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A study on the impact of a music looping technology intervention upon pre-service generalist teachers' self-efficacy to teach music in primary schools

John Nathan Heyworth
Edith Cowan University

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USE OF THESIS

Preface

I have been involved in education for many years, mainly in primary schools both as a music specialist and as a classroom generalist teacher. I have had many experiences of teaching in a wide variety of situations, some very challenging but mostly all very rewarding. I have seen first-hand how the power of music can engage and be inclusive of all students from all backgrounds into classroom learning environments. I have been involved in kindergarten, pre-primary and primary music education where music clearly supported children's emotional physical and social sense of well-being. I have taught traumatised students from refugee countries who developed a strong sense of belonging though music which transcends language barriers. I have taught and noted how partially deaf students' self-esteem increased when given the opportunity to learn guitar in group classroom environments. Similarly, students from disadvantaged backgrounds, traumatised social situations or disenfranchised groups found a voice and place to express themselves in a positive way through school music activities. In particular, I found music to be the most powerful asset especially when I was a generalist classroom teacher.

For the last twelve years, I have been a lecturer in generalist primary music education. This is where my heart is. My empathy is not with the talented few, but with all generalist teachers who can have such an important role to play in schools whether or not there is a music specialist present there. Self-belief is the key. No matter what backgrounds pre-service teachers have, all have the ability and opportunity to use music to help their future students to develop physically, emotionally, socially and intellectually. It has been my privilege to try and inspire them to do so, albeit within the limited time given to me to do so.

My desire to support generalist early childhood and primary school music teaching practices in Western Australia is the reason behind this study. If it contributes in some small way towards tertiary generalist music education and music education in primary school settings, then I will consider it a success.

John Heyworth

Abstract

In Australia, in the current climate of economic rationalism in which there has been an increasing emphasis on literacy and numeracy, funding for specialised subjects like music has been reducing. As a result, generalist classroom teachers are being given more responsibility for delivering effective music education in primary schools. However, the time dedicated to training pre-service teachers in music education in tertiary institutions has diminished. Further, time constraints involved in building pre-service knowledge and skills in teaching music may impact many pre-service teachers' beliefs about their ability to teach music.

Within these constraints, digital technology may provide a key to improving pre-service teacher training in music education in universities, resulting in better quality delivery of music in schools. This study investigates the potential of digital looping technology to build generalist pre-service teachers' knowledge of and efficacy for teaching music in primary schools. The study involved three stages of investigation: Stage One: an experimental and control intervention involving measuring the self-efficacy of pre-service teachers before and after they completed one unit of study incorporating looping technology; Stage Two: video analysis in a practicum setting; and Stage three: participant self-reflections following the practicum to investigate the transferability of pre-service teachers' self-efficacy from university-based learning to classroom practice. Based upon the study, this thesis makes a number of recommendations for future practice in terms of generalist pre-service teacher training, as well as recommendations for future research.

Declaration

I certify that this thesis does not, to the best of my knowledge and belief:

i. Incorporate without acknowledgment any material previously submitted for a degree of diploma in any institution of higher education;

ii. Contain any material previously published or written by another person except where due reference is made in the text; or,

iii. Contain any defamatory material.

I also grant permission for the library at Edith Cowan University to make duplicate copies of my thesis as required.

Signed [redacted] Date 1/10/2018

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I would also like to acknowledge the sad and tragic passing of Paul who has been another inspiring mentor to me. I am also grateful and very thankful to Christina for taking Paul's place as one my supervisors. Like Geoff, her support and advice has been first class.

I must also make mention of the additional help and support offered by the Graduate School at Edith Cowan University, and especially Dr Susan Hill, Professor Mark Hackling and the Data Analysis Group for help with many aspects of this study including video research. A special thank you also to Bev Lurie for her assistance with proof reading and formatting.

Thanks also to all my colleagues and friends who have been so supportive and encouraging. In this respect, I would especially like to thank Ilsa Smith and Christine Lovering. Ilsa gave freely of her time to be involved in the study and I am most grateful for her support and encouragement. Of course, a big thank you to all the students involved.

I owe a lot to my parents, sisters and family. A huge thank you to them and to my wonderful daughter Rosie who has always believed in me. I dedicate this work to my late daughter Pippa who will always be in my heart. Last, but not least, I have had the wonderful support of my partner, Kathy. Her endless patience helped sustain me through this long journey.

John Heyworth
October, 2018

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Chapter One: Introduction to the Study

1.1 Introduction

In 2006, after thirty years of generalist and specialist music teaching in primary schools, I started lecturing to generalist pre-service teachers on how to incorporate music into their classrooms at a leading Western Australian (WA) teaching university. Initially I was daunted by the magnitude of preparing pre-service teachers for teaching music in just one module of a five-week program in a four-year Bachelor of Education and I gradually became aware of the increased levels of responsibility on generalist primary teachers today for teaching music.

Concurrent with generalist primary school teachers taking on increased responsibility for facilitating music education in their classrooms, dedicated time for music instruction has diminished in WA tertiary institutions. The low priority of music in the curriculum has also given rise to limited resources in national and international universities and led to widespread concerns about the competence and confidence of graduate teachers to deliver adequate and meaningful music education.

In recognition of this problem, the current study investigated the potential of music technology to empower pre-service teachers to take more control over their own learning, in turn, improving their confidence and competence to effectively deliver music education in schools. Specifically, the use of a looping technology formed the basis of this study, whereby manipulation of digital ostinatos can create musical compositions ranging from the simplest to most complex.

This chapter describes the context, aims and significance of the research within a Western Australian setting. It also outlines the research questions and provides an overview of the research approach and methodology.

1.2 Background

Generalist primary school teachers in Australia are responsible for delivering eight learning areas: English, Mathematics, Science, Humanities and Social Sciences, The Arts, Technologies, Health and Physical Education, and Languages (Australian Curriculum Assessment and Reporting Authority [ACARA], 2016a). The Arts learning area is an important part of the Australian curriculum (Garvis & Lemon, 2013) and comprises five disciplines: Dance, Drama, Media, Music and Visual Arts (ACARA2016a). In the curriculum, the five arts subjects share two interrelated strands: a) Making and b) Responding, recognising that each art form is unique and presenting an individual rationale for each subject with defined aims (Australian Curriculum Assessment and Reporting Authority, 2018a). In order to provide a clear picture of the music requirements of generalist teachers, broadly represented by the participants in this study, a summary of the rationale and aims of music has been provided in Appendix G. It should be noted that in WA it is mandated for all students to study at least two arts subjects from pre-primary through to the end of Year 8; one of these must be a performance subject (Dance, Drama, Music) and the other a visual subject (Media Arts, Visual Arts). From Year 9 all arts subjects are optional (Government of Western Australia, 2016).

Music specialists in many western countries have historically been trained to provide quality music education in primary schools (Russell-Bowie, 2009). However, the diminishing time for music and the arts have contributed to generalist primary teachers being tasked with increasing responsibility for teaching music in schools (Lowe, Lummis, & Morris, 2017; Russell-Bowie, 2009). This statement by Jeanneret, in Sinclair, Jeanneret and O'Toole (2012), outlines that:

> Although some school systems maintain music specialists in primary schools, the reality of the situation is that a large number of generalist primary teachers in Australia, Great Britain, and North America have the responsibility for teaching music in their classrooms (p. 103).

Wiggins and Wiggins (2008) also note this trend in the United States of America, albeit for economic reasons, highlighting:

> …the hiring of fewer music specialists in the United States, suggesting that if general music remains in the curriculum in localities where music positions are cut, it likely will be taught by generalist teachers rather than music specialists (p. 2).

The National Review of Music Education (Pascoe et al., 2005) acknowledge the increased responsibility of generalist primary teachers for teaching music, and question the effectiveness of universities in preparing pre-service teachers adequately:

> Hours for pre-service teacher education for music have contracted radically in the last ten years and do not adequately prepare generalist primary teachers for teaching music in schools (p. iv).

Prior to the introduction of the Australian Curriculum, each state in Australia had its own education department, or similar governing body. A national approach was introduced in an attempt to provide curriculum consistency and equality across all states and territories (National Curriculum Board, 2009). In addressing inconsistencies across states, the early draft of the National Curriculum (later called the Australian Curriculum) emphasised generalist primary school teachers' facilitation of quality arts experiences highlighting: "Teachers in schools are the key to providing students with rich, sustained, rigorous learning in each of the subjects in the arts" (p. 25).

While the draft arts curriculum developed by the Australian Curriculum, Assessment and Reporting Authority (ACARA, 2011) indicated the curriculum would be accessible to both generalist and specialist teachers, many researchers believe generalist teachers are falling short of attaining these goals in the delivery of quality music education in schools (de Vries, 2013; Russell-Bowie, 2009; Wiggins and Wiggins, 2008). The National Review of Music Education (Pascoe et al., 2005) report that music is valuable and should be available to all students, but observes inconsistencies and inequalities in music delivery across schools in Australia. The review also identifies poor preparation and a lack of time for training generalist primary teachers (Pascoe et al., 2005), many of whom, upon graduation, have low self-efficacy to teach music effectively (Russell-Bowie, 2010). The lack of confidence in generalist teachers' ability to teach music (Holden & Button, 2006) appears to correlate with diminishing time for developing competence in music teaching during pre-service education (Pascoe et al., 2005). Jeanneret and Stevens-Ballenger (2013) affirm the importance of tertiary institutions taking greater responsibility for music education from the commencement of pre-service education through to graduation, in order to develop confident and competent generalist primary teachers who are able to provide quality music education.

Confidence and competence are inter-related. According to Bandura: "self-efficacy determines how people feel, think, motivate themselves and behave" (Bandura, 1994, p. 71). Self-efficacy plays a key role in how people respond to challenges, for example, students with low self-efficacy quickly lose confidence in their abilities. The challenge facing universities is how to build pre-service teachers' self-efficacy in view of current course structures and time constraints (Russell-Bowie, 2010). Given the reduced time for music education in pre-service teacher training, strategies for improving teachers' self-efficacy are vital. Furthermore, understanding the role of technology in supporting authentic real-life, real-time constructivist learning (Chen, Wang, Yang, Lu, & Chang, 2013; Stewart, Schifter, & Selverian, 2010) is a key aspect of this process.

1.3 Problem Statement

Generalist teachers have increasingly taken on responsibility for music education in primary schools, yet many are not adequately prepared or trained to teach music effectively (Russell-Bowie, 2009). Coupled with reduced training time in teacher training universities, the current trend of inadequately prepared generalist teachers is likely to continue, ultimately impacting the quality of music education.

1.4 Aims of the Research

Given the limitations and reduced time assigned to music instruction in Australian universities, this study investigated whether digital technology could be a means for engaging, up-skilling and building the self-efficacy of pre-service generalist primary teachers. Digital technology, specifically looping technology, is a type of music software that involves creating a repeating pattern, in effect a digital ostinato (Williams & Webster, 2006). Looping software is an open-platform technology that allows for individualised and group learning, whilst also supporting creative endeavours in both modern and traditional music-making (Kuzmich, 2012). Due to increasing mobility, technologies can be accessed anywhere, anytime, and are modern, engaging, interactive and intuitive to use (Kuzmich, 2012; Merrick, 2011). Leong (2012) describes looping software as potentially empowering anyone to be creative with sound:

> The learning of music technology should go beyond the 'core' study areas – such as sound and its properties, basic audio processing, introduction to MIDI, digital audio basics, basic recording techniques and introduction to music sequencing – to explore ways of applying these skills and knowledge in empowering artistic expressions, and strategies that locate music effectively as an essential, integral and vibrant aspect of human lives and civilization (p. 241).

Looping software provides a basis for creative composition in much the same way as ostinatos do with acoustic instruments. Ostinatos can be described as repeated musical patterns, while digital loops are a similar concept, and can be defined as recurring sections of digital audio (Williams & Webster, 2006). The term “loop” is defined by the Oxford dictionary as “…2) an endless strip of tape or film allowing sounds or images to be continuously repeated” (Oxford University Press, 2018b, p. 247). Loop (music) is defined on the Wikipedia website (2018) as:

> In electro-acoustic music, a loop is a repeating section of sound material. Short sections of material can be repeated to create ostinato patterns. A loop can be created using a wide range of music technologies including turntables, digital samplers, synthesizers, sequencers, drum machines, tape machines, delay units, or they can be programmed using computer music software (para.1).

For the purpose of this study, looping technology refers to music software or applications (apps), operated on digital devices, for the creation and manipulation of short repetitive sound files. Looping software, such as *GarageBand* (Apple, 2017a), allows users to make sounds on a variety of virtual instruments such as drums, keyboards and guitars. In this way, simple rhythms can be played using an iPad (Apple, 2017b) as a multi-faceted musical instrument, and allowing students to play in ensemble situations. At a higher level, these simple rhythms can be recorded in real time and then cut and pasted along a timeline, with other instruments layered to build complex digital compositions. *GarageBand* also has the capacity to record voices, sample sounds and import guitars or keyboards utilising an array of amplifiers. One of a number of similar software packages, *GarageBand* is easy to access, simple to use, inexpensive to buy, and the user can quickly achieve reasonable results. It is a well-designed technology that complements the cognitive processes of the user (Dror, 2011). *GarageBand* is a popular, engaging and interactive application (Kuzmich, 2012) and as such, was selected as the looping technology for this study.

1.5 Research Questions

This study assessed the potential benefits of a looping technology in building pre-service teachers' competence and confidence to teach music after one five-week module of music study at a tertiary institution. Accordingly, the research questions were:

1) What impact does a music looping technology intervention have upon pre-service generalist teachers' self-efficacy to teach music in primary schools compared with a traditional module of instruction?

2) In what ways does a music looping technology intervention impact pre-service generalist teachers' self-efficacy to teach music as evidenced during a practicum placement?

1.6 Significance of the Study

This study is relevant because it explores the potential of looping technology to build the confidence and self-efficacy of pre-service teachers over a short timeframe. The research is innovative because it places looping technology at the centre of the learning process as a teaching tool that is "adaptive to the changing propensity of learners towards technological possibilities" (Leong, 2012, p. 237). Leong (2012) claims that music digital technologies support learning strategies and activities by:

- Valuing both individualised and group learning;
- Integrating music and the arts into the daily life of learners, i.e., extending beyond the school setting and promoting lifelong learning;
- Utilising gaming and 3D technologies in an inclusive and immersive environment;
- Requiring creative, constructive and connectivist actions;
- Containing a balance of physical, cognitive, metacognitive and social elements;
- Providing real-time continuous feedback; and
- Are based on open platforms, content and channels (p. 241).

The findings of this research have the potential to inform pre-service education and bring about improved outcomes for pre-service teachers and their future students. Developing competent generalist primary teachers who are confident in their ability to teach music in schools was the driving force behind this study.

1.7 Organisation of the Research

This study involved three stages of data collection. To investigate the first research question, stage one utilised a quasi-experimental design for pre-service teachers' participation in a five-week module of music education, with the experimental group undertaking an additional module incorporating a looping technology intervention. Stage two involved video capture of the latter group of participants teaching music with a looping technology during a practicum, while stage three analysed the self-reflections of participants immediately following the practicum experience.

1.7.1 Stage One: Quasi-Experimental Study

The first research question required statistical data to determine pre-service teachers' self-efficacy to teach music before and after participation in a five-week music module. This was conducted within a quasi-experimental framework, whereby statistical data were collected from a control group and an experimental group (Bell, 2005). Both groups undertook the same unit of study on different campuses. The control group undertook the traditional mode of study, while the experimental group also engaged in a looping technology intervention. Both groups were surveyed, and the pre- and post-test data statistically analysed to identify any observable change between the two cohorts.

1.7.2 Testing Instrument

Since there was no all-purpose measuring tool to suit the situational demands and circumstances of this study (Bandura, 2006), one needed to be developed for measuring participants' self-efficacy and self-beliefs, both their strength and magnitude (Bandura as stated by Pintrich & de Groot, 1990). The overall survey was guided by the premise that teaching is a complex and sometimes stressful occupation, requiring "operative efficacy", that is, the skill of improvising "subskills to manage ever-changing circumstances" (Bandura, 1986, p. 391). In the music teaching domain, basic music skills are required to teach music to students, and accordingly, a three-part survey, titled Anonymous Music Undergraduates Self-Efficacy Survey (AMUSES, Appendix A) was developed for this research. Part A examined participants' beliefs in their own musical ability, while part B examined self-efficacy in their ability to teach music. Bandura (2006) notes:

> Being socially situated, and often interdependently so, individuals' judgments of their personal efficacy are not detached from the other members' enabling or impeding activities. Rather, a judgment of individual efficacy inevitably

> embodies the coordinative and interactive group dynamics. Judgment of efficacy in a group endeavour is very much a socially embedded one, not an individualistic, socially disembodied one (p. 13).

Part C was designed to examine participants' collective beliefs about the importance of music for justifying continual development of their musical skills to become better educators. The findings were expected to be an indicator of participants' self-efficacy in practice.

The AMUSES survey was piloted with 40 postgraduate music students enrolled in a Graduate Certificate of Education. Their feedback required some grammatical clarification and re-phrasing of one question. Data were entered into SSPS software and resulted in a robust Cronbach's Alpha of 0.94 (Allen & Bennett, 2008).

1.7.3 Stages Two and Three: Qualitative Studies

A field study was needed to gather evidence about the effectiveness of the looping technology intervention on pre-service teachers in a primary school setting. Video analysis has proven to be a powerful tool for qualitative research, because it enables frame-by-frame examination of interactions in a social situation (Knoblauch & Schnettler, 2012) and allows the researcher to view social interactions as they happen (Derry et al., 2010). By using a deductive approach (Derry et al., 2010), data were collected and investigated via the conceptual model developed by Derry (2010). Video data allowed for observations of speech, sounds, objects and actions, while integrating conventional written forms added depth to the data (Dicks, 2006). The *See Think Wonder* framework, a thinking routine developed by the Harvard Graduate School of Education (2013), offered appropriate flexibility and was used as the basis for a post-practicum self-reflective survey in stage three (Lowe, Prout, & Murcia, 2013).

A pilot video-capture trial was undertaken with a small number of fourth year pre-service teacher volunteers over a two-week period of a teaching practicum. Six case studies were conducted, incorporating video capture, recorded interviews and written reflections. The trial proved valuable for improving the operation of video equipment, as well as developing video coding through NVivo data analysis software (QSR international, 2012). A pilot trial of the self-reflective survey was undertaken immediately after the conclusion of the practicum and indicated no need for further editing.

1.7.4 Ethics

Full ethics clearance was obtained from the Edith Cowan University Human Research Ethics Committee prior to the commencement of the study (ethics clearance number 7939). All documents pertaining to ethics are presented in Appendices C, D, E and F.

1.8 Organisation of the Study

The thesis has been organised into seven chapters. A brief outline of each chapter is presented in Table 1.

Table 1: *Outline of Thesis Chapters*

Chapter	Title	Summary
1	Introduction to the Study	Provides the context for the study and outlines the need for the study and its significance within the Western Australian primary music education curriculum.
2	Literature Review – Issues in Primary Music Education	Provides an overview of the issues facing music education in primary schools in Australia, and concerns relating to the self-efficacy of generalist pre-service teachers to facilitate meaningful musical experiences.
3	Literature Review: Music Technology	Reviews the literature on music technology with a focus on looping technology and the support it may provide in facilitating music education in universities.
4	Research Methodology	Describes the pragmatic research approach used in this study of human behaviour as it sought to take advantage of the strengths of both quantitative and qualitative methods of inquiry within the context of social environments.
5	Results	Presents the data in each of the three research stages.
6	Discussion of the Findings	Discusses the findings presented in chapter five, answers the research questions of the study and makes recommendations for practice.
7	Conclusion	Reviews the study, summarises the key findings and makes recommendations for future research.

1.9 Conclusion

Technology can be of great assistance to generalist pre-service teachers' music-making provided traditional musical experiences are not overlooked and are valued (Wiggins, 2009). Empowering teachers to be more musically confident requires hands-on practice in music making (Harris, 2009), while developing and fostering a love of music possibly surpasses any requirement for a teacher to have high levels of musical proficiency (Harris, 2009).

Technology provides a way of integrating the old with the new and embracing the challenging, ever-changing educational landscape. It also assists with engaging students from different musical backgrounds, experiences and skills, and encouraging creative, innovative and collaborative learning. The success of such an approach for pre-service teachers was the measure for this study, with the use of “loops” as a vehicle for learning, participating and creating music. Coupled with the portable and accessible nature of technology, this approach could be of long-term value for engaging pre-service teachers in creative music making, whereby new technologies enable them to more confidently and competently facilitate musical engagement in their classrooms.

Chapter Two: Literature Review
Generalist Primary Music Education

2.1 Introduction

This chapter provides an overview of the challenges facing music education in primary schools in Australia and examines concerns about the self-efficacy of generalist pre-service teachers to facilitate meaningful musical experiences. It explores key issues in relation to the effectiveness of music training and their impact on pre-service teachers enrolled in a four-year Bachelor of Education (Primary) course.

The chapter commences with an outline of current music education in primary schools and the role of the generalist teacher, followed by self-efficacy and tertiary teacher training. It concludes with a summary of the role technology can play in supporting the teaching of music.

2.2 Background

In 2013, Australia introduced an Australian curriculum endorsed by Australian Federal, State and Territory education ministers (ACARA, 2013). Implementation of the Australian curriculum was the responsibility of each state and territory, with oversight by the federal government (ACARA, 2013). The national curriculum consisted of eight learning areas, one of which was the Arts Learning Area (ALA), comprised of Dance, Drama, Media, Music and Visual Arts (ACARA, 2016b). In Western Australia (WA), the School Curriculum and Standards Authority (SCSA) was the government agency responsible for implementing the Australian curriculum (Government of Western Australia, (2018); and the eight learning areas were to be gradually implemented from 2016 (The Conversation, 2015). The arts, technologies and languages were implemented in WA in 2018 (Government of Western Australia, 2018). The SCSA stipulated at least two of the five arts subjects must be taught in schools from pre-primary through to year 8, a further requirement being that one is a performing arts subject and the other, a visual arts subject (Government of Western Australia, 2016). The SCSA state that while desirable for students to engage in all five Arts areas, it is not mandatory to do so (Government of Western Australia, 2016), thereby allowing schools the choice to teach music or not.

