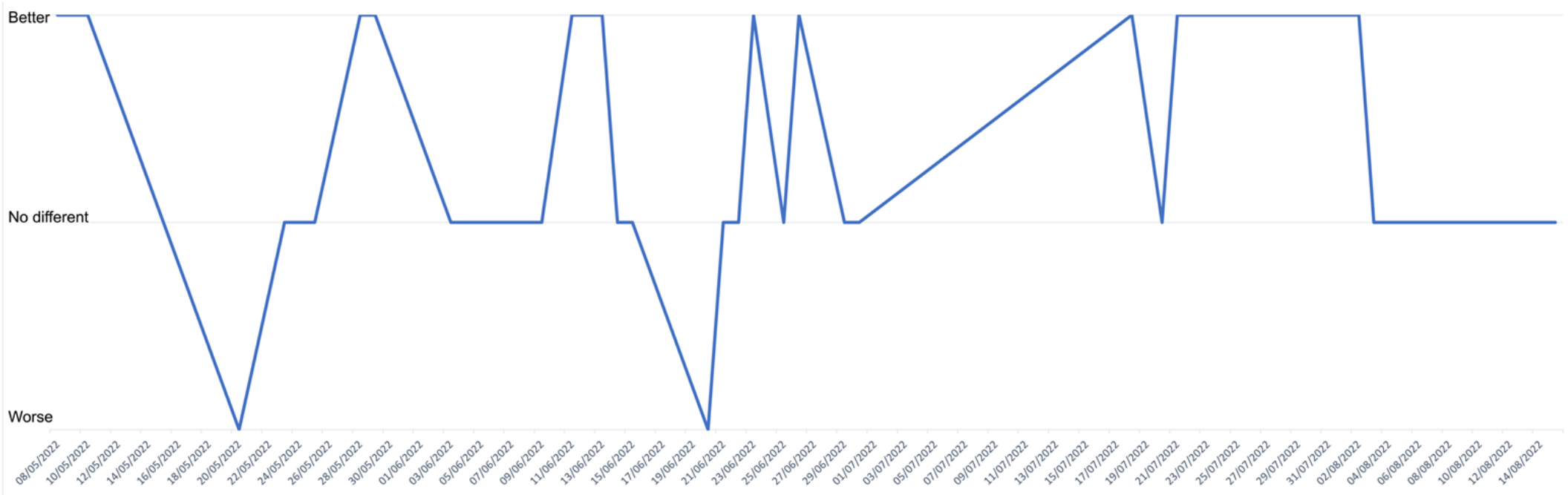


Figure H1 *Perceived performance tracked across 30 practice sessions*