2.2.1 The Current State of Music in Education

With the exception of Queensland, generalist primary school teachers are predominantly responsible for facilitating music education in Australian primary schools (de

Vries, 2013). As in other parts of the western world, improving literacy and numeracy rates has monopolised government funding, resulting in a significant decrease in funding for specialist music teaching in primary and early childhood education (Russell-Bowie, 2009). Like many other countries, generalist teachers in Australia are now expected to teach all learning areas, including mathematics, English, science, humanities, social science, technology, health and physical education, and the arts (ACARA, 2016b; Russell-Bowie, 2009). The trend for generalist teachers to become "jacks-of-all-trades" (Collins, 2016, p. 17) raises questions (Russell-Bowie, 2009) about their ability to deliver quality music education in Australian schools. This is concerning, given the benefits of music to children's overall development, and for improving literacy and numeracy skills (Hallam, 2010). Russell-Bowie (2009) state:

> More generally, students with high levels of arts participation outperform students with little arts in their background, by virtually every measure, and arts participation makes a more significant difference to students from low-income backgrounds than for high-income students (p. 23).

There is growing evidence that music plays an important role in the development of a young child's brain, leading to increased awareness of the value of music education in schools (Lowe et al., 2017). Music equips students for the demands of 21st century society that requires creative and innovative thinkers (Garvis, 2008). It supports students' social and emotional growth through developing emotional intelligences (Lopes et al., 2004; Lowe et al., 2017), and has been shown to assist the development of multiple intelligences (Heywood, 2005; Lowe et al., 2017). Gardner (1998) claims:

> I think that music may be a privileged organizer of cognitive processes, especially among young people. Evidence is accruing that for many people, especially when they are young, music is a particularly happy or salubrious way in which to organize not just music itself but other domains of experience (p. 31).

Given that music is beneficial to a child's development, it follows that teachers must be well prepared to teach music effectively (Lowe et al., 2017). Mills (1998) argues that if music is for all children then it must surely be for all teachers. However, since Arts subjects have received less curriculum time than core subjects like numeracy and literacy, tertiary institutions have assigned less time and resources to the Arts with detrimental repercussions for generalist teachers' confidence and ambitions to teach music (de Vries, 2017; Russell-Bowie, 2009).

2.3 Pre-Service Teacher Music Education

Russell-Bowie (2010) recommends that universities provide more time for music education in generalist teacher training courses to enhance the competence and confidence of pre-service teachers to teach music. However, the time allocated to tertiary music tuition has gradually declined as schools transitioned from a subject-based to outcome-based curriculum in the 1980's (Lummis, Morris, & Lock, 2016). In the mid-1980s, primary pre-service teachers in WA completed a three-year Diploma of Education which included a four-hour core unit in Music for a full semester, with the added option of a further two music electives (Lowe et al., 2017). Visual art and music were the only core arts units offered until the early 2000s, when the Diploma was upgraded to a four-year Bachelor of Education (Primary) (Lowe et al., 2017). Music education was further reduced in the mid-2000s, when the core music unit was reduced to three hours with the option of only one music elective (Lowe et al., 2017).

The advent of the Australian curriculum saw generalist teachers tasked with responsibility for all five Arts areas (ACARA, 2011). However, in recent years, an increased emphasis on literacy and mathematics in Australia and other western countries has led to a simultaneous decline in priority for the arts (Russell-Bowie, 2009). Today only two general arts core units are offered in the Bachelor of Education Course (Primary) at Edith Cowan University (ECU) where this study was conducted.

The current four-year Bachelor of Education (Primary) at ECU includes two core units that cover all five arts disciplines, organised into five-week module blocks. Music tuition is limited to one of these five-week modules (Edith Cowan University, 2018). At the time of this study, pre-service teachers also had the option of studying one music elective, although in 2018 this was increased to three units as a music specialisation (ECU, 2018). The National Audit of Music Discipline and Music Education Mandatory Content within Pre-Service Generalist Primary Teacher Education Courses found on average, universities in Australia only allocated 16.99 hours of music training in their Bachelor of Education (Primary) courses. Primary schools may therefore not have generalist teachers capable of teaching music effectively (Hocking, 2009).

The problem of inadequate pre-service training is not new. Thirteen years ago, the Australian National Review of Schools Music: Augmenting the Diminished (Pascoe et al., 2005) reported three key points:

1. Music education is valuable and essential for all Australian students;
2. Many Australian students miss out on effective music education; and
3. Action is needed to right the inequalities in school music (p. v).

The review identified a need to improve and sustain the quality of music education and emphasised the priority to "improve teacher pre-service and in-service education" (Pascoe et al., 2005, pp. v-vi). More recent research in Australia and other western countries supports the view that generalist teachers are ill equipped to teach effectively in schools (de Vries, 2014), reinforcing Pascoe et al.'s (2005) assertion that generalists receive limited preparation for teaching music. The resultant lack of consistency in music provision underscores little change since the original 2005 report. In fact, many generalist teachers still commence their careers with little or no formal Arts education; and often with low self-efficacy to teach music in schools (Garvis, 2008; Russell-Bowie, 2010).

An already onerous curriculum places pressure on generalist teachers to focus on so-called "important" subjects at the expense of the arts (Collins, 2016, p. 17; Lowe et al., 2017). The expectation for them to be "masters-of-all-trades" is therefore unrealistic, but the question remains whether it is possible for generalist teachers to adequately teach music? Mills (1998) is of the opinion that generalist teachers are capable of teaching music in the classroom with appropriate preparation. Wiggins (2007) suggests teachers "start where the students are, to link to their perspectives, to recognise and honor (*sic*) the knowledge they bring to the experience" (p. 40). Although referring to a dedicated music course, this could equally apply to a music unit in a general education course, involving as it does pre-service teachers' knowledge, values, beliefs and perceived competence for teaching music. While some basic music notation reading skills may need to be taught, a lack of notation or other formal music theory need not hinder "enjoyable" music participation (Mills, 1998, p. 2). A more pressing need appears to be facilitating learning that builds upon the existing skills of pre-service teachers in a tertiary training music unit, as it may well be that a perceived lack of skills rather than an actual lack of skills is the root cause of feelings of inadequacy. This would support Mills' (1998) observation: "These students measure their musical competence by what they cannot do. Measurement of what they can do would be more to the point" (p. 4).

2.4 The Generalist Teacher

As previously noted, there has been a steady decline in allocated time for music in pre-service teachers' training, leading to gaps in their musical knowledge. Hocking (2009) raised concerns about generalist graduates not acquiring the necessary abilities and confidence to teach music effectively and predicted that "primary schools may not have generalist teachers who can competently deliver a music program" (p. 27). In the United Kingdom (UK), specialist music teachers have traditionally been responsible for teaching music, while generalist teachers rarely taught music unless they were inclined to do so (Mills, 1998). In advocating for generalists, Mills argues that they know and understand their students better than visiting specialist teachers and have sufficient musical skills to assist in the development of a child's musical ability. However, the research also shows that generalist teachers in the UK and Australia suffer from low self-confidence in their musical abilities, and consciously avoid teaching music in their classrooms (de Vries, 2013; Hennessy, 2000; Russell-Bowie, 2009). A recent study of pre-service teachers undertaking a Bachelor of Education (Primary) in WA found this cohort believed they had low self-efficacy to teach music in schools, largely due to their own limited music experience and lack of time for acquiring sufficient mastery to feel competent or confident (Lowe et al., 2017).

The literature highlights a lack of confidence amongst generalist teachers and their apprehension to teach music, particularly in the UK and post-colonial countries like Australia. De Vries (2013) offers several reasons why this might be the case: there is often a music specialist in the school; they believe they are unmusical; inadequate teacher training; lack of time and resources to teach music; lack of in-school professional training; and general lack of confidence to teach music. In the UK, Holden and Button (2006) report that participants assigned the lowest ranking to confidence in their ability to teach music, and described feeling vulnerable due to an inability to read music notation. These findings showed, unlike any other subject in the UK national curriculum, that participants viewed music as a specialist subject. Seddon and Biasutti (2008) report that pre-service teachers' perceptions of music as a specialist area significantly impacted their confidence to teach music after graduation. In Australia, Jeanneret (in Sinclair et al., 2012) confirm that "teachers' own musical experiences frequently shape their attitude towards, and confidence in teaching music" (p. 103). In a study of teaching effectiveness of primary music in the absence of specialists, Wiggins and Wiggins (2008) observed that generalist teachers "were not able to teach in ways that would connect to and foster students' musical understanding" (p. 24). Garvis (2008) however, considers generalist teachers' self-beliefs in their competency to teach music a powerful influence on their effectiveness to teach music in schools, while Bandura (1997a) concludes that self-beliefs or self-efficacy are key factors in personal competence for achieving tasks successfully.

2.5 Self-Efficacy

Self-belief informs actions to accomplish a task or succeed in specific situations, while self-efficacy plays a major role in how an individual meets these challenges or tasks (Bandura, 1997a). Motivation, behaviour and performance are all affected by a person's self-belief in their own capabilities (Bandura, 1986). Bandura (1997a) identifies three important factors that influence teacher self-efficacy: 1) vicarious experiences; 2) mastery experiences; and 3) collective efficacy. Vicarious experiences incorporate activities such as modelling, and are influential in learning by observing another's proficient use of skills and strategies, thereby acquiring effective ideas for raising one's own efficacy and motivation to succeed. By contrast, mastery experiences are more concerned with success in past actions, leading to optimism for success in similar future tasks. Collective efficacy includes aspects such as educational leadership, the supportive nature of the education system, working conditions, and ongoing training and support. Collective efficacy creates a circular effect, in that the positive self-efficacy displayed by instructors can enhance student learning, who in turn, may become teachers themselves. Bandura (1997a) summarises this as follows:

> There are three main ways in which efficacy beliefs operate as important contributors to the development of cognitive competencies that govern academic achievement: student beliefs in their efficacy to master different academic subjects; teachers' beliefs in their personal efficacy to motivate and promote learning in their students; and faculties' collective sense that their schools can accomplish significant academic progress (p. 214).

According to Bandura (1997a), self-efficacy beliefs have a direct influence on persistence and effort. Given that music is largely a skill-based subject involving high levels of performance, participation in musical activities requires motivation to expend effort meaningfully. In short, positive engagement with music can build a positive attitude to music

(Garvis, 2008). Feeling a sense of joy or success in learning a skill is likely to motivate an individual to repeat the skill and build upon it in the future (de Vries, 2017).

Pre-service teachers' lack of musical confidence is a common hurdle in teacher training courses (Sinclair et al., 2012). Their attitudes towards music have usually been acquired over their lifetimes (Russell-Bowie, 2002), and in some cases, providing positive learning experiences in a minimal timeframe is a major challenge for tertiary institutions (Russell-Bowie, 2010). The undisputed link between confidence and competence could potentially reduce incidences of pre-service teachers coming to teacher training with little musical experience from school, and therefore fewer skills (Lowe et al., 2017). Wiggins and Wiggins (2008) note that: "Much attention has been paid to generalist teachers' confidence to teach music (Jeanneret, 1997; Russell, 1996) and factors that contribute to that confidence (Hennessy, 2000)". Wiggins and Wiggins go on to state: 'However, Bartel, Cameron, Wiggins and Wiggins (2004) drew on Bandura's (1977, 1986, 1997) work on self-efficacy to make the point that confidence alone is meaningless if it is not accompanied by competence" (p. 3).

Bandura (1997a) states categorically that an individual who does not believe they can achieve a task is unlikely to attempt it:

> Unless people believe they can produce desired effects by their actions, they have little incentive to act. Efficacy belief, therefore, is a major basis of action. People guide their lives by their beliefs in personal efficacy. Perceived self-efficacy refers to beliefs in one's capabilities to organise and execute the courses of action required to produce given attainments (p. 3).

Gu and Day (2007) describe the particular challenges and demands of the teaching profession. To teach music (or any other subject) competently requires not only the requisite skills, but also the self-belief to use those skills effectively (Bandura, 1986). Bandura argues that operating effectively requires an ability to continuously call on "subskills to manage ever-changing circumstances, most of which contain ambiguous, unpredictable and often stressful elements" (1986, p. 381). Le Cornu (2009) asserts that pre-service teachers need to be resilient and able to persevere under stressful conditions. One's self-belief influences one's decisions to pursue any course of action, in this case, to teach music (Bandura, 1997a). Furthermore, self-influence is determined by the freedom of individuals to make their own choices (Bandura, 1997a). Bandura (1997a) describes self-influences as: 1) participants feel they have a professional choice to engage in activities or not; 2) participants' beliefs in whether an activity is "worth the effort"; and 3) participants' beliefs that something is worth pursuing. These three influences can also be applied to pre-service music teachers as shown in Figure 1, where examples of belief statements revolve around the central premise: Will I teach music?

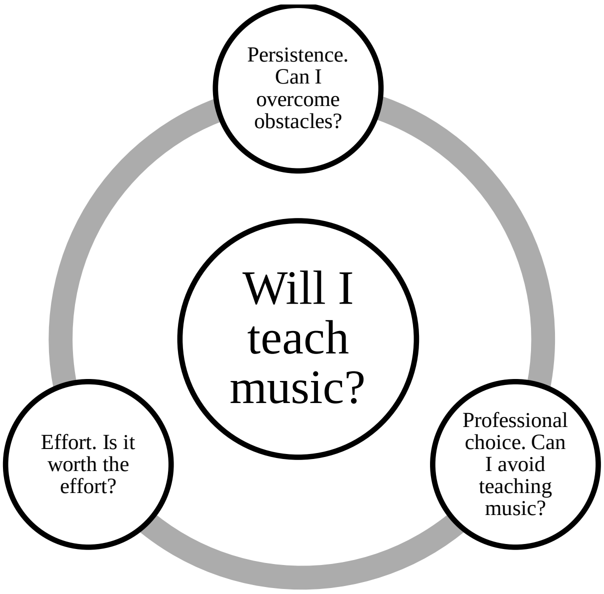

Figure 1: Self-Influences on Pre-Service Teachers' Decisions to Teach Music

A decision to teach music is partly self-determined, since pre-service teachers have the capacity to learn how to do so through their own efforts (Bandura, 1989). The prospect of failure or the belief that music is too hard to learn can undermine a teacher's efficacy to teach music successfully. Bandura (1989) elaborates:

> People's perceptions of their efficacy influence the types of anticipatory scenarios they construct and reiterate. Those who have a high sense of efficacy visualize success scenarios that provide positive guides for performance. Those who judge themselves as inefficacious are more inclined to visualize failure scenarios that undermine performance by dwelling on how things will go wrong (p. 3).

The acquisition of knowledge and skills requires resilient self-belief (Bandura, 1989); that is, the self-belief to continue striving for success despite difficulties and setbacks. Pre-service teachers with low self-efficacy to teach music often have increased anxiety and may avoid teaching music wherever possible (Bandura, 1989). Bandura (1994) proposes four major processes effect performance:

1. Affective – the emotional state of mind;
2. Cognitive – the acquisition of knowledge;
3. Motivation – persistence of effort; and
4. Self- Regulation – self-control over self-motivation, inner thoughts, emotional outlook and behaviour patterns.

Pre-service teacher education directly assists with building cognitive processes and potentially influences motivation and affective states. Bandura (1994) maintains that mastery of experiences is the most effective way of developing a strong sense of self-efficacy. Teacher training institutions have the capacity to provide opportunities for pre-service teachers to master associated subjects and build self-efficacy. Bandura (2011) argues self-belief can be developed in four ways:

1. Providing opportunities to build mastery - overcoming obstacles through persistence;
2. Social modelling - observation of peers overcoming challenges;
3. Social persuasion - encouragement to believe in oneself; and
4. Resolve - encouragement to measure success by self-improvement.

By their very nature, capabilities take time to develop. “Self-efficacy is concerned with perceived capability” within a specific domain or area of interest (Bandura, 2006, p. 2). In music education, specific skills need to be understood and/or mastered, and this requires time and persistence through gradations of challenges (Bandura, 2006). Mastering music skills is one aspect or causality that can lead to a self-belief in teaching music. Music education requires adequate development of both music and teaching skills, for example, the ability to perform music and having the requisite skills will affect the perceived self-efficacy of one’s ability to teach music skills (Bandura, 2006). Perceived collective efficacy is a collective view that one can and should be able to succeed in a given area. For example, an educational viewpoint influencing generalist teachers could be a collective belief that it is important for generalists to teach music effectively in their classrooms (Bandura, 2006). Figure 2 depicts the environmental conditions that can impact on pre-service teachers’ self-efficacy to teach music in the context of music education, where there is a collective belief that generalist teachers can and should teach music and develop adequate music skills to enhance their ability to do so effectively.

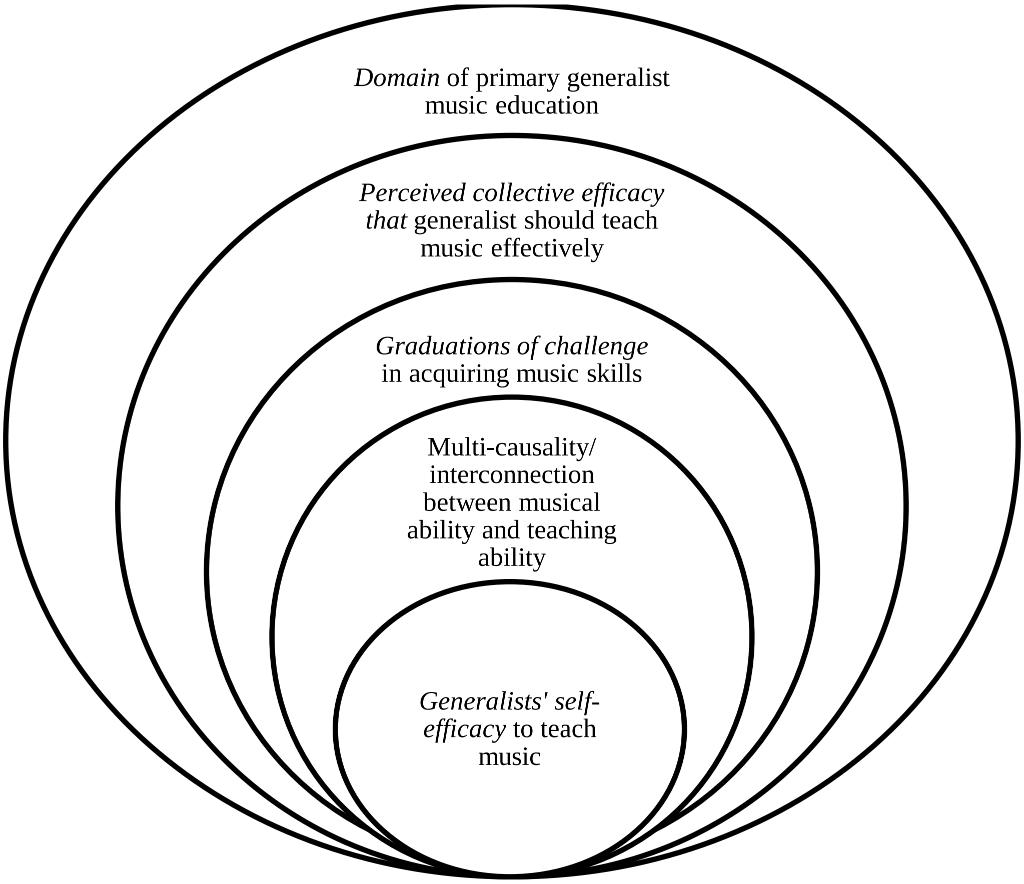

Figure 2: Institutional Expectations and Training that Influence Pre-Service Teachers' Self-Efficacy to Teach Music

Importantly, as Figure 2 demonstrates, once an individual has developed self-efficacy in a given skill or domain it can be difficult to change, and therefore teacher training institutions play a vital role in forming positive dispositions towards music and teaching (Bandura, 1997a; Garvis, 2013). However, as previously noted, the time allocated for developing musical skills has been considerably reduced in primary teacher training over the last ten years, and it may be the case that the limited time is inadequate for pre-service teachers to develop the self-efficacy required to competently teach music, despite it being a mandated curriculum subject.

2.6 The Role of Digital Technology

Coupled with increased expectations for generalist teachers to teach music after graduation, reduced pre-service training time in tertiary institutions has necessitated consideration of alternative pre-service learning strategies. One option is to use emerging technology as a tool or strategy to support learning (Walters & Kop, 2009). Bandura (1997b) acknowledged the potential of technology to transform education. Digital access to information and instruction is easy and immediate, and offers learning opportunities that are self-paced, individualised and transcend place and time, thus empowering students with greater control over their own learning outcomes (Bandura, 1997a). Technology also has the potential to motivate students to participate and develop their musical skills (Zhukov, 2015). Furthermore, in today's world, technology may provide a relevant musical learning tool that young people can easily relate to and engage with (Acker, Nyland, & Niland, 2015). Technology and global media are becoming increasingly influential in children's learning and development (Marsh, 2004). Leong (2012) stated: "Today's digital media can combine text, graphics, sound and data in an integrated multi-sensory, multimedia and multi-networked manner to enable people to enter into new experiences of realities" (p. 235).

The increasingly mobile nature of technology is a significant development. The Horizon Report (New Media Consortium Educause Learning Initiative, 2007) claimed: "the environment of higher education is changing rapidly" (p. 3) and "higher education is facing a growing expectation to deliver services, content and media to mobile and personal devices" (p. 5). Indeed, a 2008 review of Australian Higher Education, published by the Australian government, identified the need to provide pre-service teachers with a "stimulating and rewarding higher education experience" as well as developing their "knowledge, skills and understandings" for "labour markets" as future school teachers (Bradley, Noonan, Nugent, & Scales, 2008, p. 6).

Apart from the obvious benefits of instant delivery and accessibility of content, technology may also have a place in facilitating music participation in a creative setting. In terms of music and the creative arts, Sir Ken Robinson (Aronica & Robinson, 2009), a strong advocate for creativity, concluded that being creative in the arts may be just as important, if not more so, than being merely skilled in the arts, since a creative approach utilising digital technology allowed students to harness their talents for "making something original" (Aronica & Robinson, p. 72). Leong (2012) stated:

> As more emphasis is given to creativity and the arts, music education practices need to devote more attention to developing learners' digital literacies, analytical and critical thinking, and the other 21st century skills with reference to the realities of the cultural and creative industries (p. 240).

Vella (2000) described the potential of new and old technologies to illustrate creative uses of music, including:

- Sound sources: the exploration of environmental resources, traditional and non-traditional instruments, acoustic and virtual instruments;
- Soundscapes: sounds to create audio images or pictures; sound and silence; and,
- Sounds supporting story telling: sounds/music depicting mood, atmosphere, scenes and movement.

As noted by Vella (2000), Williams and Webster (2006) also believed technology should be used to improve musical experiences, with a focus on artistic and pedagogical end products as opposed to merely opening up creative opportunities. O'Toole (in Sinclair et al., 2012) expressed the view that young people tend to be explorative and creative with new technologies:

> …Young people spend a great deal of time expressing and discovering them in cyberspace. For instance, young people today enjoy themselves with online activities like creating Facebook homepages or inventing wikis and blogs that are 'full of design and intricate narratives and problem solving (p. 34).

According to Sinclair et al. (2012), it is important to equip pre-service teachers with critical skills to understand and manage professional creative tools. In terms of digital music software, looping software has the potential to provide a basis for creative composition in much the same way as ostinatos do with acoustic instruments. Similarities between ostinatos and loops are evident in their respective definitions. Farmer (1982) defined ostinatos as constantly repeated musical patterns, either rhythmic or melodic (Farmer, 1982, p. 337), while Williams and Webster (2006) defined loops as simply recurring sections of digital audio. Looping software is deemed to have the potential to overcome efficacy and skills development limitations, while opening doors for pre-service teachers to acquire musical skills for teaching as well as generating opportunities to participate in creative music making.

2.7 Creative Music Making

Participating in music is a creative process involving composing, performing and listening (Mills, 1998). For music in the creative tertiary setting, pedagogical implications suggest it will be necessary to remain mindful of upskilling non-musicians while simultaneously challenging more musically able students (Mills, 1998). Swanbrick (1999) is of the view that pre-service teachers' backgrounds can add value and depth to the overall group's musical experience in tutorials, similar to ways in which school students can enrich the classroom experience:

> It (composing) gives students an opportunity to bring their own ideas to the micro-culture of the classroom, infusing formal education with music from 'out there' (p. 55).

Success can develop positive self-efficacy belief, and in turn, eventually transform pre-service teachers' low expectations (Bandura, 1997a). As noted by Seddon and Buisutti, (2008):

> It could be argued that by facilitating feelings of personal success at various aspects of music that participants considered fundamental to a person's musicality (e.g., engaging with an instrument, knowledge of musical form and structure and experience of improvisation) participant confidence in their musical abilities was increased and in this way the 'cycle of low expectation' was interrupted (p. 417).

Seddon and Buisutti (2008) found that engaging students in informal music-making with popular music ideas, such as a 12-bar blues pattern, made music feel "real" and accessible to all students, not just special students (p. 418). As an entry point to other genres of music, contemporary music can also be a strategic motivational tool (Moore, 2001). Supported by creative technologies, creative music-making in any style or genre may provide a pathway to engaging students from a wide variety of musical backgrounds and experiences. Deeper engagement could then develop student motivation and confidence to participate in further creative activities. Bandura (1997a) states: "Creativity constitutes one of the highest forms of human expression" (p. 239). Bandura goes on to discuss the role of innovation through restructuring and synthesising knowledge as part of the creative process. Importantly, he reports that being innovative requires "an unshakable sense of efficacy to persist in creative endeavours". Bandura's research into self-efficacy has important implications for this study, in particular, the level of pre-service teachers' self-efficacy and their resulting decisions to engage with music in the classroom after they graduated. Given the recent reductions in face- to-face training in universities, there is certain value in exploring the potential for technology to increase the self-efficacy of pre-service teachers in creative learning areas like music.

2.8 Conclusion

Many practicing generalist primary teachers avoid teaching music, not only because they lack belief in their own musical ability, but also because they deem it a specialist area of teaching and only for musically gifted people (de Vries, 2013). Helping pre-service teachers build confidence in their abilities to teach music in the new Australian Arts curriculum is a continuing challenge for many tertiary institutions (Jeanneret, 2006). While pre-service teachers enrolled in university courses have a wide variety of experiences and beliefs about music education, a large percentage has low expectations of their ability to teach music (de Vries, 2013; Lowe et al., 2017; Mills, 1998; Russell-Bowie, 2009). As a result, the task of preparing generalist pre-service teachers to competently and confidently teach music with limited hours of tuition is no small challenge (Jeanneret, 2006). Technology may offer a way of maximising the limited time, given it has become an increasingly more accessible and powerful tool for educators (Bandura, 1997a; Leong, 2012; Walters & Kop, 2009; Williams & Webster, 2006; Zhukov, 2015).

Chapter three discusses the choice of a looping technology as an intervention tool and its potential for increasing pre-service teacher's self-efficacy to teach music.

Chapter Three: Literature Review
Music Technology

3.1 Introduction

Chapter two outlined issues related to the self-efficacy of generalist pre-service teachers to teach music effectively. Problems associated with the effectiveness of tertiary music education training were discussed, in addition to their potential impact on pre-service teachers in a Bachelor of Education (Primary) Teaching course.

Chapter three reviews the literature on music technology with a focus on looping technology and its potential value for facilitating music education in universities. The objective of the study was to investigate the impact of looping technology on equipping pre-service teachers with the necessary skills to competently and confidently teach music. Accordingly, it was guided by the following research questions:

1. What impact does a music looping technology intervention have upon pre-service generalist teachers' self-efficacy to teach music in primary schools compared with a traditional module of instruction?

2. In what ways does a music looping technology intervention impact pre-service generalist teachers' self-efficacy to teach music as evidenced during a practicum placement?

Chapter three also provides an overview of looping technology and its potential as a strategic teaching resource for building generalist pre-service teachers' confidence and competence to teach music, as well as facilitating meaningful musical engagement with future students upon graduation.

3.2 Technology and Principles of Learning

Russell-Bowie (2015) argues constructivism, inquiry-based learning and authentic learning are three key principles of learning. The view that learning is best attained by constructing knowledge rather than rote learning draws upon the works of Piaget, Vygotsky, Bruner and Garner (Boddy, Watson, & Aubusson, 2003; Gordon, 2009; Russell-Bowie, 2015). Russell-Bowie (2015) state:

> No longer is the teacher the fount of all knowledge; rather the teacher is a facilitator who encourages cognitive engagement by providing relevant scaffolding, a positive environment and sufficient resources throughout the activity to optimize the children's learning (p. 8).

Constructivist learning is meaningful in real-life authentic situations (Chen et al., 2013; Russell-Bowie, 2015), while authentic learning involves grasping concepts and contexts embedded in real-world situations that students can relate to (Curtin University, 2018). Usually associated with physical, real-life environments, Chen et al. (2013) argues authentic learning can also occur in digital environments. Technology, including digital technology, can support constructivist learning, provided it is utilised as a medium for "learning with" or "learning through" technology, rather than "learning from" technology (Stewart et al., 2010, p. 10). "Learning from" technology through the internet relates to an 'instructivist' approach, which offers material for learners to be recipients of knowledge or to learn and practice new skills (drill and practice). On the other hand, "learning with" or "learning through" technology provides the opportunity for a more constructivist approach, where technology becomes a tool for solving problems, critical thinking, research and developing new ideas or concepts (Stewart et al., 2010, p. 10). In 2013 Chen et al claim that the emergence of an interactive, internet-transformed technology had become readily available for supporting social constructivist learning:

The biggest transformation in availability, social interactivity, control of media in the classroom and social constructivist pedagogical perspective was the advent of the World Wide Web (Stewart et al., p. 13) in 1993. "Emerging technologies" are described by Merrick (2011) as "new digital and web 2.0 based learning opportunities within society" (p. 17). Digital technology is an evolving medium and devices are becoming smaller, more mobile and easier to use. It has enabled fast and easy access to a plethora of products and processes such as information, media, creative tools, collaborative forums and interactive platforms (Stewart et al., 2010). Walters and Kop (2009) claim that digital technology impacts all aspects of life: "Digital technology is transforming life—personal life, leisure, shopping, commerce, culture, music, news, community networks, and education" (p. 403).

Furthermore, the ability of technology to support authentic real-life and real-time constructivist learning is increasing (Chen et al., 2013; Stewart et al., 2010). While Walters and Kopp (2009) express reservations about excessive electronic engagement, they also acknowledge that the digital environment has many advantages for educating and preparing children for life. Southcott and Crawford (2011) caution that educators need a sound pedagogical approach towards integrating technology for it to become a valid and useful tool in the classroom and to be "judicious in their choices of which technologies to include" (p.133). Webster (2016b) is also of the view that successful use of technology stems not from the technology itself, but more from the dynamics of the classroom learning environment. The guided use of images and sound can create a sense of real-life experience and provide unique learning opportunities, such as learning simple rhythms on an interactive drum kit or exploring auditory timbres or pitches on a variety of virtual instruments (Webster, 2016b). Technology can also create opportunities for unique and different uses, for example, music technology can support the development of children's auditory cognition (Kraus, 2012):

> Auditory-based communication skills are developed at a young age and are maintained throughout our lives. However, some individuals – both young and old – encounter difficulties in achieving or maintaining communication proficiency. Biological signals arising from hearing sounds relate to real-life communication skills such as listening to speech in noisy environments and reading, pointing to an intersection between hearing and cognition. Musical experience, amplification, and software-based training can improve these biological signals (p. 403).

Technology has had a major impact on participation and engagement in the arts, especially music (Roy, Baker, & Hamilton, 2012). While audio coding technology, such as mp3s (compressed sound files), has reduced time and location barriers in the creation and consumption of art works, educators have to be careful to utilise technology to engage children in meaningful and active arts participation, rather than as passive consumers (Roy et al., 2012). Russell-Bowie (2015) expresses the view that music in education should be experienced, believing that children gain a deeper understanding of music by playing, creating, moving and singing. She describes music as a "way of knowing" and a way of "expressing one's identity in the world" (p. 46). In the creative, constructivist space, technology may be a valuable medium for helping children explore and learn about music (Merrick, 2011). In education, technology can potentially offer generalist teachers a valuable tool to facilitate new and exciting ways for children to make and respond to art works (Roy et al., 2012). Tertiary institutions play an important role in preparing pre-service teachers to utilise technologies effectively in their future classrooms (Uer, Volman, & Kral, 2017).

3.3 Technology and Music

In a general sense, technology refers to any "machinery and equipment developed from scientific knowledge" (Oxford University Press, 2018b, p. 750). In biblical times, music training involved vocal and aural teaching without instrumental accompaniment. Primitive wind instruments, created from bird bones that date back to over 40,000 years ago (Turnbull, 2017) have been discovered. The Christian church played a major role in western music education, largely for the purpose of religious ritual. Although vocal and aural in nature, Beckstead (2001) points out that using technologies as teaching aids began to appear many centuries ago:

> One thousand years ago, the Benedictine monk Guido d'Arezzo began teaching singing with visual aids for pitch notations, an early precursor to the methodology that dominates music classrooms today (pp. 44-45).

Examples of instrumental advances include the ancient Egyptian harp in 3000 BC, which led to the development of the harpsichord in 1397, and eventually the piano in 1709 (Turnbull, 2017). As time progressed, advances in music technology have become more prevalent. Seventeenth and eighteenth-century examples include the player piano, wind-up music boxes and barrel organs (Williams & Webster, 2006). While these devices were mechanical in nature, more recent examples of music technology include computer tablets, digital watchbands and portable personal music players such as Smartphones (Williams & Webster, 2006). These authors identify five stages of music technology development:

1. Period I (1600 – mid 1800): Mechanical devices such as music boxes, calliopes, organs and player pianos.

2. Period II (mid 1800 – early 1900): Electrical devices such as the Hammond Organ and Cahill's Telharmonium.

3. Period III (early 1900 – mid 1900): Electromagnet and vacuum tube devices such as juke boxes, tape recorders, amplifiers and electronic instruments like the Theremin.

4. Period IV (mid 1900s – 1970s): Transistorised devices such as Moog and ARP synthesizers and DEC PDP-8 minicomputers.

5. Period V ((1970s - present): digital portable devices: MIDI software and hardware, drum machines, Digital Audio Workstations [DAW], internet, cloud technologies, smart phones and mini tablets.

With the exception of the piano, older mechanical technologies are of little use in music education, however more recent technology are having a profound impact (Beckstead, 2001). Webster (2016a) hypothesises that internet-based materials for teaching and learning music has been one of the most important educational trends in recent times (Webster, 2016a), with significant benefits for teachers and students to incorporate the internet and new technologies into schools and tertiary teacher training institutions (Reese & Hickey, 2016).

Williams and Webster (2006) argue that the digital revolution transformed the way audio is produced through extremely high-speed manipulation of 0 and 1 digital information. Micro-electronic circuits are used to transform digital data into waveform signals for loudspeakers or headphones in order to transmit sounds in understandable formats directly to the human ear. Conversely, these circuits can capture waveform signals from microphones and convert them into digital data that can easily be stored or shared with other digital devices or servers such as the internet: "Digital audio is the most pervasive method used today to represent sound and music" (Williams & Webster, 2006, p. 77).

Portable, powerful digital software and hardware have become an affordable and accessible means for people to create and share musical ideas (Williams & Webster, 2006). At the same time, portable devices like the iPad and iPhone have transformed the music education landscape:

> The iPad itself inspires creativity and hands-on learning with features you won't find in any other educational tool and on a device that students really want to use (Kuzmich, 2012, p. 43).

Mobile technology has created new and imaginative ways for educators to facilitate learning (Heflin, Shewmaker, & Nguyen, 2017). Educators have an opportunity to develop philosophical approaches to the integration of technologies into teaching and learning (Southcott & Crawford, 2011). Crawford (2013) claims that technology is transforming teaching strategies in the 21st century:

> The recognised benefits of technology for the use of music education have resulted in collaborative projects and learning and teaching that is not constricted by walls or location. Music education can be accessible to all young people through a combination of social media, blogging and interactive creative musical activities to engage students in all locations, including rural and remote areas. In this 21st century classroom, music education includes online resources, digital learning, in-school workshops, online master classes and live concert streaming where a range of musical styles are explored (p. 717).

Music technologies help foster creative play and higher-order thinking in young children. Given that digital technologies are becoming increasingly more accessible, they are also influencing students' engagement in areas such as instrumental music (Kraus, 2012) and developing ongoing understandings through creative work where "Learning can occur anytime, anywhere" (Merrick, 2011, p. 17). Williams and Webster (2006) examine the types of educational approaches that include technology to support learning. These are presented in Table 2.

Table 2: *Types of Educational Software*

Software Applications	Examples
Drill and practice	MiBAC Music lessons, Piano Suite
Flexible practice	MacGAMUT, Practica Musica
Guided instruction	Music Ace, eMedia Guitar Method
Game-based	Musicus, Pianist Performance
Exploratory/creative	Band-in-box, Super Duper Music Looper
Teacher resource	Sibelius Notes, Sibelius Instruments
Internet-based	Arts Edge, New York Philharmonic Kidzone

The interactive nature of tablets like the iPad has increased the level of engagement and learning experiences for students with looping technology such as *GarageBand* (Apple, 2017a; Kuzmich, 2012). Kuzmich (2012) states:

> The iPad environment can offer distinct, dynamic, and interactive instruction that students will enthusiastically embrace. As music educators, we need to embrace technology and understand how to utilize these new tools to inspire our 21st century students (p. 46).

GarageBand is a looping technology that can be used for performing solo or with other instruments, improvising melodies and rhythms, composing and arranging music, recording voices and acoustic sound sources, and storing or sharing audio files (Apple, 2017a; Kuzmich, 2012; Williams & Webster, 2006).

3.4 Looping Technology

Looping software is a tool for creative music making and can be used as a constructivist tool for "learning with" or "learning through" technologies (Stewart et al., 2010, p. 10). Looping technology software allows users to cut and paste patterns of sound along a timeline to create a digital sound file. Using patterns of sounds to create musical works is not a new concept. In popular music, digital loops are a modern version of an ostinato, a term for repeated patterns within music. Repeated patterns are a valuable pedagogical strategy for developing improvisational skills and are often used in percussion-related activities (Mills, 1998). Looping technology is one example of a technology that is forever evolving to support the creative learning process:

> As technology evolves, applications become more flexible in terms of being able to create and share files using touch screen devices such as Smartphones and iPads (for example, Apple's *GarageBand* app creates files that can be directly opened in Logic Pro). These capabilities, in addition to easy file sharing, can facilitate spontaneous learning, creativity and collaboration (Kardos, 2012, p. 151).

For the purpose of this study, the term *loops* is used to describe repeated patterns of sound, whether generated acoustically or digitally. Many examples of loops can be found on YouTube and in modern pop songs. A Kevin Heinz vocal loop is one such example, where vocal loops can be created by an individual, one at a time, and layered on top of each other to create a vocal ensemble of sounds. This can be viewed at: https://www.youtube.com/watch?v=TuyldwUQj6Y (Heinz, 2008). Loops have been used for many years in the popular music recording industry. For example, the track *Money* by Pink Floyd (1970) commences with a recorded loop of a cash register, which sets the backing beat and rhythm for the song. The looping of the haunting voice calling "number 9" from *Revolution 9* (Beatles, 1968) is yet another widely recognised example of the use of recorded sounds to create a loop, albeit using analogue technology. Today, loops are often digitised and stored in digital libraries, many of which are free to download. In addition, many digitised loops are free from royalty fees. Digital loops are often created by professional musicians and of very high audio quality. Modern dance tracks are created by cutting and pasting loops along a timeline interface involving banks of sounds. Figure 3 illustrates the interface from *Acid Studio*, where banks of digital loops can be imported and recorded by pressing a record button. These loops can then be further edited by cutting and pasting and/or mixing by increasing or reducing volume controls.

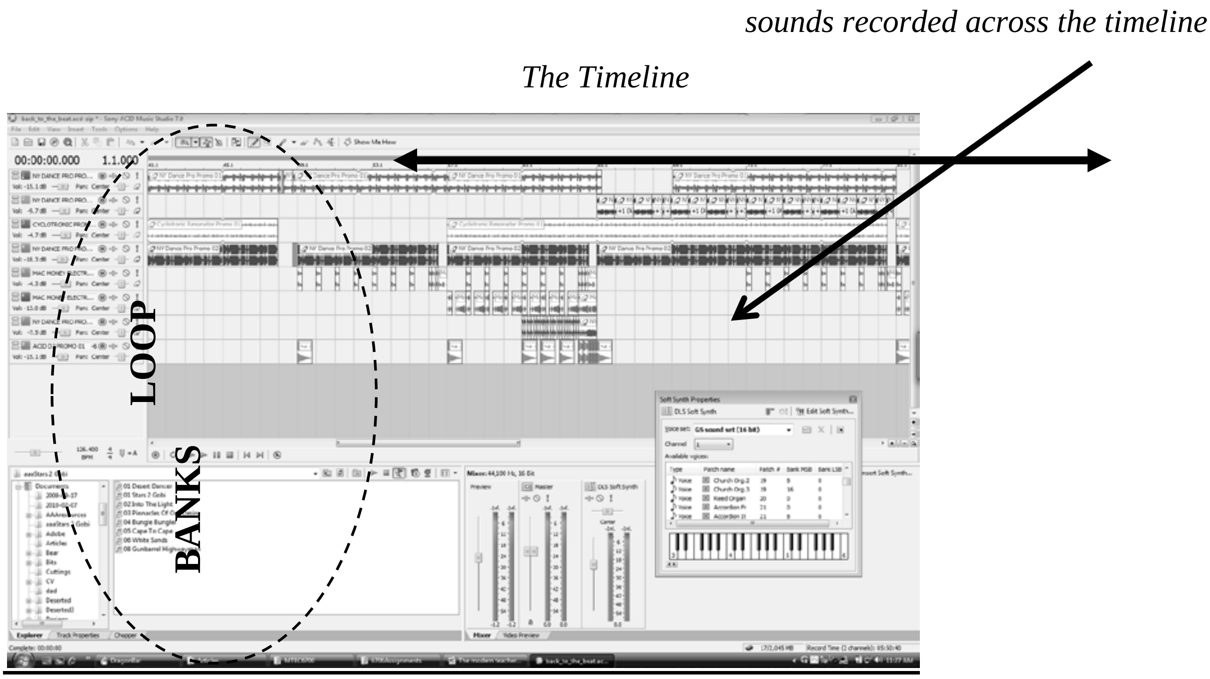

Figure 3: Sony Acid Music Studio (2010): Pasted Loops across a Timeline

This approach to composition has been stigmatised in music, especially the creation of "muzak – the derogatory name for recorded light music often played in the background in public places such as airports and shops" (Oxford University Press, 2018b, p. 476). However, Williams and Webster (2006) see it more as an opportunity for people to be artistic and creative with music and sound, observing:

> As researchers, educators, and musicians, we saw the role of music technology as a major force in teaching the technical aspects of music and, perhaps more importantly, encouraging the creative experience of music composition, improvisation, performance, and music listening (p. xxiii).

Popular looping software, previously called the *Super Duper Music Looper* and now known as *Jam Trax* (Sony, 2010) is simple to use and contains a user-friendly interface and uncluttered "cut-and-paste" panel. The sounds are professional and satisfying to the ear (Holzberg, 2002; Williams & Webster, 2006). A more advanced package is *Acid Music Studio 8* (Sony, 2010) shown in the screenshot in Figure 3. Numerous other looping software packages are available, with varying levels of complexity, functionality and cost. For young children there are simple looping programs such as *Flexi Kids Composer* (FlexiMusic, 2010) and the *Groovy* series by Sibelius (Avid, 2010). Sample timelines designed for children are illustrated in Figures 4 and 5.

Figure 4: Traditional Timeline Format in Flexi Kids by Sibelius

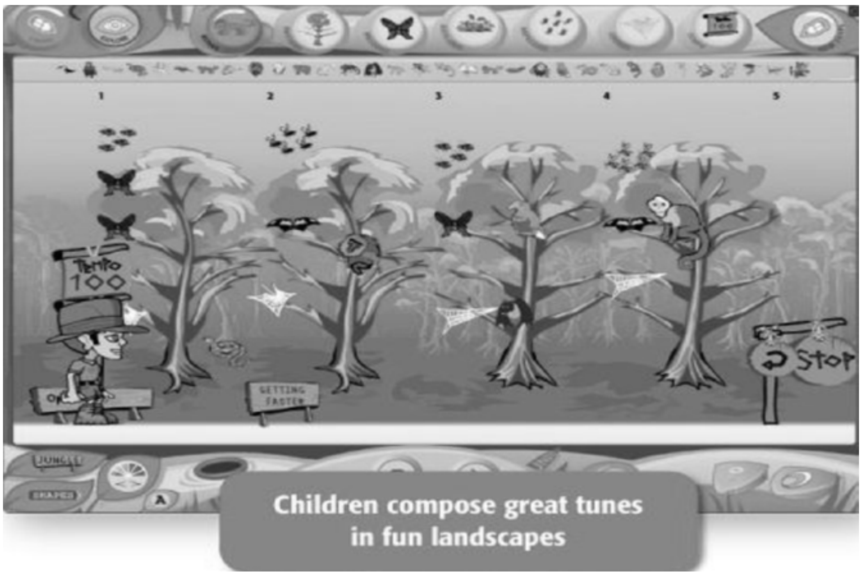

Figure 5: Animated Timeline Format in Groovy by Sibelius

More advanced and some less user-friendly products include *Fruity Loops* (now known as *FL Studio (*ImageLine, 2012*)* and *ReCycle (*PropellorHead, 2010*).* Recent developments have seen looping products packaged as applications (apps) for the iPhone and iPad. Two examples of these are *Looptastic* and *Studio HD* by Sound Trends (2014). *Looptastic* is illustrated in Figure 6.

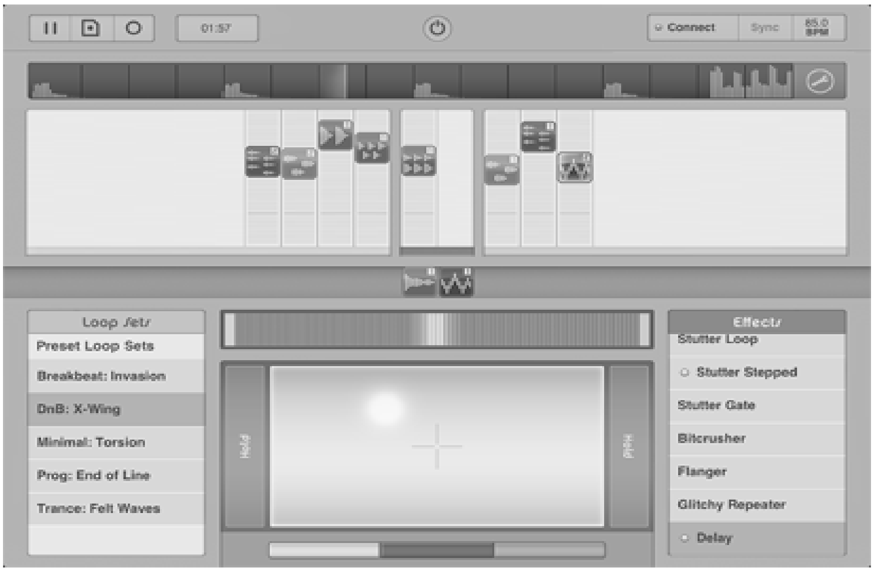

Figure 6: Interactive Timeline in Real Time used in Looptastic by Sound Trends

Microsoft Windows products include *Music Maker* by Magix and *Loop Studio* by Microsoft (Benassi, 2018; Magix, 2018; Microsoft, 2018). Software examples such as *GarageBand* (Apple, 2017a), presented in Figure 7, has also reinvented itself for the iPad with inviting pathways for students to create and compose original loops.

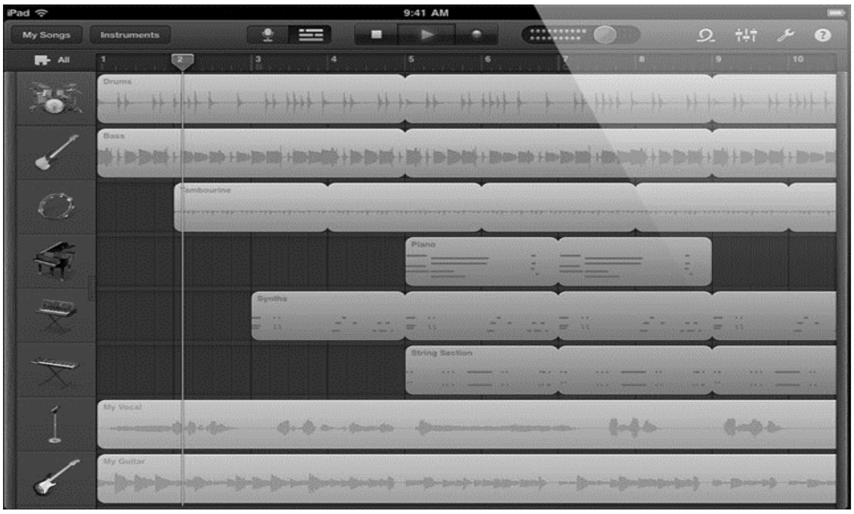

Figure 7: Traditional Timeline in GarageBand by Apple

Importantly, *GarageBand* is described as an open platform suitable for all levels of musical expertise (Gouzouasis, 2005):

> On the other hand, music technologies seem to be pushing the traditional boundaries and challenging our notions of what constitutes music composition as well as notions of the abilities and skills humans need to learn to compose and perform music. One such example may be found in the recently released software called *GarageBand* (Apple, 2003). *GarageBand* is touted as the panacea for the musically and non-musically inclined person who wants to compose music (p. 4).

Looping software like *GarageBand* (Apple, 2017a) allows users, at the simplest level, to explore and create sounds on a variety of virtual instruments including drums, keyboards and guitars. In this way, simple rhythms can be played on the iPad (Apple, 2017b) as a multi-faceted musical instrument in ensemble situations. At a higher level, these simple rhythms can be recorded in real-time, and then cut and pasted along a timeline for storage and further manipulation. Other instruments can be layered to build up a complex digital composition. *GarageBand* also has the capacity to record voices and sample sounds, and even functions as an amplifier when a guitar is plugged into the iPad. It is an inexpensive, creative and interactive App for iPads, and given that iPads are readily accessible in schools, can easily be employed to support music learning in primary school (Kuzmich, 2012). One teacher participant in this study informed the researcher that the principal of her school had purchased a set of iPads with *GarageBand* installed, specifically for use in the music classroom (Weldon personal communication, 2012).

3.5 GarageBand and the Australian Curriculum

Technology in music education is not a universal panacea and requires a clear pedagogical framework to harness its potential as a learning tool (Gouzouasis, 2005). Williams and Webster (2006) discuss how music technologies supported learning within the American National Curriculum. Table 3 has been adapted from Williams and Webster (2006) and presents the technologies used, software examples, the learning experiences identified by the authors and their link to the National Standards:

Table 3: *Technologies Supporting Learning.* Adapted from Williams and Webster (2006, p. 443)

Music Technology	Learning Experiences	Software Examples	National Standard (USA)
Internet	Browsing web for music. Interacting with friends about music.	Internet browsers.	6. Listening to, analysing and describing music. 7. Evaluating music and music performances. 8. Understanding relationships among music, other arts, and disciplines outside the arts. 9. Understanding music in relation to history and culture.
Capturing, editing and storing digital audio	Downloading MP3 files from the internet. Producing and editing digital audio for storing and sharing.	*iTunes, QuickTime, Audacity, Sound Forge.*	5. Listening to, analysing and describing music. 6. Evaluating music and music performances.
Multiple tracks and channels of digital audio	Recording and producing music for a school band, orchestra or choir. Creating a dance loop for the school prom.	*Audition, ACID Studio, GarageBand, Toast.*	1. Singing alone and with others, a varied repertoire of music. 2. Performing on instruments, alone and with others, a varied repertoire of music.
MIDI Sequencing and digital audio	Forming a MIDI group and recording music. Combining MIDI and audio tracks for a personal web page.	*Logic, Cubase, Protools, Home Studio*	1. Singing alone and with others, a varied repertoire of music. 2. Performing on instruments, alone and with others, a varied repertoire of music.
Sound Shaping and Synthesis	Designing music for a play or a dance. Producing digital-movie music for an integrated arts activity.	*SONAR, Reason, Digital Performer*	8. Understanding relationships among music, other arts, and disciplines outside the arts.
Music Notation	Creating musical scores. Arranging parts for a group.	*PrintMusic, Finale, Sibelius*	4. Composing and arranging music with specified guidelines. 5. Reading and notating music.
Computer-Aided Instruction	Learning to sight-sing melodies. Learning to play with accompaniment. Learning to improvise and compose. Learning to listen.	*Practica music, SmartMusic, Band-in-a-Box, Making Music, Hearing Music.*	1. Singing alone and with others, a varied repertoire of music. 2. Performing on instruments, alone and with others, a varied repertoire of music. 3. Improvising melodies, variations, and accompaniments. 4. Composing and arranging music with specified guidelines. 6. Listening to, analysing and describing music.

In similar ways, a looping technology, such as *GarageBand*, can support learning within the Australian Curriculum. For example, the content descriptors in the National Curriculum for the primary middle Years 3 and 4 prescribe the following:

1. Develop aural skills by exploring, imitating and recognising elements of music including dynamics, pitch and rhythm patterns;

2. Practise singing, playing instruments and improvising music, using elements of music including rhythm, pitch, dynamics and form in a range of pieces, including in music from the local community;

3. Create, perform and record compositions by selecting and organising sounds, silence, tempo and volume; and

4. Identify intended purposes and meanings as they listen to music using the elements of music to make comparisons, starting with Australian music, including music of Aboriginal and Torres Strait Islander Peoples (ACARA, 2016).

GarageBand can support learning of the elements described in the first and second of these content descriptors. For example, students can use the bass drum to learn how to perform and keep a steady beat loop on the drum kit, as illustrated in Figure 8.

Figure 8: GarageBand Interactive Drum Kit

By using other drums and cymbals on the drum kit, students can add rhythms over this beat by recording themselves playing with or without an inbuilt metronome. They can also play along with others using the Jam Session link to connect with other iPad users. Students can learn to play or improvise and create simple melodies using keyboards, guitars, strings and other interactive instruments, such as the piano interface, illustrated in Figure 9. These can also be recorded and played over beats and rhythms.

Figure 9: GarageBand Interactive Piano

The interactive nature of *GarageBand* responds to the expressiveness with which notes are played, allowing students to use loud and soft dynamics in their performances, improvisations and compositions. *GarageBand* can record live sounds, such as vocals or other sound sources using the *GarageBand* microphone – these can also be added to a recorded loop mix along with other sound effects.

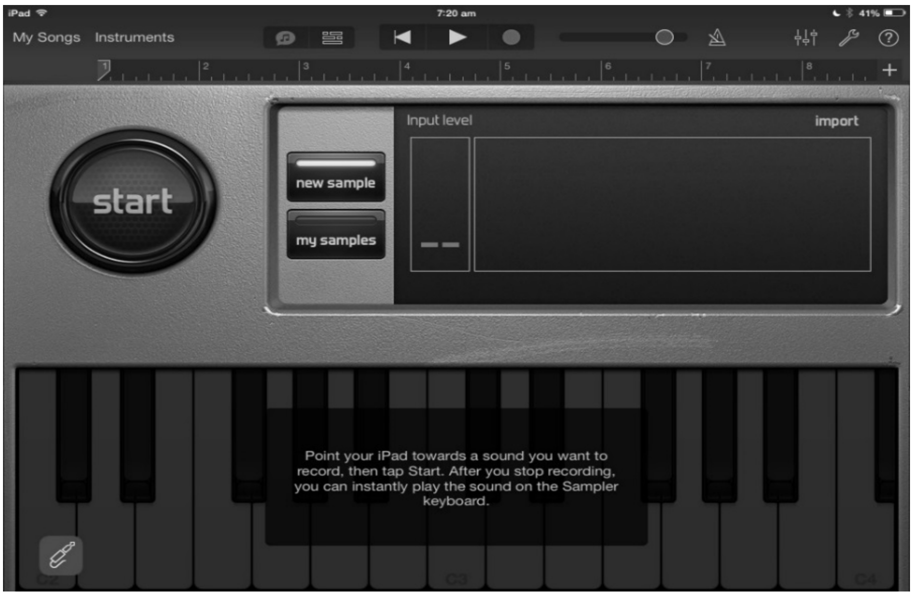

Figure 10: GarageBand Interactive Sampler

For example, the Sampler, a device for capturing real or natural sounds, allows the user to capture a single sound source and use the keyboard to play or improvise simple melodies using the sound source captured, as illustrated in Figure 10. These samples can also be stored as sound files for later use.

GarageBand supports the third content descriptor, whereby students create, perform and record compositions by selecting various sound sources within *GarageBand*. In addition, it can be used to record natural sound sources, which can then be organised and manipulated along with sourced material. Tempo and volume can be adjusted within the timeline interface, as illustrated in Figure 11.

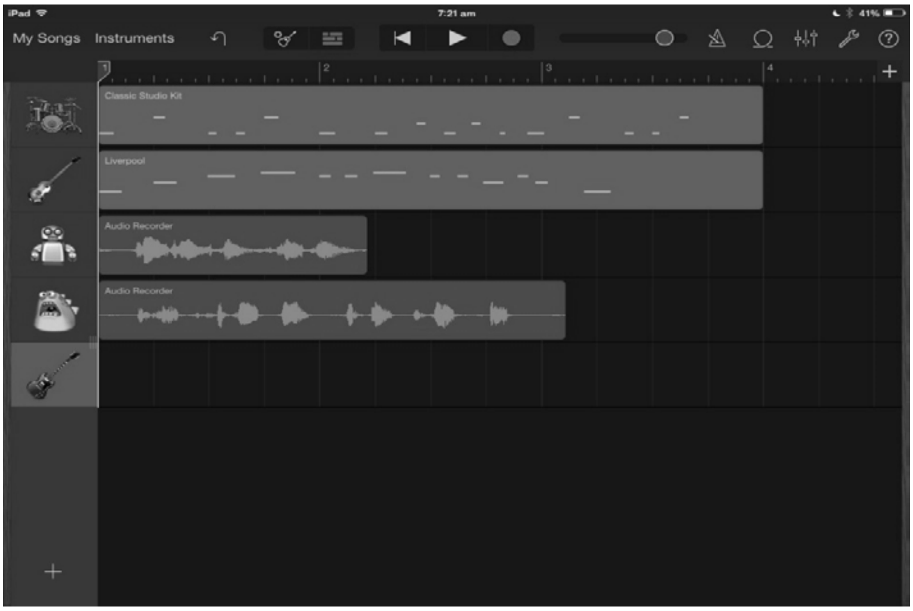

Figure 11: GarageBand Timeline Interface

These compositions can be stored and shared across networks and the internet as compressed mp3 files or uncompressed wav files. In a range of ways *GarageBand* can be employed as a resource to support learning as described in the sample Year 3 and 4 Achievement Standards (ACARA, 2018b):

> By the end of Year 4, students describe and discuss similarities and differences between music they listen to, compose and perform. They discuss how they and others use the elements of music in performance and composition. Students collaborate to improvise, compose and arrange sound, silence, tempo and volume in music that communicates ideas. They demonstrate aural skills by singing and playing instruments with accurate pitch, rhythm and expression.

Furthermore, incorporating applications such as *GarageBand* into music teaching, enhances students' life-long technological skills (Leong, 2012):

> As more emphasis is given to creativity and the arts, music education practices need to devote more attention to developing learners' digital literacies, analytical and critical thinking, and the other twenty-first-century skills with reference to the realities of the cultural and creative industries (p. 240).

3.6 Technology and the Self-Efficacy of Pre-Service Teachers

Technology continues to transform educational systems as the information age is ushered in, bringing with it an increased demand for self-directed learning and where new realities in times of technological and social change place more demands on an ability to organise, create and manage circumstances that affect one's life (Bandura, 1997b). Today there is an expectation for teachers to use technology and facilitate new ways of learning in order to prepare students for life in the 21st century (Uer et al., 2017). Bandura (1997b) argued that pre-service teachers need to possess three skills to gain appropriate knowledge and skills: 1) intellectual tools; 2) efficacy beliefs; and 3) intrinsic interests to continue lifelong learning and be better teachers throughout their lifetime. These are elaborated below:

1) Pre-service teachers require ever-evolving intellectual tools to succeed in their chosen career (Uer et al., 2017). As a cognitive tool, "learning with" technology is advanced, and as a digital tool, technology engages and facilitates complex cognitive processing (Stewart et al., 2010, p. 10). The tools are learner controlled in the sense that users construct their knowledge themselves (Stewart et al., 2010)

2) Efficacy beliefs make an important contribution to the academic development of pre-service teachers, because they include self-beliefs to regulate their own learning, master difficult subjects, and therefore beliefs in their ability to promote learning in their students (Bandura, 1997b). Technology makes access to information and instruction easy and immediate; and offers opportunities for learning that is self-paced, individualised and transcends time and place, thereby empowering pre-service teachers with greater control over their own learning outcomes. In turn, this will improve pre-service teachers' self-efficacy to succeed (Bandura, 1997a).

3) The Oxford dictionary defines "intrinsic" as "belonging naturally; essential. Access to the arts is intrinsic to a high quality of life" (Oxford University Press, 2018b, p. 382).

> Music supports and develops cultural and social understandings (Lowe et al., 2017) and is an expressive medium that transcends language barriers. In a similar way, technology is not necessarily language specific and has expressive use in many cultures (Acker et al., 2015). Young people especially identify with and engage socially through technology (Walters & Kop, 2009) in a modern global landscape where technological and cultural understandings are an important aspect of life (Lowe et al., 2017). Music technology has the potential to engage teachers in lifelong learning and become well equipped to provide a rich learning environment for their students: "The child of today will learn about and learn from these ubiquitous technologies, whether or not teachers use them. They can be an essential aspect of a rich educational environment, if and only if a human teacher embraces them into a humanistic and constructivist vision of early childhood education" (Clements and Nastasi (1993), as quoted in Webster (2016b, p. 74).

Technological skills, pedagogical understandings and self-beliefs, along with innovation and professional learning are important competencies for successful teaching with technology (Uer et al., 2017). Multimedia digital resources enable teachers to create exciting learning environments for their students (Bandura, 1997a), and as such, digital technology can be an important tool for developing pre-service teachers' self-beliefs in their ability to provide opportunities for students to express themselves musically (Acker et al., 2015; Bandura, 1997a, 1997b).

3.7 Conclusion

Technology has given rise to challenges and opportunities in an ever-changing educational landscape:

> With the tools we have today, all forms of music can be both related to and relative to what children and adolescents are able to learn and compose on their own, but will we take the challenge? Moreover, if we do not turn the attentions of our profession to what is happening in the broad landscape of educational technology/technology education, we will lose yet another opportunity to demonstrate the empirical, praxial values (i.e., performatively, economically, and qualitatively) of music, and all the arts, in general education. (Gouzouasis, 2005, p. 15).

Digital technologies are transforming practice, particularly in supporting creative play and higher-order thinking (Acker et al., 2015). Tertiary students readily embrace new technologies (Zhukov, 2015) and future teachers will increasingly play an important role in integrating technologies into their classroom practice (Uer et al., 2017). A looping technology, such as *GarageBand*, is an engaging and motivational resource for students (Kuzmich, 2012) and as such could be a valuable source of confidence for generalist teachers to teach music in their classrooms, since it offers self-paced and individualised learning, is accessible and engaging, and potentially improves pre-service teachers' self-beliefs to succeed (Bandura, 1997b; Webster, 2016b; Williams & Webster, 2006). The extent to which a looping technology may influence pre-service teachers' self-efficacy to teach music is the focus of this study and is discussed in further detail in chapter four.

Chapter Four: Research Methodology

Part One: Method of Inquiry

4.1 Introduction

Chapter four describes the research approach in this study of human behaviour as it seeks to take advantage of the strengths of both quantitative and qualitative methods of inquiry (mixed methodology) within the context of social environments. While recognising the tensions between quantitative and qualitative arguments, the current study utilises the strengths of both research paradigms (Johnson & Onwuegbuzie, 2004); and the research questions dictates the methodological approach (Newman & Hitchcock, 2011). Part one describes the research considerations, methods and design, while part two introduces the participants, research settings and research instruments, and describes the data management and analysis.

4.2 Background

The Oxford Dictionary (2018b) defines research as "study of materials and sources in order to establish facts and reach new conclusions" (p. 616). In his Dictionary of Qualitative Research, Schwandt (2007) proposes thinking beyond answering a question, and of research as an "argument connecting theoretical claims, method and empirical claims derived from evidence" (p. 265). Drew, Hardman and Hart (1996) describe research as "a systematic method of inquiry" (p. 2); while Whittemore and Melkus (2008) chart the five main phases of the research process as conceptual, design, empirical, analytical and dissemination.

The conceptual focus of this study is based on human activity in a social situation, that is, testing pre-service teachers' self-efficacy levels in tutorial settings in university, and later, in primary school classrooms. Within the context of the research questions, the participants and their situations influenced the research methodology (Whittemore & Melkus, 2008), and accordingly, quantitative and qualitative data collection methods are deemed appropriate for this study. Castellan (2010) discusses the different philosophical perspectives of quantitative and qualitative research in the context of positivist and post-positivist ideals. Philosophical perspectives imply an interrelationship that impacts on the research design (Schwandt, 2007). Creswell (2014) also described philosophical worldviews (post-positivism, constructivism, transformative and pragmatic) as influencing and interrelating with research designs (quantitative and/or qualitative) and research methods (questions, data collection, data analysis, interpretation and validation). This interrelationship is shown in Figure 12.

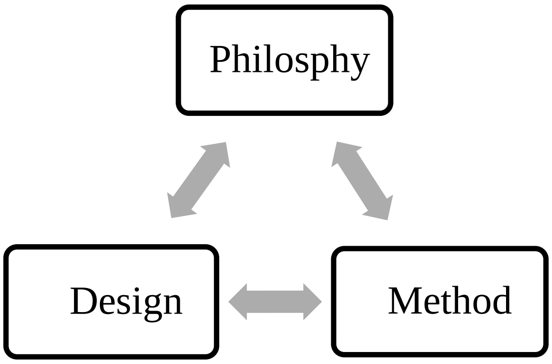

Figure 12: Interrelationships of Research Framework

As a result of this interplay, there is a need to identify philosophical views that will influence the design and method of research (Creswell, 2014).

4.3 Philosophy

4.3.1 Ontological Considerations

Ontology is defined as “a philosophy dealing with the nature of being” (Oxford University Press, 2018b, p. 501). Ontological enquiry is concerned with assumptions about existence and/or different ways entities and their categories may be understood to exist (Harvey, 2016). Assumptions about existence can lead towards the ‘conceptualisation’ of such existences of entities (Hoekstra, 2009). Therefore, in order to share knowledge ‘conceptualisations’ need to be specified in an agreed vocabulary; and the Oxford Dictionary proceeds to define “conceptualise” as “forming an idea of something in the mind” (Oxford University Press, 2018b, p. 143). Hoekstra (2009) also articulates the need for a common understanding of the vocabulary in order to understand an idea of something, describing ontology as a necessary step in the design of a system that can help in the acquisition of new knowledge by “providing a conceptual coat rack to which new knowledge can be added” (p. 71). He claimes ontology is a term “used in the context of the analysis of the fundamental building blocks of reality”, elaborating:

> Instead of specifying a vocabulary, ontology tries to pinpoint the vocabulary used to describe the world; it usually adopts realism, i.e. the belief that reality exists independently of human observers (p. 76).

Reality has a number of definitions in the Oxford Dictionary (2018b) including “the state of things as they actually exist, as opposed to an idealistic or notional idea of them and philosophical existence that is absolute, self-sufficient, or objective, and not subject to human decisions or conventions” (p. 601). The idea that existence is objective and independent of human interactions implies a positivist philosophical perspective, a position that if adopted will affect the methodology of the study.

4.3.2 Positivism (Objective Reality)

Positivism is not easily definable, however, the underlying premise is to present an objective view of the world (Punch, 2005). One way of conceiving representations of the world is from experiences and thoughts, forming various and differing perspectives on a single objective reality. Objectivity is associated with the concept of unbiased research (Given, 2008), based on discovering facts without making any judgements (value freedom), as noted by Lincoln and Guba (1984). Oxford Living Dictionaries (Oxford University Press, 2018a) describe value judgements as “an assessment of something as good or bad in terms of one's standards or priorities” (Value judgement: Noun, para.1), suggesting the researcher must be an independent and objective observer of phenomena. Lincoln and Guba (1984) describe five assumptions of positivist research:

1. A single and tangible reality able to be broken down into smaller parts;
2. Separation of the observer from the observed;
3. Temporal and contextual independence of observations (what is true in one place can be true in another);
4. Linear causality (cause and effect); and
5. Value freedom (no bias)   (p.28).

According to Schwandt (2007), positivism is the application of scientific method to the study of human action. The notion that a human researcher has no effect on what is being observed is questionable; and human interaction of a researcher within social settings may be difficult to avoid. Quantitative research identifies with positivism, whereby researchers are concerned with a single objective reality (Castellan, 2010, p. 4).

Quantification is the expression of something as a quantity or amount in terms of numerical data (Schwandt, 2007). In quantitative studies, numerical data can be collected via experimental and non-experimental modes (Castellan, 2010). The ontological basis of experimental research is that the world is independent of humans, and humans learn about the world utilising scientific methods (Duffy & Chenail, 2008).

Researchers tend to use numerical data for identifying differences between groups (for example control and experimental, or pre- and post- surveys) (Drew et al., 1996). Conversely, data reduced purely to numbers makes no reference to words and feelings and may be too simplistic and therefore difficult to understand or interpret (Drew et al., 1996). An advantage of the positivist approach is the ability to control and minimise extraneous factors and more accurately establish causality (Drew et al., 1996, p. 35), while a disadvantage may be having to use an artificial environment (as in a laboratory) (Drew et al., 1996), divorced from the very reality it is investigating. In this regard, this study of pre-service teachers in an educational social setting, placing them in an artificial environment such as a laboratory is not a practical solution.

4.3.3 Positivism to Constructivism

Positivists argue that metaphysical statements based on philosophical perspectives of reality cannot be judged as true or false, and are therefore of no consequence for increasing scientific knowledge of the world (Schwandt, 2007). While positivists believe that truth is discoverable (Drew et al., 1996, p. 21), Thomas (2008), in his exposition of philosophies, states there could be different viewpoints of a single independent reality:

> Each of us, as an agent or thinker, moves through or thinks about a real world that is independent of our will and our thought. One natural way to conceive of what we are doing is to conceive of our representations of the world, in our experience and thinking, as various different perspectives on a single objective reality (p. 2).

Lincoln and Guba (1984) describe reality as a difficult concept to understand, and identify four types of realities: 1) objective reality; 2) perceived reality; 3) constructed reality; and 4) created reality. These authors argue that the nature of reality is that “it doesn’t exist until either it is constructed by an actor or it is created by a participant” (1984, p. 87).

Finn (1997, p. 9) explores the notion of “truth” as fact in contrast to reality, especially in relation to social realism. He asserts the notion of reality is a result of human interaction (1997, p. 1). As groups of people observe and modify their actions, they form social structures and institutions, which Finn (1997) describes as social reality, and argue that social facts are those which we have taught ourselves to believe. For example, words have constructed meaning because they are developed through the intellectual activity of understanding, explanation and classification; that is, words describe reality. Finn (1997) defines social construction of reality as a collective construction of facts. Therefore, since they are collective, “they are facts about the plurality of human individuals and their mutual relationships” (p. 101). In the words of Schwandt (2007): “we do not construct our interpretations in isolation, but rather, against a backdrop of shared understandings, practices, language and so forth” (p. 36). Castellan (2010, p. 4) describes social reality as “constructed by the participants in it”. Researchers using this paradigm are more likely to observe, analyse and describe what exists rather than manipulating a variable under study (Drew et al., 1996).

The implications for research methods, as outlined by Lincoln and Guba (1984), involves factors such as: natural setting, human instrument, utilisation of tacit knowledge and qualitative methods (p. 39) amongst others. Lincoln and Guba’s (1984) description of the contrast between naturalist and positivist paradigms are shown in Table 4.

Table 4: *Comparison between Positivist and Naturalist Paradigms (From Lincoln and Guba (1984)*.

	Positivist	Naturalist
Reality	Reality is single and fragmentable	Realities are constructed
Relationship	Inquirer and object of inquiry are independent of each other	Inquirer and object of inquiry are inseparable
Generalization	Time and context free	Time and context bound
Causality	Cause and effect can be distinguished	Cause and effect cannot be distinguished
Values	Inquiry is value free	Inquiry is value bound

Cresswell (2014) describes post positivism as a position that recognises research cannot represent absolute truth; that is, be positive about knowledge involving the study of behaviour and actions of people:

> The knowledge that develops through a post positivist lens is based on careful observation and measurement of the objective reality that exists “out there” in the world (p. 8).

Post positivism embodies contrasting theoretical positions. Finn (1997) describes two broad positions: extreme and moderate. He clarifies the extreme view as science constructivist, concerned with construction of natural fact; as opposed to the moderate view, concerned with the social construction of social fact (p. 13). Extreme constructivist social research is undertaken from the viewpoint of "interpreting social phenomena from the perspective of the actor" (Rossman & Wilson, 1985, p. 630), that is, from the cognitive viewpoint of the individual knower. It is based on the hypothesis that reality exists regardless of the knower's experiences (Schwandt, 2007). By contrast, the social constructivist has a strong focus on social process and interaction (Schwandt, 2007).

Research on human action (and interaction) poses the problem of generalisation or translation of understandings to other social settings (Miles & Huberman, 1984), particularly due to the influence of time, place and participants in constructing realities and that knowledge in one situation can be generalised for an understanding of another similar setting or reality. However, Lincoln and Guba (1984) argue that there are differences in contexts from one situation to another, and even one situation changes contexts over time. They propose the answer to transferability from one situation to another is related to fittingness:

> …the degree of transferability is a direct function of the similarity between the two contexts, what we shall call "fittingness". Fittingness is defined as the degree of congruence between sending and receiving contexts. If Context A and Context B are "sufficiently" congruent, then working hypotheses from the sending originating context may be applicable in the receiving context (p. 124).

To achieve fittingness, Lincoln and Guba (1984) recommend (p. 37) the inquirer give the reader "descriptors" to put any findings into context and build understandings of how the world people live in can be built upon or constructed (Creswell, 2014). Humans construct understanding of the world with which they engage through meanings and knowledge based on their historical and social perspectives (Crotty, 1998). This constructed meaning is social in nature, and involves human interactions with their community (Crotty, 1998). For example, in this study pre-service teachers interact with their tutor, each other and later on with schoolchildren in a school setting.

4.3.4 Constructivism to Pragmatism

The idea that there may not be certainty about the nature of the world, and other interpretations exist to explain phenomena is a form of realism (Wright, 2011). Critical realists define social reality as based on human interactions, conditioned by social structures

(Cruickshank, 2009), raising the question whether social research should be conducted in the same way as scientific study of the physical world? Critical reality draws a distinction between the duality of knowledge of changing things (transitive) and unchanging things (intransitive) (Centre for Critical Realism, n.d.). In other words, what holds true for one situation may or may not be true for another. Punch (2005) asks: "under what conditions (settings, treatments, experimenters, dependent variables, etc.) can the same results be expected?" (p. 258). John Dewey (1859-1952), as stated in Schwandt (2007), made the claim that "truth of assertions is determined by whether they function well in making our way in understanding the world" (p. 266). Cresswell (2013) discusses a pragmatic view of truth as something that works at the time and expands a pragmatist's position:

- Pragmatists have the freedom to choose methods that meet the needs of their research and are not committed to one philosophical or worldview position;
- Individual researchers are free to choose methods that best meet the needs of their research;
- They do not see the world as an absolute unity;
- Their research occurs in social, historic, political and other contexts; and
- Pragmatists believe in a world within and outside the mind. (p.28)

A pragmatic position suggests the research question itself can lead to different choices of methodologies, as Scott (2016) states:

> In the exploration of the approaches to research and the different paradigms offered, it can be argued that there is no single methodology that is superior to any other methodology in every case. Different research questions lend themselves to different methodologies (p. 4).

With the research question as the central focus, Scott (2016) proposes data collection and data analysis can be conducted without adhering to one particular philosophical outlook. It is possible to adopt a mixed method mode as an appropriate approach to a research question (Creswell, 2014). Scott (2016) articulates:

> I contend that those rich philosophical problems offered in construction can be addressed through a pragmatic orientated lens that will bring a sense of realism to the improvement of practice and hence the profession (p. 8).

It is evident that pragmatic approaches have their advantages, and research questions, settings and other influences guide the research method (Drew et al., 1996). Table 5 summarises Cresswell's (2014) three world views.

Table 5: *Summary of Post Positivist, Constructivist and Pragmatist World Views*

Post Positivism	Constructivism	Pragmatism
Determination Reductionism Empirical observation and measurement Theory verification	Understanding Multiple participant meanings Social and historical construction Theory generation	Consequence of actions Problem-centred Pluralistic Real-world practice oriented.

4.3.5 Implications of the Research Questions, Participants and the Environment

According to Punch (2005): "to choose the pragmatic approach is to start by focusing on what we are trying to find out in the research and then to fit methods in with that" (p. 3). In the current study of human interactions within a social setting, the first research question suggested a true or false outcome, that is, technology either has a positive effect on the self-efficacy levels of pre-service teachers or not. To answer this question, numerical data were obtained from a survey and analysed statistically using a quantitative approach to data collection (Allen & Bennett, 2008). By contrast, the second research question implied investigation of human interactions within a social setting (Schwandt, 2007), in this case, pre-service teachers' work with primary school children in a classroom. This dictated a more constructivist approach and collection of qualitative data. The next step was to combine these two approaches in the study's methodology.

4.4 Research Methods, Design and Stages of the Study

There are two general approaches to conducting educational research (Castellan, 2010). The positivist or quantitative research approach strives to investigate educational theories to objectively measure whether there is a significant improvement between current practice and any innovation or intervention (Schrag, 1992). It requires the researcher to remain separate and detached, in order to minimise any bias or possible interference (Duffy & Chenail, 2008). On the other hand, the post-positivist or qualitative research approach involves a more subjective approach, creating understandings based on the view that social reality is continuously constructed by its inhabitants (Castellan, 2010; Johnson & Onwuegbuzie, 2004). Castellan (2010) proposes three ways to reconcile these approaches:

1) Only quantitative *or* qualitative;

2) Either quantitative *or* qualitative; and,

3) *Both* quantitative *and* qualitative.

Onwuegbuzie and Leech (2005, p. 376) argue that the first perspective can be described as purist; the two methods being totally incompatible with one another. They describe the second as situationalist, whereby both approaches have equal importance but only one is utilised as dictated by the situation or the research question. Finally, the pragmatist integrates the two approaches. Examination of the two research questions and the situations in this study led the researcher choose the pragmatic approach:

> By utilizing quantitative and qualitative techniques within the same framework, pragmatic researchers can incorporate the strengths of both methodologies (Onwuegbuzie & Leech, 2005, p. 385).

Therefore, the research approach taken for this study will be a pragmatic position where both quantitative and qualitative methodologies will be utilised in a mixed methodology design.

4.4.1 Research Methods

The objective of this study was to investigate the impact of technology in equipping pre-service teachers with the necessary skills to feel able to teach music in their classrooms. It was guided by two research questions:

1) What impact does a music looping technology intervention have upon pre-service generalist teachers' self-efficacy to teach music in primary schools compared with a traditional module of instruction?
2) In what ways does a music looping technology intervention impact pre-service generalist teachers' self-efficacy to teach music as evidenced during a practicum placement?

The first research question entailed a statistical study, partly due to the large number of participants, and mainly because it required testing (Newman & Hitchcock, 2011). In many cases, constructing numerical data instruments to collect data from large numbers of participants is relatively easy (e.g. questionnaires), and reliability and analysis can be undertaken quickly using statistical software (Allen & Bennett, 2008).

The units that pre-service teachers enrol in as part of their Bachelor of Education comprised naturally occurring groups of targeted participants and allowed for comparisons in a quasi-experimental design (Punch, 2005). In this case, pre- and post-test questionnaires were administered to a control group and experimental group, to determine the level of effect, if any, of a technology intervention on the experimental group. This was possible because there were two distinct groups on two different campuses studying the same module of music.

Quantitative researchers generally have the view that there is "no absolute certainty in social science research in the first place" (Henson, Hull, & Williams, 2010, p. 233). In this study there was an opportunity to minimise the influence of many variables (Johnson & Onwuegbuzie, 2004) by utilising a matched-pair tandem design (Randler, 2008). Participants comprised pre-service teachers enrolled in equivalent units, facilitated by the same tutor on two separate metropolitan campuses. A significant degree of fittingness was achieved, since the experimental and control groups were taught by the same tutor, received the same content in the same manner and in similar tutorial environments. Pre- and post- questionnaires enabled the collection of empirical data from over a hundred participants. In this way, variations in variables that may influence the data, such as content, delivery, environment and tutor, were reduced. The research design in relation to the first research question is presented in Table 6.

Table 6: *Pre- and Post-Test Control Group Design*

Group A	O ----------------------------X-----------------------------------O
Group B	O ---O

O	Pre/post testing at the start and end of participant's study period
X	Intervention

The first research question attempted to measure participants' self-beliefs in imagined future teaching scenarios, while the second question attempted to assess improvements, if any, in generalist pre-service teachers' self-beliefs in an actual practicum setting. The second research question suggested a qualitative study, utilising the researcher's observations in the field and/or a participant survey immediately after the event or activity under investigation.

As the numbers to be studied were of a manageable size, qualitative research enabled understanding of the observed pre-service teachers' teaching experiences (Johnson & Onwuegbuzie, 2004).

Since the study investigated the extent to which the unit of study impacted on pre-service teachers' self-efficacy and whether this was evidenced in the field, data were only taken from the experimental group. The qualitative data were used to triangulate the findings of the earlier quantitative method (Castellan, 2010). Observation in the field was conducted via video capture of pre-service teachers in action (Derry et al., 2010). Observed behaviour was then triangulated with additional qualitative data from individual participants' responses to the surveys (Oliver-Hoyo & Allen, 2006). An examination of what was observed alongside pre-service teachers' reflections provided rich data and new insights (Newman & Hitchcock, 2011), and added depth to the study.

4.4.2 Research Stages

The study involved three stages of data collection:

1) A quasi-experimental pre- and post-test control group design based on pre-service teachers' participation in a unit of a music education course.
2) Observation and video capture of participants working in a practicum setting.
3) Participant's self-reflections.

The research stages are shown in Figure 13.

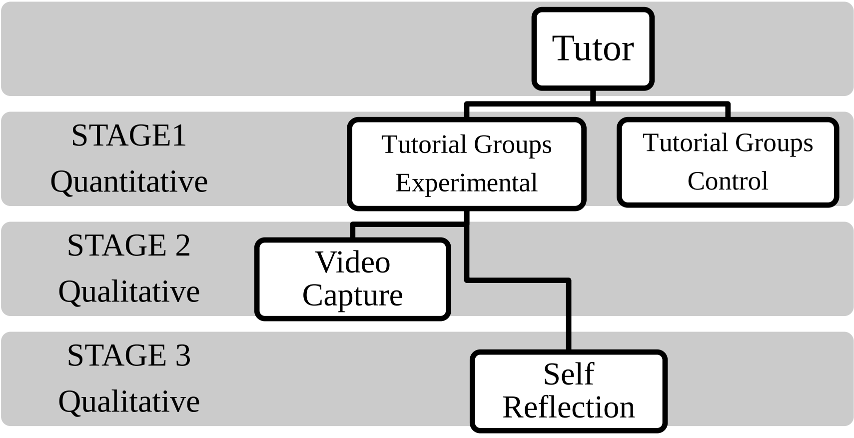

Figure 13: Three Stages of Data Collection

According to Terrell (2012), a mixed-method approach depends on four factors: 1) theoretical perspective; 2) priority of strategy; 3) sequence of data collection; and 4) integration of data. In this study, the theoretical perspective implied that a technology intervention could have a measurable impact on participants' self-efficacy beliefs. Data collection followed a clear sequence; participants' self–efficacy beliefs were measured before and after a unit of study, and data were subsequently collected from participants in the field. The pre-/post-test quantitative data collection was assigned priority as it was a precursor to examining any change in participants' behaviour in the field. While stage one measured levels of change in participants reported self-efficacy, stage two provides substance with support from observations of participants working in the field, and finally, participants' self-reflections. This mixed-method approach therefore a sequential strategy: stages one, two and three (Terrell, 2012, p. 265), respectively comprising a quantitative questionnaire, qualitative video capture in the field and participants' reflective surveys after completion in the field, as illustrated in Figure 14.

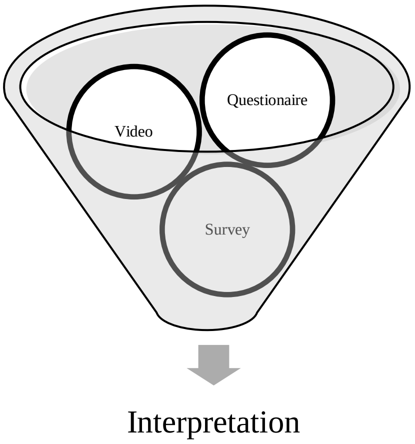

Figure 14: Data Collection and Triangulation

4.5 Overview of Research Instruments

4.5.1 Stage One: Questionnaire

In this quasi-experimental stage**,** pre-service teachers' self-efficacy beliefs were measured prior to and at the conclusion of a five-week module of music education. Stage one involved creating a suitable pre-/post-testing instrument to measure self-efficacy levels. Since no suitable all-purpose measuring tool existed, one had to be developed for measuring self–efficacy and music self-beliefs to answer the research questions in this study. Bandura's

(2006) *Guide for Constructing Self-Efficacy Scales* was used to develop a conceptual basis for the instrument, while Colton and Covert's (2007) book, *Designing and Constructing Instruments for Social Research and Evaluation* was used to construct an appropriate instrument to meet the needs of this study. The questionnaire was then piloted for validation (Creswell, 2014).

4.5.2 Stage Two: Video Analysis

Video analysis has emerged as a powerful tool for qualitative research, especially as it enables frame by frame examination of ongoing interaction in a social situation (Knoblauch & Schnettler, 2012). Sequential analysis of video footage can be useful because it enables the researcher to easily catch moment-by-moment social interaction. While video analysis is not new (Eriksson, 1982), technology has advanced and increased its speed and ease in education research (Flewitt, 2006). Multi-modal examination not only captures speech, but also facial expression, gestures, actions and other non-verbal interactions (Flewitt, 2006). Derry et al. (2010) claims that:

> Accessible video technologies provide researchers with powerful "microscopes" that greatly increase the interactional detail that can be obtained and permanently stored for comprehensive analysis and reanalysis by multiple investigators (p. 6).

Derry et al. (2010) talks about two approaches to video analysis; namely inductive and deductive. The inductive approach is based on Erikson's episode or whole-to-part analysis; while a deductive approach is employed with a research question in mind. In this study, deductive video analysis helped to find evidence of confidence and competence in multi-modal interactions between pre-service teachers and students (Flewitt, 2006).

4.5.3 Self-Reflection Survey

In this study, pre-service teachers' reflections on their practice provided triangulation for reaching appropriate and transferable conclusions. Video recordings in the field allowed for observations of speech, sounds, objects and actions, while meaning was enhanced by integrating conventional written notes to add depth to the data (Dicks, 2006). The researcher acknowledged participants' reflections would require some support or scaffolding (Benson, 1997), and the guidelines for the Harvard Graduate School of Education's *See Think Wonder* thinking routine (2013) proved to be a practical and effective thinking and documentation tool (Ritchhart, 2008). The framework offered flexibility, and in the context of this study, was simple and easy to understand with structured, sequential steps for pre-service teachers to follow (Lowe et al., 2013).

Both research questions in this study ultimately focused on the levels of pre-service teachers' self-efficacy to teach music. Triangulation was undertaken across the three data collection points, as illustrated in Figure 15.

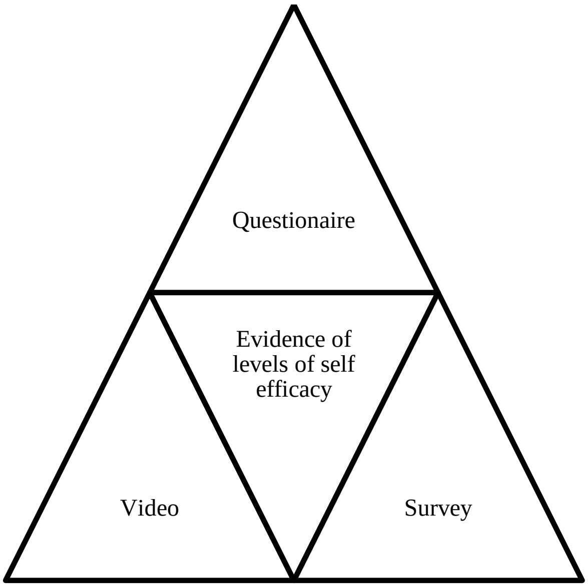

Figure 15: Mixed Method Interpretation Model

In summary, the three different forms of data collection were deemed appropriate for painting a full picture of the study by adding depth to the conclusions reached (Oliver-Hoyo & Allen, 2006). Part two places the methods of inquiry within the research setting and examines the data collection methods, participants and settings in more detail.

Part Two: Data Collection

4.6 Introduction

The overall objective of this study was to investigate the effectiveness of looping technology in equipping generalist primary pre-service teachers with the necessary skills and self-efficacy to teach music in their classrooms. Part one of this chapter described the research design and three research stages that imbued the data with breadth and depth. Part two described the research participants, research settings and research instruments, along with data collection and data analysis.

4.7 Stage One

Stage one of the research was guided by the following research question:

> What impact does a music looping technology intervention have upon pre-service generalist teachers' self-efficacy to teach music in primary schools compared with a traditional module of instruction?

4.7.1 Participants

Third year generalist Bachelor of Education (Primary) pre-service teachers from two campuses at Edith Cowan University in Perth Western Australia (Mount Lawley and Joondalup) were invited to participate in stage one. All participants were enrolled in the same music module in two separate arts units; AED3240 Arts in Education and AED3105 Arts as Learning. Forty-six pre-service teachers from the Mount Lawley AED3240 unit participated in this study, mainly comprised of females in the 20 to 25 years age range. Fifty pre-service teachers from the Joondalup unit AED3105, comprised of mainly females in the 20 to 25 year age range, also participated in stage one.

4.7.2 Research Setting

Stage one featured a quasi-experimental pre- and post-test control group design, conducted around pre-service teachers' participation in one module of music education study. Pre-service teachers' self-efficacy beliefs were measured prior to and at the conclusion of the five-week module of music education. Participants were enrolled on two campuses, so there was a physical separation between the control group and the experimental group, which kept any discourse between the two groups to a minimum and helped negate corruption of the results. Both the Joondalup AED3105 and Mount Lawley AED3240 units comprised five weeks of two-hour workshops. The content was the same in both units and consistent delivery was maintained by the same tutor on each campus. The same pre- and post-questionnaires were administered to the control group and experimental group at the start and end of the five-week period.

The steps for constructing the self-efficacy instrument were based on the model set out in Colton and Covert's book, *Designing and Constructing Instruments for Social Research and Evaluation* (2007, p. 18). From this model, a tool was developed for measuring self-efficacy and music self-beliefs to meet the specific needs of this study.

4.7.3 Questionnaire Background

The conceptual framework for building the instrument was based on Bandura's *Guide for Constructing Self-Efficacy Scales* (2006). The result was the *Anonymous Music Undergraduate's Self-Efficacy Survey* (AMUSES). A translation of Bandura's framework to the AMUSES survey is presented in Table 7.

Table 7: *Translation of the Bandura Framework to the AMUSES Survey*

Element	Comment	AMUSES
Content validity	The items should be phrased in terms of can do rather than will do. Can is a judgment of capability; will is a statement of intention.	Wording of questions
Domain specification and self-efficacy multi-causality	The efficacy scales must be linked to factors that, in fact, determine quality of functioning in the domain of interest.	Ability to perform music skills leading to the ability to teach music skills.
Gradations of challenge	Self-efficacy appraisals reflect the level of difficulty individuals believe they can surmount.	Simple skill sets (clapping) moving to more complex skill sets (creating)
Response Scales	Scales that use only a few steps should be avoided because they are less sensitive and less reliable.	Likert 7-point scale
Minimizing response biases	Self-efficacy judgments are recorded privately without personal identification to reduce social evaluative concerns.	Anonymous and confidential. Coded by number.
Item analysis in scale construction	Pre-test the items.	Peer scrutiny, pilot survey and resulting editing.
Assessment of perceived collective efficacy	Judgment of efficacy in a group endeavour is very much a socially embedded one, not an individualistic, socially disembodied one.	Is there a belief among generalist as a whole that only specialists can teach music?
Predictive and construct validation	Self-efficacy scales should have face validity.	Pilot test subjected to Cronbach scale analysis. Ongoing editing.

Bandura, as stated by Pintrich and de Groot (1990), recommends measuring beliefs and confidence or "strength and magnitude", for which surveys are widely considered an appropriate method (Colton & Covert, 2007). A Likert rating scale was used to achieve this (Pintrich & de Groot). Initially a five-point scale was considered, based upon a tool developed by Wilson (2009) for measuring self-efficacy amongst early adolescents. While five-point scales offer a mid-way point of neutrality, they may not offer enough choice for levels of uncertainty. Matell and Jacoby (1972) state:

> Uncertain and neutral response categories tend to be used more often on 3- and 5-point scales, less often on 7- to 19-point scales, where such scales have an equal number of positive and negative points (p. 508).

A seven-point scale was ultimately deemed a more appropriate option because it offered more certainty than a five-point scale, and nine points or more did not appear to be psychometrically stronger or better that seven (Matell & Jacoby, 1972). In designing the questions, the use of pronouns “I” and “my” were considered to indicate participants’ own self-belief. Shulruf, Hattie and Dixon (2007) argue that participants are more likely to answer questions in the first person.

The researcher also needs to consider the problem of user fatigue and boredom (Matell & Jacoby, 1972, p. 508), where a long or wordy questionnaire may cause participants to lose concentration or interest and answer questions randomly. To achieve this, each section was limited to 10 questions and the questionnaire required a mix of positively and negatively worded responses to minimise acquiescent response bias (Rattray & Jones, 2007) and minimise participants simply ticking boxes at one end of the scale. Each page of the survey featured guiding statements: 1 = strongly disagree; 4 = not sure; and 7 = strongly agree. Negative statements were scored reversely (Allen & Bennett, 2008).

The questions were created specifically for this study; modifications were based on successful tools used in previous self-efficacy studies in music and general education (Pintrich & de Groot, 1990; Ritchie & Williamon, 2010; Wilson, 2009) together with Bandura’s Guide for Constructing Self-Efficacy Scales (2006).

4.7.4 Design and Content

The survey was divided into three parts and was based on the premise that pre-service teachers must have self-belief in their own musical ability in order to have belief in their ability to teach music. The survey explored the expectation for generalists to teach music and whether they had an aptitude and attitude to do so. Accordingly, part A examined participants’ beliefs in their own musical ability, part B examined participants’ beliefs in their ability to teach music, and part C examined participants’ perceived collective efficacy; their aptitude and attitude to teach music. The overall survey design and direction of the questions are illustrated in Figure 16.

Each part of the survey commenced with general questions that gradually became more specific and direct. Wherever possible, the first two parts were maintained in parallel by asking questions about specific concepts at similar stages in the survey.

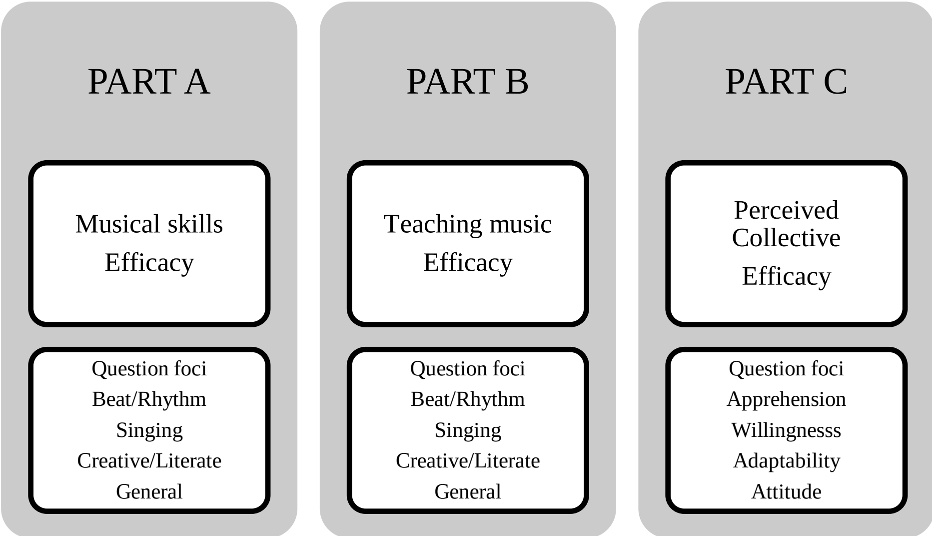

Figure 16: Questionnaire Content Overview

For example, question three in part A referred to participants' skills to clap a simple rhythm, while part B related to their ability to teach a simple rhythm in class. Figure 17 depicts an example of a general question from part A:

For each of the following statements, please circle the choice that is closest to how true you think it is for you.

1 = strongly disagree **4 = not sure** **7 = strongly agree**

1. I consider myself to be musically skilled	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Figure 17: Questionnaire Content: Question 1

Subsequent questions in part A became more specific, for example:

- Question 3: I can clap a simple rhythm
- Question 4: I cannot clap in time with music

In part A, gradations of difficulty in relation to musical skills included questions ranging from clapping simple rhythms to creating simple pieces of music. In part B, gradations of difficulty related to participants' self-beliefs to teach musical skills:

- Question 13: *I believe I could lead a class in clapping simple rhythms*

Part C examined perceived collective efficacy, that is, efficacy that has an impact on individuals within a social system, such as the teaching profession. As stated by Bandura:

> ...the higher the perceived collective efficacy, the higher the groups' motivational investment in their undertakings, the stronger their staying power in the face of impediments and setbacks, and the greater their performance accomplishments (p. 15).

Part C examined the aptitudes and attitudes of individuals within a generalist teaching collective. For example, question 30 probed a collective belief that teaching music is a specialist area and therefore not suitable for generalists to teach:

- Question 30: Generalist teachers should not be expected to teach specialist subjects like music.

Teaching is understood to be a complex and sometimes stressful occupation, requiring "operative efficacy", in other words, utilising "subskills to manage ever-changing circumstances" (Bandura, 1986, p. 391). Accordingly, self-belief in an ability to teach music in the future was examined:

- Question 20*:* With practice, I could become skilful enough to teach music in a classroom.

Since "it is difficult to achieve much while fighting self-doubt" (Bandura, 1994, p. 3), self-belief, willingness and adaptability to manage potentially stressful teaching situations were also investigated, such as participants' optimism about their chances to succeed:

- Question 21: The fear of failure will prevent me from teaching any music in a classroom.

Finally, clarity of the components, including the title and instructions, aligned with the guidelines of Colton and Covert (2007). Confidentiality was established upfront by using the word *Anonymous* in the title, followed by the statement: *Do not put your name on this* *form.* The final survey formed the Anonymous Music Undergraduates Self- Efficacy Survey, hereafter referred to as AMUSES (see Appendix A).

4.7.5 Content Validity

Content validity was determined by the items within the instrument measuring what they were intended to investigate (Creswell, 2014). The items in this study were constructed after careful consideration of Bandura's *Guide for Constructing Self-Efficacy Scales* (2006), which discussed content delivery and "can do" rather than "will do" statements. The author viewed "can" as a judgment of capability and "will" as a statement of intention (Bandura, 2006, p. 2). Items were based on what generalist pre-service teachers would be expected to teach after one five-week module of music, for example, elements of music noted in the Australian Curriculum, such as rhythm, pitch, dynamics and expression, form and structure, timbre and texture within the context of the overarching outcomes of Making and Responding (Australian Curriculum Assessment and Reporting Authority, 2013).

4.7.6 Construct Validity

Construct validity is based on whether the scores from ranking the answers served a useful purpose when used in practice (Creswell, 2014). The items in this study were created after extensive review of Bandura's work on self-efficacy (Bandura, 1986, 1989, 1994, 1997a, 2006, 2011) and the Australian Curriculum Arts, Foundation to Year 10 Curriculum (Australian Curriculum Assessment and Reporting Authority, 2013), and complied with conventions in Colton and Covert's book, *Designing and constructing instruments for social research and evaluation* (2007).

4.7.7 Piloting

Piloting was useful for assessing validity and reliability of the AMUSES survey. This was done with 40 postgraduate students studying music as part of a Graduate Certificate in Education. Students were invited to participate in the pilot and the feedback led to rephrasing one question that they found difficult to understand. The question was changed from "I am confident that I can participate in simple rhythmical activities" to a more focussed and simple question "I can clap a simple rhythm".

4.7.8 Reliability

Reliability refers to the consistency of an instrument over time, after repeated administration, as in a pre- and post-test scenario (Creswell, 2014). Cronbach's coefficient alpha was used to estimate the reliability of AMUSES (Punch, 2005). Pilot group data entered into SSPS software returned a high reliability level of 0.94, given Allen and Bennett's (2008) recommendation of results above 0.8 for reliability.

Cresswell (2014) notes the importance of consistency in administering any instrument. To minimise any issues, the questionnaire was administered by the same tutor in both the pre- and post-test data collection stages with both the control and experimental groups. The tutor was given clear directions by the researcher for administering the instrument in the same manner and with same instructions each time.

4.7.9 Ethics

Full ethics clearance was obtained from the Edith Cowan University Human Research Ethics Committee prior to the commencement of the study (see appendices C, D, E and F). In stage one, letters were handed out to enrolled pre-service teachers, outlining the study and seeking their permission to proceed.

4.7.10 Procedures and Analysis

All participants were provided with written information about the purpose of the study along with consent forms to indicate their willingness to participate. Willing participants were then asked to complete the pre-test AMUSES questionnaire with pen and paper. There was no time limit. Participants were instructed to answer each question to the best of their beliefs and advised that there were no right or wrong answers.

Following the five-week intervention, both groups were given post-test AMUSES questionnaires to complete in their final tutorial, with the same instructions and under the same conditions as the pre-test questionnaire. Data were then collated and entered into SSPS statistical software and paired t-tests conducted (Allen & Bennett, 2008).

4.8 Stage Two

Stage two involved video capture to investigate the impact of the unit of study (intervention) on pre-service teachers' self-efficacy and recording evidence in the field. It was guided by the second research question:

2) In what ways does a music looping technology intervention impact pre-service generalist teachers' self-efficacy to teach music as evidenced during a practicum placement?

Data were gathered from the experimental group only. Details of the participants, research setting and research procedures are set out below.

4.8.1 Participants

After completing AED3105, participants engaged in AED3106, Arts as Learning 2, which gave them an opportunity to work in a school setting as part of their normal tutorial workshop. In semester two, 2013, forty-one students from stage one who had completed AED3105 were invited to participate in stage two. All participants were allocated times to work with a year 5 class at Rosethorn Primary School (Rosethorn is a pseudonym), and were videoed at various times during six 45-minute lessons. Each pre-service teacher taught a small group of children in the class over a twenty to twenty-five minute period.

4.8.2 School and Year Groups

Rosethorn Primary School (pseudonym) is located in a suburb north of Perth, Western Australia. It is situated between Joondalup and Mount Lawley and is accessible to both campuses. The primary school is a modern facility built on the same site as an education support centre that caters for a diverse student population in a lower socio-economic area (Department Of Education, 2012).

The school has close ties with Edith Cowan University; it possesses research facilities that include a research classroom and observation rooms with the latest video technologies and was specifically chosen for its purposeful research facilities. In addition, it provided a safe classroom environment. The children represented a broad cross section of students likely to be encountered in Western Australian schools, many from a non-English background. Around 10% were of Vietnamese origin, and a further 30% were of Indigenous origin (Department Of Education, 2012). The year five class in this study consisted of approximately 30 students with an almost equal number of girls and boys (Weldon personal communication, June 2012). Participants were provided with information on the children's backgrounds and experiences in music and their varying skill levels prior to the practicum. They were also given sample lesson plans and teaching examples for teaching basic musical elements using the software application *GarageBand*.

4.8.3 Ethics

In stages two and three of the research, letters were sent to the school principal, teachers, students and their parents, as well as the pre-service teachers, explaining the study and seeking their permission to proceed. Full ethics clearance was obtained from the Edith

Cowan University Human Research Ethics Committee and the West Australian Department of Education (see appendices C, D, and F).

4.8.4 Principles Guiding Video Analysis

The second research question involved searching for evidence of improved participant self-efficacy in a practicum setting. Using audio-visual recording equipment, data were captured and analysed with the benefit of repetition and minute detail where necessary (Punch, 2005). Not only were the pre-service teachers' voices and actions recorded, but also the students' responses and ongoing interactions amongst them. Erickson (1982) notes:

> Face-to-face interaction also has a complementary dimension of organization in real time. This involves the relationships between simultaneous actions of interactional partners. Verbally and nonverbally, at any given moment, interactional partners are taking account of what others are just doing then, or have just done, or are about to do next. For example, while speakers are doing speaking, listeners are doing listening in the same time. The listening behaviour of the listeners and the speaking behaviour of the speakers co-occurs simultaneously and in synchrony, each partner completing (complementing) the actions of the other (p. 3).

New video technologies provides researchers with powerful ways of collecting rich data to support teaching and learning and intensive study of these practices. Derry et al. (2010) proposes a deductive approach to video data analysis where researchers have a clear research question, involving coding systems to categorise and record occurrences and calculate frequency of occurrences (Derry et al., 2010).

4.8.5 Procedures

In stage two, data were collected via digital video recordings in the field. Out of 41 eligible participants, 26 pre-service teachers actively participated and were captured on video. Video capture was random and based on where pre-service teachers situated themselves in the classroom. Participants taught year 5 students using the looping technology they had studied in the AED3105 unit.

One week prior to the practicum, pre-service participants were given simple musical concepts to teach, appropriate for year 5 children's age and experience. The concepts had been studied previously in AED3105. Lessons were structured in three stages: the first involved simple beats and rhythmic ostinatos/loops, the second involved simple pitch attached to these beats and rhythms, and finally, creative work, using all these elements. The latter included beat, rhythm, pitch, harmony, tempo, dynamics and texture/timbre in conjunction with components previously studied: AED3240 Arts in Education and AED3105 the Arts as Learning. Figure 18 presents a simple beat ostinato/loop on *GarageBand* from the start of the lesson:

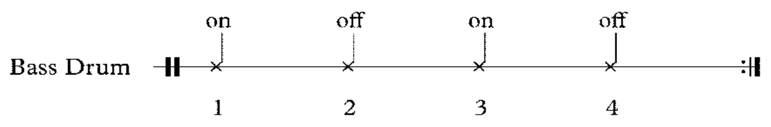

Figure 18: Beat Loop Example

Simple rhythms were then added to the loop, enhancing the overall texture of the sound, requiring coordination and concentration by the students to keep in time, as in the two examples in Figure 19:

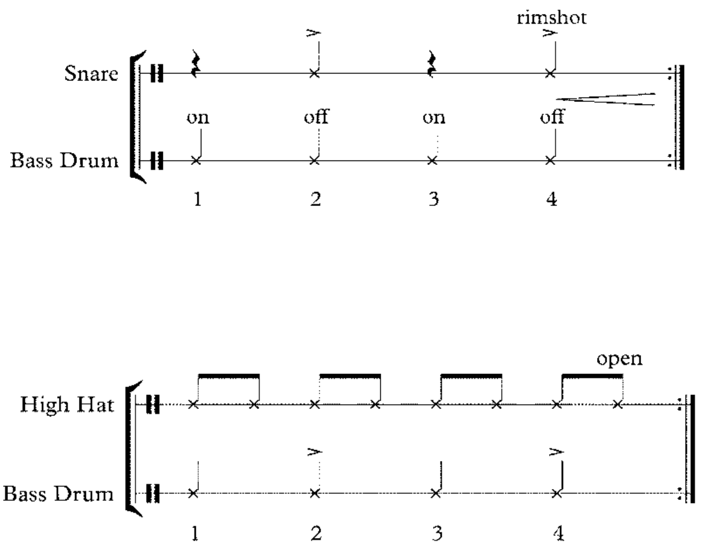

Figure 19: Rhythmic Loop Example

Rhythmic looping harmonies were added using guitars and a simple chord chart, such as C G as C - / C G C - //. The teaching environment was safe, and in the event of an unlikely incident, the regular teacher and researcher were on hand to assist and take the necessary action.

4.8.6 Coding and Analysis

The overarching framework for analysis was based on an interactive cycle of data collection, data display and data reduction, followed by drawing and verifying conclusions, as described by Miles and Huberman (1984). Initial coding was the first step in the analysis process and was modified, edited and/or verified as recommended by Punch (2005): "…coding begins the analysis and also goes on at different levels throughout the analysis" (Punch, 2005, p. 199).

Collection of video footage was guided by a plan and preconceived coding strategy (Derry et al., 2010, p. 16). The codes were synthesised from a combination of Erdem and Demirel's (2007) study on teacher self-efficacy beliefs and Bandura's Guide for Constructing Self-efficacy Scales (2006). To maintain consistency with the quantitative survey instrument in stage one, Bandura's Guide for Constructing Self-efficacy Scales was synthesised as an underlying hypothesis for coding design, analysing the video footage and subsequent participant self-reflections (2006). These are presented in Table 8.

Table 8: *Video Analysis Plan Based on Bandura's Guide for Constructing Self-Efficacy Scales*

Bandura	Comment	Survey
Content validity Page 2	The items should be phrased in terms of "can do" rather than "will do". "Can" is a judgment of capability; "will" is a statement of intention.	Wording of answers in Self reflections (e.g. *can or will*)
Domain specification and self-efficacy multi-causality Page 4	The efficacy scales must be linked to factors that in fact determine quality of functioning in the domain of interest.	Evidence of participants teaching music skills accurately.
Gradations of challenge Page 5	Self-efficacy appraisals reflect the level of difficulty individuals believe they can surmount.	Evidence of teaching more complex skills
Response scales Page 7	A certain threshold of self-assurance is needed to attempt a course of action, but higher strengths of self-efficacy will result in the same attempt. The stronger the sense of personal efficacy, however, the greater the perseverance and the higher the likelihood that the chosen activity will be performed successfully.	Coding to reflect the differing levels of achievement in the practicum setting. Similar levels to be used for coding self-reflections
Minimising response bias Page 10	Self-efficacy judgments are recorded privately without personal identification, to reduce social evaluative concerns.	Assurance that video only used by researcher, and not used for assessment or any other purpose. Likewise, self-reflections to be anonymous and confidential.

Bandura	Comment	Survey
Item analysis in scale construction Page 11	Pre-test the items.	Support from the Video support group data analysis group*
Assessment of perceived collective efficacy Page 12	Judgment of efficacy in a group endeavour is very much a socially embedded one, not an individualistic, socially disembodied one.	Evidence of trust, confidence and risk taking in the field, coded appropriately.
Predictive and construct validation Page 15	As noted earlier, self-efficacy scales should have face validity. They should measure what they purport to measure, i.e. perceived capability to produce given attainments. But they should also have discriminative and predictive validity.	Coding open to critical review by the researcher

Bandura n.d.

Video analysis was directed at:

1. Evidence of self-efficacy multi-causality – participants with some music skills are able to facilitate teaching music skills accurately;
2. Evidence of gradations of challenge – participants are able to teach from simplest to more complex skills; and
3. Evidence of perceived collective efficacy – including evidence of trust, confidence and risk-taking in the field. According to the Australian Standards for Teaching (graduate level), evidence of collective efficacy includes being organised, professional, supportive, inclusive, appropriate, affirmative, risk taking and in control (Australian Institute for Teaching and School Leadership, 2012).

A conceptual framework for coding, adapted from the Australian Institute for Teaching and School Leadership (AITSL, 2012) and Bandura (2006), were developed as shown in Figure 20. NVivo 10 was utilised to view and code the video footage (QSR international, 2012).

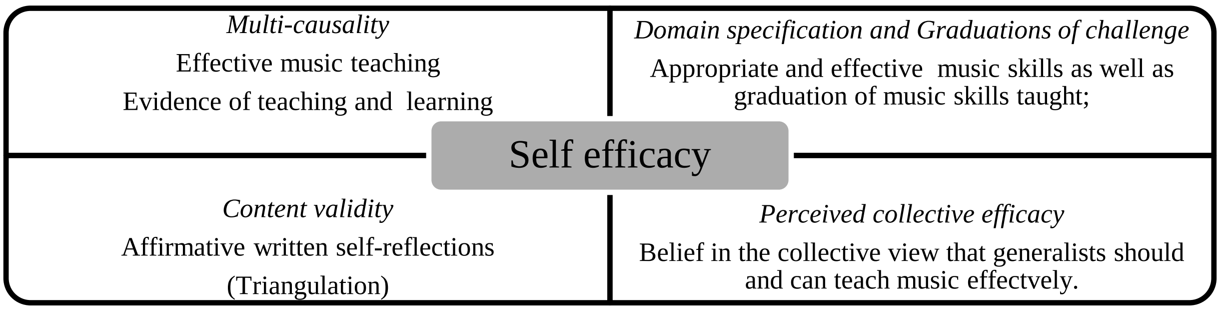

Figure 20: Overarching Conceptual Framework for Coding and Analysis

4.8.7 Validity and Reliability

Validity is based on a determination of accuracy from the viewpoint of the researcher (Creswell, 2014). Triangulation is achieved by finding corroborating evidence from multiple methods to locate common themes or categories (Creswell & Miller, 2000). Creswell (2014) states:

> If themes are established based on converging several sources of data or perspectives from participants, then this process can be claimed as adding to the validity of the study (p. 201).

While video data provided audio and visual references to the actions of participants in the field, the written reflections on stage two undertaken in stage three were designed to offer insights into participants' feelings about their experiences in order to add depth to the findings.

Content validity was determined in conjunction with participants' self-reflections; for example, matching evidence of words in self-reflections and visual data in the video footage. It was important to observe (in the video footage) and ascertain pre-service teachers' levels of self-assurance and self-confidence while they were teaching simple to complex musical concepts. Despite coding participants as "teaching beat and rhythmic elements", they may nevertheless have felt unsure about what they were trying to achieve. Reliability was enhanced by the researcher transcribing the data from video recordings in the field.

4.9 Stage Three

4.9.1 Background

Immediately following the practicum, pre-service teachers were asked to complete a self-reflective journal. Their reflections were important for reaching conclusions about improved self-efficacy in conjunction with the video data. The video data provided audio and visual references to participants' actions, while the written reflections provided insights into their feelings about their experiences.

4.9.2 Construction

To be effective, reflective surveys require a supporting structure (Benson, 1997). The guidelines for the Harvard Graduate School of Education's *See Think Wonder* thinking routine framework (2013) were deemed appropriate for this study, as it has a proven track record as a practical and effective thinking and documentation tool in the field of educational development in schools (Ritchhart, 2008). The format offered flexibility in the context of this study and provided structured sequential steps for pre-service teachers to follow (Lowe et al., 2013). The questions in the *See Think Wonder* thinking routine framework move from descriptive to analytical (Lowe et al., 2013), with the first question in Harvard's Visible Thinking Routine (2013) observational (*See*):

1. Observational – what did I do? (descriptive)

The second question prompts thought about the experience (*Think*), and an *inner focus* on pre-service teachers' thoughts about their own performance:

2. How do I think I went? (inner focus)

The third question also prompts thought about the experience (*Think*), however with an *outer focus* on pre-service teacher's thoughts about how their students performed:

3. How did the children react? (outer focus)

The final question prompts an analysis of the experience with a view to future applications (*Wonder*):

4. How would your experience in this be useful in the future? (Transformative)

4.9.3 Participants and Procedures

The same 26 pre-service teachers who participated in stage two also participated in stage three. On the same day, immediately following their practicum experience, they were asked to complete surveys involving critical self-reflection, based upon the Harvard Visible Thinking framework.

4.9.4 Coding and Analysis

Analysis of the self-reflection surveys abided by an interactive cycle of data collection, data display, data reduction, drawing and verifying conclusions (Miles & Huberman, 1984). The process followed the approach of Erikson (1982) and involved breaking the data down into episodes and sub-episodes. Coding was used to seek and measure evidence of feelings of success, as Bandura (1994) articulates: "successes build a robust belief in one's personal efficacy" (1994, p. 2; Punch, 2005). In addition, coding sought evidence of self-satisfaction or mastery. Bandura describes motivated people as those who "seek self-satisfaction from fulfilling valued goals and are prompted to intensify their efforts by discontent with substandard performances" (1994, p. 4). Finally, coding was also used to measure optimism or risk taking in future music teaching: "There is a growing body of evidence that human accomplishments and positive well-being require an optimistic sense of personal efficacy" (Bandura, 1994, p. 6). From these perspectives, the coding measured the strength of the pre-service teachers' responses according to the categories shown in Figure 20, namely: 1) multi-causality; 2) domain specifications; 3) gradations of challenge; 4) content validity; and 5) perceived collective efficacy. Content validity sought to explore affirmative written self-reflections, responses ranging from strong/convincing to positive, timid/doubtful, and inconclusive. Strong responses contained "will do" words, and positive statements contained words synonymous with "can do". The researcher transcribed the surveys using NVivo 10 software to code and analyse the written reflections in conjunction with the video capture.

4.9.5 Validity and Reliability

Content validity was sought by examining the self-reflections to assess whether they supported or not the evidence gathered in the video data. Reliability was established by the researcher by checking completed transcripts for any errors against the NVivo transcriptions. Further checking was undertaken to ensure there were no subtle changes to the meanings of codes during the coding process (Creswell, 2014). The video data and self-reflective surveys were also cross-checked for reliability.

4.10 Conclusion

The methodology for this study was designed to investigate the impact of technology on the levels of pre-service teachers' self-efficacy to teach music in primary schools. In the first stage, a quasi-experimental approach was used to assess the impact of technology in one module (half-semester unit) of study, as derived from pre-service teachers' perceptions of their own abilities. Stages two and three looked for evidence of the results, whether positive or negative, of a technology intervention on pre-service teachers' practice in the classroom. Chapter five presents the findings of stages one, two and three.

Chapter Five: Results

5.1 Introduction

Chapter four outlined the methods of inquiry: part one focusing on the research considerations, methods and three-stage design, while part two introduced the participants, research settings and research instruments, and described the data management and data analysis.

Chapter five presents the results of the data in each of the three research stages; i.e. the quantitative data from the AMUSES survey in stage one, the video data in stage two and the journal data in stage three. A summary of the findings in each stage follows.

5.2 Stage One: AMUSES Survey Results

Stage one utilised a quantitative statistical approach to answer the first research question:

1) What impact does a music looping technology intervention have upon pre-service generalist teachers' self-efficacy to teach music in primary schools compared with a traditional module of instruction?

Survey data for both the control and experimental groups were entered into SPSS statistical software for initial analysis and to obtain a global view of the data (Allen & Bennett, 2008). Control and experimental pre- and post-test results were entered and the averages calculated. The control and experimental averages were then subjected to paired sample *t-tests* with an α of .05. The results are shown in Table 9.

Table 9: *Mean, Mean Difference and Significance for Control and Experimental Groups*

Intrinsic Value N = 46	Pre-test		Post-test			
	Mean	SD	Mean	SD	Mean diff.	Significance
Control	4.47	.88	5.02	.93	-.56	.003*
Experimental	4.46	.81	5.23	.74	-.77	.000*

For the control group, t= -3.108, df = 45, p < 0.03 (two tailed).
For the experimental group, t= -6.296, df = 49, p < .001(two tailed).

The t-tests revealed a statistically significant increase in the mean for the control group between pre- and post-test (p <*0.03*). They also showed a statistically significant increase in the mean for the experimental group between pre- and post- test (p <*.001).*

However, the difference between pre- and post-test mean was greater in the experimental group than the control group, suggesting that while the self-efficacy ratings of both groups increased, the increase was notably greater in the experimental group that had the technology intervention.

Cohen's *d* was used to further assess the pre- and post-test mean differences (Allen & Bennett, 2008). As stated in Allen and Bennett (2008), Cohen (1988) professed a result of .02 is small, .05 is medium and .08 is large. For the control group in this study S_p = (.88+.93)/2 = .90, therefore *d* = (5.02 -4.47)/.90 = 0.6., above the medium range; while for the experimental group, S_p = (.81 + .74)/2 = .78, and so *d* = (5.23 -4.46)/.77= .99 or above the high range. Assumptions of normality and normality of difference scores did not appear to be violated after visually inspecting the relevant histograms.

The overall results indicated an increase in the self-efficacy ratings of pre-service generalist teachers to teach music in primary schools following participation in a music module with the music looping technology. The increase was greater for the experimental group than the control group. The AMUSES survey was broken down into parts A, B and C to provide a clearer view of efficacy levels in relation to competence and confidence (Bandura, 1986).

5.2.1 AMUSES Survey: Part A Results

Part A of the AMUSES survey set out to examine self-beliefs around basic musical competence, notably the ability to perform basic musical skills. The questions sought to explore Bandura's domain specification and specifically targeted musical elements and challenge gradations (Bandura, 2006). The questions included:

1. I consider myself to be musically skilled.
2. I consider myself to be musically creative.
3. I can clap a simple rhythm.
4. I can<u>not</u> clap in time with music.
5. I can read and write simple rhythms.
6. I can sing a well-known song.
7. I can<u>not</u> sing in tune.
8. I can create simple pieces of music.
9. I don't know how to put musical ideas down on paper.
10. With practice I can become more musically skilled.

The paired *t-test* results of part A total scores are presented in Table 10.

Table 10: *Means, Mean Differences and Significance of Survey Part A*

Intrinsic Value N = 46	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Control	4.45	1.12	5.27	1.04	-.82	.002*
Experimental	4.46	.94	5.32	.85	-.86	.000*

For the control group, t= -3.368, df = 45, p <.002 (two tailed)

For the experimental group, t= -5.592, df = 49, p < .001(two tailed)

Results for the control group were statistically significantly different (t = -3.368, p = .002 < 0.05). S_p = (1.12 +1.04)/2 = 1.08, therefore d = (5.27 - 4.45)/ 1.08 = 0.76. Cohens' d value was above the medium range. For the experimental group, the results were also statistically significantly different (t = -5.592, p< .001). S_p = (.94 + .85)/2 = .89, therefore d = (5.32-4.46)/ .89 = 0.97. Cohens' d value was above the high range.

Based on these results, the reported efficacy levels of musical skills increased for both groups, with a greater increase in the experimental group. However, the reported mean values for both groups were slightly above 5.0. The midpoint value of 4 on the seven-point Likert scale in the AMUSES survey was assigned the annotation of *not sure*, so the results indicated moderate self-efficacy for both groups. A further breakdown into individual questions was deemed helpful for providing greater clarity when later examining each question construct in turn.

5.2.2 Part A: Questions One and Two

Part A opened with two general questions exploring efficacy responses for (1) musicality and (2) musical creativity. Data for both questions were subjected to a two-tailed paired sample *t-test.* The results for the control group are shown in Table 11.

Table 11: *Means, Mean Differences and Significance for Control Group: Questions 1and 2*

Intrinsic Value N = 46	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Question 1	2.72	1 .6	3.98	1.7	1.26	.001*
Question 2	2.93	1.58	4.15	1.6	1.22	.000*

For question 1, t = -3.696, df = 45, p < .001 (two tailed)

For question 2, t = -3.899, df = 45, p < .001 (two tailed)

The *t*-tests revealed a small but statistically significant increase in the mean for questions 1 and 2 post-test, suggesting the control group's self-belief in their musicality and creativity increased marginally after completing the standard module of music tuition. Data for questions 1 and 2 from the experimental group were also subjected to a two-tailed paired sample *t-test*, and the results are presented in Table 12.

Table 12: *Means, Mean Differences and Significance for Experimental Group: Questions 1and 2*

Intrinsic Value N = 50	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Question 1	3.32	1.69	4.11	.15	.78	.005*
Question 2	3.2	1.47	4.36	1.16	1.16	.000*

For question 1, t = -2.956, df = 49, $p < .005$ (two tailed)

For question 1, t = -5.408, df = 49, $p < .001$ (two tailed)

The *t*-tests revealed a small but statistically significant increase in the mean, suggesting the experimental group's self-belief in their musicality and creativity increased after completing a module of music tuition involving the looping technology intervention. While the increase was not as great as the control group, it should be noted that the pre- and post-test means for the experimental group were higher overall.

5.2.3 Part A: Questions Three to Seven

Questions three to seven sought participants' responses to self-beliefs about specific musical skills (beat, rhythm and pitch). The control group data for these questions were subjected to two-tailed paired sample *t-test* and the results are presented in Table 13.

Table 13: *Means, Mean Differences and Significance for Control Group: Questions 3-7*

Intrinsic Value N = 46	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Question 3	6.02	1 .16	6.17	0.95	0.15	.483*
Question 4	6.11	1.48	6.41	1.02	0.3	.257*
Question 5	3.11	1.97	4.39	1.73	1.28	.001*
Question 6	5.57	1.46	5.82	1.34	0.25	.392*
Question 7	4.14	2.03	4.57	2.14	0.43	.330*

For question 3, t = -0.707, df = 45, $p < .483$ (two tailed)

For question 4, t = -1.799, df = 45, $p < .257$ (two tailed)

For question 5, t = -3.479, df = 45, $p < .001$ (two tailed)

For question 6, t = -0.864, df = 45, $p < .392$ (two tailed)

For question 7, t = -0.985, df = 45, $p < .330$ (two tailed)

The *t-tests* revealed a statistically significant increase in the mean for question 5 post-test, indicating an increase in the control group's self-belief in their musical literacy. However, the *t-tests* revealed no statistically significant increase in the mean for questions 3, 4, 6 and 7. These results indicate that the control group's self-belief levels in their basic beat, rhythm and singing abilities did not increase.

Data for questions 3, 4, 5, 6 and 7 for the experimental group were also subjected to a two-tailed paired sample *t-test,* and the results are presented in Table 14.

Table 14: *Means, Mean Differences and Significance for Experimental Group: Questions 3-7*

Intrinsic Value N = 46	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Question 3	5.78	1.06	6.42	0.64	0.64	.000*
Question 4	5.7	1.22	6.36	0.96	0.66	.003*
Question 5	3.5	1.76	4.94	1.76	1.44	.000*
Question 6	5.14	1.49	5.68	1.22	0.54	.038*
Question 7	4.02	2.02	4.68	1.65	0.66	.079*

For question 3, t = -4.039, df = 49, $p < .000$ (two tailed)

For question 4, t = -1.147, df = 49, $p < .003$ (two tailed)

For question 5, t = -2.137, df = 49, $p < .000$ (two tailed)

For question 6, t = -1.398, df = 49, $p < .038$ (two tailed)

For question 7, t = -1.795, df = 49, $p < .079$ (two tailed)

The *t-tests* revealed a statistically significant increase in the mean for questions 3, 4, 5 and 6 post-test, and unlike the control group, suggest the experimental group's self-belief in their beat, rhythmic and singing skills did increase. Interestingly, there was no statistically significant increase in the mean for question 7, indicating that the experimental group's self-belief did not increase in their ability to sing in tune.

5.2.4 Part A: Questions Eight and Nine

Questions 8 and 9 sought to examine the level of participants' beliefs in their ability to create or compose musical ideas. Responses were expected to indicate more advanced musical skills. Data for these questions were subjected to a two-tailed paired sample *t-test* and the results are presented in Table 15.

Table 15: *Means, Mean Differences and Significance for Control Group: Questions 8 and 9*

Intrinsic Value N = 46	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Question 8	3.24	1.91	4.48	1.75	1.24	.002*
Question 9	3.69	2.27	5.06	1.58	1.46	.001*

For question 8, t = -3.275, df = 45, $p < .002$ (two tailed)

For question 9, t = -3.667, df = 45, $p < .001$ (two tailed)

The *t-tests* revealed a statistically significant increase in the mean for questions 8 and 9 post-test, suggesting that the control group's self-belief in their composition and music literacy skills increased following the standard module of music tuition. The results of a two-tailed paired sample t-test for questions 8 and 9 for the experimental group are shown in Table 16.

Table 16: *Means, Mean Differences and Significance for Experimental Group: Questions 8 and 9*

Intrinsic Value N = 50	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Question 8	3.18	1.74	4.22	1.37	2.04	.000*
Question 9	3.44	2.02	4.94	1.43	1.5	.000*

For question 8, t = -3.735, df = 49, $p < .001$ (two tailed)

For question 9, t = -4.122, df = 49, $p < .001$ (two tailed)

The *t-tests* revealed a similar statistically significant increase for the experimental group, suggesting their self-belief in composition and music literacy skills also increased after completing music looping technology intervention. While both control and experimental groups increased in self-efficacy, the experimental group's results indicated a greater increase.

5.2.5 Part A: Question Ten

Question ten responses indicated participants' beliefs about advancing their musical skills in the future. Data for both groups were subjected to a two-tailed paired sample *t-test* and the results are presented in Table 17.

Table 17: *Means, Mean Differences and Significance for Control and Experimental Groups: Question 10*

Intrinsic Value N = 46	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Q 10 control	5.30	1.41	5.91	1.15	0.61	.027*
Q 10 exp.	5.54	1.33	5.88	1.20	0.38	.199*

For question 10, t = -2.284, df = 45, $p < .027$ (two tailed)

For question 10, t = -3.735, df = 49, $p < .199$ (two tailed)

The *t-tests* revealed a statistically significant increase in the mean for the control group, suggesting their self-belief in their ability to advance their musical skills in the future increased after completing a module of music tuition. It is interesting to note that no statistically significant increase was detected in the mean for the experimental group, suggesting their self-belief to advance their musical skills in the future did not increase after completing the five-week module with the looping technology intervention.

5.2.6 Summary of AMUSES Findings Part A

Overall, Part A of the AMUSES survey indicated similar pre-test scores for both the control group (4.45) and the experimental group (4.46). Part A also indicated similar increases in the post-test scores for the control group (5.27), with the experimental group slightly higher at 5.32. However, the standard deviation for the control group (1.04) indicated a wider range of scores than for the experimental group (0.85).

Questions one and two, related to self-assessment of musical skills and creativity, indicated low control group pre-test means (2.72 and 2.93), while the experimental group results were slightly higher at 3.32 and 3.2. The control group indicated slight increases to 3.98 and 4.15 post-test, while the experimental group exhibited slightly lower increases. The experimental group's post-test means were still higher than the control group at 4.1 and 4.36.

Questions three and four, relating to rhythmic abilities, indicated higher pre-test means for the control group (6.02 and 6.11) than the experimental group at 5.78 and 5.7. Post-test results indicated marginal increases for both groups. However, the experimental group's increases were three times greater than the control group, indicating a marked increase in self-belief to clap simple rhythms in time. Question five, relating to reading and writing simple rhythms, saw low pre-test results and marginal increases post-test for both groups. However, there was a slightly larger increase for the experimental group.

Questions six and seven sought responses on self-belief related to singing abilities. Both groups' pre-test responses indicated a reasonable belief in their singing ability and both groups indicated only marginal increases post-test. There was little improvement in participants' singing self-beliefs.

Questions eight and nine examined self-beliefs in creating music, to which both groups indicated improvements post-test. However, for question eight, the mean difference for the experimental group (2.04) was significantly higher than the control group at 1.24, suggesting the looping technology intervention may have positively impacted the experimental group's self-belief in creating music. By contrast, question 10 indicated little or no statistical difference in either group's belief to improve with practice.

Overall, it appears that the looping technology intervention may have resulted in a slight increase in self-efficacy beliefs in musical abilities, particularly in the areas of rhythmic ability and creating music.

5.2.7 AMUSES Survey Results Part B

Part B of the survey investigated participants' self-beliefs about teaching confidence; i.e. confidence to teach basic music skills as described in part A. In conjunction with part A, the questions sought to explore multi-causality of self-efficacy, in other words, did the acquisition of music skills directly relate to the teaching of these skills? (Bandura, 2006). The questions were:

11. I think I have the basic skills to be able to teach some music in a classroom.
12. I am not confident enough to be able to incorporate music into creative classroom activities.
13. I believe I could lead a class in clapping simple rhythms.
14. I don't believe I can teach a class how to write simple rhythms.
15. I think I could teach my class to read and write music.
16. I would be happy to lead a classroom of children in singing a song.
17. I do not have the confidence to be able to sing in front of any classroom of children.
18. I think I could teach my class how to create simple pieces of music.
19. I would not be able to facilitate a lesson where children put musical ideas down on paper.
20. With practice I could become skilful enough to teach music in a classroom.

A global paired *t-test* was conducted on Part B and the results are shown in Table 18.

Table 18: *Mean, Mean Difference and Significance for Control and Experimental Groups: Survey Part B*

Intrinsic Value N = 46	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Control	4.24	1.21	5.04	1.02	-.8	.296*
Experimental	4.29	.92	5.32	.84	-1.03	.000*

For the control group, *t*= -3.506, df = 45, $p < .296$ (two tailed).

For the experimental group, *t*= -7.954, df = 49, $p < .001$ (two tailed).

The *t-tests* for the control group revealed no significant difference ($t = -3.5$ $p < .296$). S_p = (1.21+1.02)/2 = 1.12, therefore *d* = (5.04 -4.24)/1.12 = 0.71. Cohen's *d* value was well above the medium range, however, these results were not statistically significant. For the experimental group, the *t-tests* revealed a significant difference ($t = -7.954$, $p < .001$). S_p = (.92 + .84)/2 = .88, therefore *d* = (5.32 - 4.29)/ .88 =1.17. Cohen's *d* value was above the high range. Assumptions of normality and normality of difference scores did not appear to be violated after visually inspecting the relevant histogram output.

The overall results indicated a more significant improvement in results for the experimental group compared with the control group. Results of individual questions defined the differences between the two groups for the individual question constructs.

5.2.8 Survey Part B: Questions 11 and 12

Part B of the AMUSES survey opened with two general questions related to participants' self-beliefs in: (11) the ability to teach some music and (12) the ability to facilitate creative musical activities in the classroom. Data from the control group were subjected to a two-tailed paired sample t-test and are presented in Table 19.

Table 19: *Means, Mean Differences and Significance for Control Group: Questions 11and 12*

Intrinsic Value N = 46	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Question 11	4.04	1.96	5.39	1.29	1.35	.000*
Question 12	4.39	1.73	5.72	1.39	1.33	.000*

For question 11, t = -4.444, df = 45, $p < .001$ (two tailed)

For question 12, t = -5.026, df = 45, $p < .001$ (two tailed)

The *t-tests* revealed a statistically significant increase in the mean, suggesting that the control group's self-belief increased after completing the standard music module. Data from the experimental group were also subjected to a two-tailed paired sample *t-test* and the results are shown in Table 20.

Table 20: *Means, Mean Differences and Significance for Experimental Group: Questions 11 and 12*

Intrinsic Value N = 50	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Question 11	4.22	1.95	5.39	1.29	1.17	.000*
Question 12	4.24	1.65	5.76	1.17	1.52	.000*

For question 11, t = -4.444, df = 49, $p < .001$ (two tailed)

For question 12, t = -5.090, df = 49, $p < .001$ (two tailed)

The *t-tests* revealed a statistically significant increase in the mean, suggesting the experimental group's self-belief in their ability to teach music and facilitate creative musical work also increased, particularly in relation to the latter.

5.2.9 Survey Part B: Questions 13 to 17

Questions 13 through 17 sought responses to self-beliefs about teaching specific musical skills (beat, rhythm and pitch). The results of a two-tailed paired sample *t-test* of control group data for questions 13, 14, 15, 16 are presented in Table 21.

Table 21: *Means, Mean Differences and Significance for Control Group: Questions 13-17*

Intrinsic Value N = 46	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Question 13	5.89	1 .07	6.13	1.22	0.24	.323*
Question 14	3.87	1.91	5.02	1.87	1.15	.002*
Question 15	3.07	1.82	4.0	1.96	0.93	.011*
Question 16	5.02	1.49	5.39	1.56	0.37	.264*
Question 17	4.74	1.97	5.52	1.7	0.78	.225*

For question 13, t = -1.000, df = 45, $p < .323$ (two tailed)

For question 14, t = -1.874, df = 45, $p < .002$ (two tailed)

For question 15, t = -2.644, df = 45, $p < .011$ (two tailed)

For question 16, t = -1.132, df = 45, $p < .264$(two tailed)

For question 17, t = -1.229, df = 45, $p < .225$ (two tailed)

The *t-tests* revealed a statistically significant increase in the mean for question 14 (writing simple rhythms) post-test, but no statistically significant increase in the mean for the other four questions. With one exception, these results indicate the control group's overall self-belief in teaching these skills did not increase after completing the standard module of music tuition. Response data to the same questions for the experimental group were also subjected to a two-tailed paired sample *t-test* and are presented in Table 22.

Table 22: *Means, Mean Differences and Significance for Experimental Group: Questions 13-17*

Intrinsic Value N = 50	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Question 13	6.0	0.78	6.3	0.79	0.3	.062*
Question 14	3.98	1.73	5.38	1.19	1.40	.000*
Question 15	3.32	1.75	4.0	1.34	0.68	.008*
Question 16	5.26	1.56	5.68	1.24	0.42	.126*
Question 17	3.78	1.4	5.56	1.50	1.78	.000*

For question 13, t = -1.000, df = 49, $p < .062$ (two tailed)

For question 14, t = -5.584, df = 49, $p < .001$ (two tailed)

For question 15, t = -2.137, df = 49, $p < .008$ (two tailed)

For question 16, t = -1.557, df = 49, $p < .126$ (two tailed)

For question 17, t = -7.277, df = 49, $p < .079$ (two tailed)

The *t-tests* revealed a statistically significant increase in the mean for questions 14, 15 and 17, indicating that the experimental group's self-belief in their teaching abilities in rhythm, literacy and singing increased after completing the five-week module with a looping technology intervention. Notably, there was no statistically significant increase for question 17, showing no improvement in self-belief in singing in front of a class. There was also no statistically significant increase in question 13, related to teaching simple beat, but it should be noted that the pre- and post-test means were both high to begin with.

5.2.10 Survey Part B Questions 18 and 19

Questions 18 and 19 were aimed at determining the level of participants' beliefs in creating and writing musical ideas with a class. Responses were expected to offer insights into teaching more advanced musical skills. Data for the control group were subjected to a two-tailed paired sample *t-test* and the results are presented in Table 23.

Table 23: *Means, Mean Differences and Significance for Control Group: Questions 18 and 19*

Intrinsic Value N = 46	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Question 18	3.37	1.73	4.46	1.64	1.09	.001*
Question 19	3.89	1.74	4.67	1.24	0.78	.047*

For question 18, t = -3.511, df = 45, $p < .001$ (two tailed)

For question 19, t = -5.943, df = 45, $p < .047$ (two tailed)

The *t-tests* revealed statistically significant mean increases for both questions post-test, suggesting the control group's self-belief in their teaching abilities for composition and music literacy skills increased after completing a module of music tuition. After a two-tailed paired sample *t-test*, the same data for the experimental group produced the results shown in Table 24.

Table 24: *Means, Mean Differences and Significance for Experimental Group: Questions 18 and 19*

Intrinsic Value N = 50	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Question 18	3.62	1.55	4.94	1.28	1.32	.000*
Question 19	3.8	1.53	5.12	1.24	1.32	.000*

For question 18, t = -3.735, df = 49, $p < .001$ (two tailed)

For question 19, t = -5.943, df = 49, $p < .001$ (two tailed)

The *t-tests* revealed statistically significant mean increases for both questions post-test, with a slightly greater increase in the experimental group.

5.2.11 Survey Part B Question 20

Question 20 examined participants' beliefs about advancing their music teaching skills in the future. Data for both groups were subjected to a two-tailed paired sample *t-test* and are presented in Table 25.

Table 25: *Means, Mean Differences and Significance for Control and Experimental Groups: Question 20*

Intrinsic Value N = 46	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Control	5.26	1.25	5.5	1.28	0.24	.297*
Experimental	4.76	1.39	5.58	1.26	0.82	.001*

For control group, t = -2.284, df = 45, $p < .297$ (two tailed)
For experimental, t = -3.366, df = 49, $p < .001$ (two tailed)

The *t-tests* revealed no statistically significant increase in the mean for the control group, suggesting their self-belief in their ability to advance their music teaching skills in the future did not increase after completing the standard module of music tuition. By contrast, the *t-tests* did reveal a statistically significant mean increase for the experimental group, which showed an increase in their self-belief to advance their music teaching skills in the future.

5.2.12 Summary of AMUSES Findings Part B

Overall, Part B of the AMUSES survey indicated similar pre-test scores for both the control group (4.24) and the experimental group (4.29). However, the post-test results of the control group (5.04) were lower than the experimental group (5.32). The standard deviation for the control group (1.02) also indicated a wider range of scores than the experimental group (0.84). The results indicated no statistically significant difference for the control group pre- and post-test.

Question 11, related to self-assessment of teaching musical skills, indicated a moderate pre-test mean for the control group (4.04) and slightly higher pre-test mean for the experimental group (4.22). Both groups had reasonable increases to 5.39. By contrast, question 12, related to facilitation of creative activities, indicated a moderate pre-test mean for the control group (4.39), slightly higher than the experimental group (4.24). The control group indicated a reasonable increase to 5.72, but the experimental group had a larger increase to 5.76, with the mean difference for the experimental group at 1.52, significantly larger than the control group at 1.33. While the control group appeared to have made some improvement in self-belief in teaching music generally, the experimental group indicated more improvement in self-belief for teaching music creatively.

Question 13 was related to teaching rhythms. Results indicated a lower pre-test mean for the control group at 5.89 than the experimental group at 6.00. Post-test results indicated only marginal increases for both groups. Question 14, related to teaching rhythmic notations, had a slightly lower pre-test mean of 3.87 for the control group than the experimental group at 3.98. Post-test results also indicated larger improvement in the experimental group (5.38) compared to the control group (5.02). Question 15, related to teaching, reading and writing music, saw both groups return low pre-test results and marginal increases post-test.

Unexpectedly, there was a slightly larger increase for the control group (mean difference of 0.93) compared with the experimental group (mean difference of 0.68).

Question 16 examined self-beliefs in relation to leading singing in class. Both groups' pre-test responses indicated a reasonable belief in singing ability. The control group indicated only a marginal increase post-test with a mean difference of 0.37; and a slightly larger increase for the experimental group post-test with a mean difference of 0.42. By contrast, question 17, related to confidence to sing in front of a class returned a higher pre-test score of 4.74 for the control group, compared to the experimental group at 3.78. The experimental group's post-test result of 5.56 (a mean difference of 1.78) was higher than that of the control group (5.52) with a mean difference of 0.78.

Questions 18 and 19 examined self-beliefs in teaching students how to create music. Both groups indicated improvements post-test. However, for question 18, the mean difference for the experimental group (1.32) was significantly higher than the control group at 1.09. Furthermore, for question 19, the mean difference for the experimental group at 1.32 was considerably more than the control group at 0.78, suggesting that the looping technology intervention may have impacted the experimental group's self-belief in teaching students to create music. This was reinforced by question 20, which indicated a larger increase in the experimental group's mean difference (0.82) compared to the control group (0.24), suggesting an increase in the experimental group's self-belief to improve teaching with practice.

Overall, it appears that the looping technology intervention may have resulted in increased self-efficacy beliefs to teach music, particularly in the area of facilitating creative music activities. Further research could be valuable for establishing and implementing a broader framework based on reliable and more robust results.

5.2.13 AMUSES Survey Part C Results

Part C of the survey investigated operative efficacy within perceived collective efficacy (Bandura, 1986, 2006). The following questions were asked to measure adaptability and willingness to succeed:

21. The fear of failure will prevent me from attempting to teach any music in a classroom.
22. I am hoping that there will be a music specialist in my school so I won't have to teach any music at all.
23. I am hoping to teach music in my classroom whether or not there is a school music specialist.
24. I would like to become skilful enough to take on the role of a music specialist.
25. I will use music in different ways to create a friendly and stimulating learning environment.
26. I will probably only play music in the background.
27. I would be happy to incorporate music into my teaching.
28. I believe music is too difficult a subject for me to teach.
29. With further training I would be happier incorporating music into my teaching.
30. Generalist teachers should not be expected to teach specialist subjects like music.

A global paired *t-test* was conducted on Part C of the AMUSES survey and the results are shown in Table 26.

Table 26: *Means, Mean Differences and Significance for Control Survey Part C*

Intrinsic Value N = 46	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Control	5.27	0.90	5.45	1.02	0.18	.000*
Experimental	5.29	0.99	5.94	.83	0.65	.000*

For the control group, t= -3.696, df = 45, $p < .001$ (two tailed).

For the experimental group, t= -3.368, df = 49, $p < .001$ (two tailed).

The global *t-tests* revealed the control group's results were significantly different (t = -3.696, $p < .001$). S_p = (.9+.1.02)/2 = .96, therefore d = (5.45 - 5.27)/ .96 = 0.19. Cohen's d value was within the low range. The *t-tests* also revealed the experimental group results were significantly different (t = -3.368, $p < .001$). S_p = (.99 + .83)/2 = .91, therefore d = (5.94 - 5.29)/ .91 = .71. Cohen's d value was above the medium range. Assumptions of normality and normality of difference scores did not appear to be violated after visually inspecting the relevant histograms.

Overall, the results indicated increased self-beliefs in both groups, with a marginally higher increase in the experimental group. Individual questions were examined in detail for greater clarity of the results. Data from the control group's responses to questions 21-30 were subjected to a two-tailed paired sample *t-test* and are presented in Table 27.

Table 27: *Means, Mean Differences and Significance for Control Group: Questions 21-30*

Intrinsic Value N = 46	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Question 21	4.74	1.54	5.26	1.57	0.52	.134*
Question 22	3.24	1.8	3.48	2.06	0.44	.562*
Question 23	4.67	1.25	4.8	1.6	0.13	.661*
Question 24	2.85	1.71	3.2	1.9	0.35	.319*
Question 25	5.39	1.22	5.63	1.34	0.24	.377*
Question 26	5.08	1.4	4.74	1.63	-0.34	.240*
Question 27	5.61	1.31	5.72	1.19	0.11	.667*
Question 28	5.09	1.38	5.00	1.69	-0.09	.788*
Question 29	5.63	1.37	5.48	1.35	-0.15	.540*
Question 30	5.11	1.74	4.7	1.79	-0.41	.249*

For question 21, t = -0.585, df = 45, $p < .134$ (two tailed)

For question 22, t = -2.137, df = 45, $p < .562$ (two tailed)

For question 23, t = -0.441, df = 45, $p < .661$ (two tailed)

For question 24, t = -1.008, df = 45, $p < .319$ (two tailed)

For question 25, t = -0.893, df = 45, $p < .377$ (two tailed)

For question 26, t = 1.191, df = 45, $p < .240$ (two tailed)

For question 27, t = -0.433, df = 45, $p < .667$ (two tailed)

For question 28, t = 0.271, df = 45, $p < .788$ (two tailed)

For question 29, t = 0.617, df = 45, $p < .540$ (two tailed)

For question 30, t = 1.167, df = 45, $p < .249$ (two tailed)

Unlike the combined findings, *t-tests* for the individual items revealed no statistically significant increase or decrease in the mean for any of the questions. This suggests that for the control group, self-belief in their ability to overcome fear of failure did not increase after completing the standard module. Neither did their self-belief in completely avoiding teaching music increase over the same period. Self-belief in their desire to teach music did not increase after completing the module, nor did their self-belief to specialise in music teaching. Self-belief in utilising music in different ways did not increase; and self-belief in only using music in the background remained the same, as did self-belief in incorporating music into their teaching after completing the music tuition. Of particular concern was the unchanged self-belief that music is too difficult to teach and further training will not improve their desire to teach music. The belief that music should only be taught by specialists also remained unchanged.

Data from the experimental group's responses to questions 21-30 were subjected to a two-tailed paired sample *t-test* and are presented in Table 28.

Table 28: *Means, Mean Differences and Significance for Experimental Group: Questions 21-30*

Intrinsic Value						
N = 50	Pre-test		Post-test			
	Mean	*SD*	*Mean*	*SD*	*Mean diff.*	*Significance*
Question 21	4.86	1.4	5.69	1.16	0.83	.002*
Question 22	3.74	1.81	4.12	1.54	0.38	.229*
Question 23	4.28	1.4	5.01	1.17	0.73	.002*
Question 24	2.96	1.71	2.92	1.66	-0.04	.912*
Question 25	5.08	1.41	5.76	0.98	0.68	.001*
Question 26	5.08	1.44	5.52	1.03	0.44	.056*
Question 27	5.58	1.14	5.77	1.65	0.19	.412*
Question 28	5.06	1.53	5.61	1.32	0.55	.056*
Question 29	5.8	1.14	5.65	1.19	-0.13	.526*
Question 30	5.1	1.81	5.39	1.71	0.29	.432*

For question 21, t = -4.039, df = 49, $p < .002$ (two tailed)

For question 22, t = -1.218 df = 49, $p < .229$ (two tailed)

For question 23, t = -3.318, df = 49, $p < .002$ (two tailed)

For question 24, t = 0.111, df = 49, $p < .912$ (two tailed)

For question 25, t = -1.078, df = 49, $p < .001$ (two tailed)

For question 26, t = -1.398, df = 49, $p < .056$ (two tailed)

For question 27, t = -0.827, df = 49, $p < .412$ (two tailed)

For question 28, t = -1.957, df = 49, $p < .056$ (two tailed)

For question 29, t = 0.639, df = 49, $p < .526$ (two tailed)

For question 30, t = 0.792, df = 49, $p < .432$ (two tailed)

While the *t-tests* revealed no statistically significant increase or decrease in the mean for questions 22, 24, 26, 27 or 30, they did reveal significant increases for questions 21, 23 and 25. This suggests that for the experimental group, self-belief in their hopes of avoiding teaching music did not increase after the looping technology intervention; and self-belief in their desire to specialise in music teaching remained unchanged, as did self-beliefs to only use music in the background. However, while self-belief in a desire to incorporate music into their teaching did not increase, the belief that music is too difficult to teach also did not increase. Similarly, there was no decrease in their belief that further training will improve their desire to teach music after the looping technology intervention, neither in their self-belief that music should only be taught by specialists.

Importantly in the context of this study, participants' self-beliefs in the ability to overcome fear of failure improved after the intervention, along with increased self-beliefs to teach and utilise music in different ways.

5.2.14 Summary of AMUSES Survey Findings Part C

Overall, part C indicated similar pre-test scores for both the control group (5.27) and the experimental group (5.29). However, the post-test results for the control group (5.45) was lower than for the experimental group (5.94), while the standard deviation for the control group (1.02) was wider than the experimental group (0.83).

Question 21, related to fear of failure to teach music, indicated a moderate pre-test mean for the control group (4.74) and a slightly higher mean for the experimental group (4.86). While the control group showed a reasonable increase to 5.26, the experimental group had a higher increase to 5.69, indicating a greater willingness to overcome nervousness about teaching music.

Questions 22 and 23 related to a desire to teach music even if not required to do so. Responses to question 22 indicated a low pre-test mean for the control group (3.24) and the experimental group at 3.74. Both groups recorded relatively small increases, but the post-test mean of 3.48 for the control group and 4.12 for the experimental group seem to indicate that the experimental group, although not improving greatly, had more of a desire to teach music even when not required to do so. Responses to question 23 confirmed this interpretation with the control group improving only marginally from a pre-test score of 4.67 to 4.8, while the experimental group improved from 4.28 pre-test to 5.01 post-test.

Responses to question 24, relating to a desire to become a skilled music specialist, revealed a low control pre-test mean of 2.85, just slightly lower than the experimental group at 2.96. Post-test results indicated little improvement for the control group (3.2) and a negative result for the experimental group (2.92), indicating a reluctance in both groups to teach music exclusively as a music specialist.

Question 25 examined a desire to use music for creating a supportive teaching and learning environment. Both groups returned moderately high pre-test results and marginal post-test increases. However, there was a larger increase for the experimental group (5.76 post-test with a mean difference of 0.68) compared with the control group (5.63 post-test with a mean diff of 0.24). Both groups indicated a moderately high desire to use music for creating a supportive environment in their classrooms.

Question 26 related to the use of music beyond just background sounds. Both groups' pre-test responses indicated a moderately high belief in doing so, but interestingly, the control group had a negative result to 4.74 post-test, with the experimental group increasing to 5.76, suggesting an increased desire to use music proactively. Question 27 related to incorporating music in teaching, and while the control group had a higher pre-test score of 5.61 compared to the experimental group at 5.58, the experimental group's post-test result of 5.77 (mean difference of 0.19) was higher than that of the control group (5.72) with a mean difference of 0.11.

Question 28 elicited participants' beliefs about the difficulty of teaching music. Both groups had moderately high pre-test scores of 5.09 (control group) and 5.06 (experimental group) respectively. The control group's post-test result of 5.00 revealed a negative mean difference of 0.09 while the experimental group increased to 5.61 (mean difference of 0.55), indicating an increased belief in their ability to teach music. Question 29 examined whether further training would assist participants to feel more confident using music in their teaching. Both groups had moderate pre-test results of 5.63 (control group) and 5.8 (experimental group) respectively, and both groups indicated negative trends to 5.48 (control group) and 5.65 (experimental group) respectively.

Question 30 related to beliefs that generalist primary teachers should be expected to teach music. Both groups had moderate pre-test results of 5.11 (control group) and 5.1 (experimental group), with a downturn to 4.7 for the control group and an increase to 5.39 for the experimental group. In both questions 29 and 30 the experimental group had higher post-test results than the control group.

Overall, it appears that the looping technology intervention may have resulted in a small increase in collective beliefs that music can and should be taught by generalists, and in particular, an increased willingness to adapt and take risks in teaching.

5.2.15 Overall Summary of AMUSES Survey Findings

Part A of the AMUSES survey related to self-beliefs in participants' musical abilities. Overall pre-test and post-test responses indicated broadly similar results for both the control and experimental groups over the period of music instruction. However, the experimental group showed a slightly higher improvement overall, especially in relation to rhythmic activities and creative music making, suggesting that the looping technology intervention may have resulted in increased self-efficacy belief in creating music amongst this group.

Part B of the AMUSES survey sought responses about participants' music teaching self-beliefs. Global pre- and post-test responses indicated a larger improvement in the experimental group's self-efficacy compared to the control group. Questions relating to rhythmic activities had varied results, with larger increases in self-belief for teaching rhythms in the experimental group, while the control group showed greater improvement in teaching reading and writing of music. Questions related to teaching creative music making indicated that the looping technology intervention may have resulted in increased self-efficacy belief in this area.

Part C examined participants' responses relating to perceived collective efficacy and their adaptability and willingness to succeed. Overall pre- and post-test responses indicated greater improvement in self-efficacy for teaching music in the experimental group. The experimental group also exhibited a greater willingness to take risks and an increased desire to teach meaningful music (other than using it as a background resource). Overall, it appears that the looping technology intervention may have resulted in increased collective belief that music can be taught by generalist primary teachers, in particular, a willingness to adapt and take risks in teaching.

In summary, the survey indicated that the looping technology intervention had a positive impact upon pre-service generalist teachers' self-efficacy to teach music in primary schools after participation in the five-week music module.

5.3 Stage Two - Video Capture

The second research question in stage two of the study required observations in the field:

2) In what ways does a music looping technology intervention impact pre-service generalist teachers' self-efficacy to teach music as evidenced during a practicum placement?

Unlike stage one that employed a quantitative quasi-experimental method of data collection, the second stage utilised a qualitative approach, whereby data were collected on video in the field. Experimental group participants were invited to take part in the field study. Out of the 41 participants who indicated their willingness to participate, 36 travelled to the school and took part in stage two. Of these, 26 pre-service teachers were randomly captured on video.

Data analysis was based on an ongoing cycle of data collection, data display, data reduction, and drawing and verifying conclusions (Miles & Huberman, 1984). The initial approach to analysing the video data was from the viewpoint of an impartial or non-participant observer attempting to quantify the information observed in the video footage (Punch, 2005, pp. 181-182). A deductive approach was adopted to investigate a clear research question (Derry et al., 2010, p. 10), and collection of the video footage was guided by a plan and pre-conceived coding. The codes were synthesised from a combination of the Erdem and Demirel (2007) study on teacher self-efficacy beliefs and Bandura's *Guide for Constructing Self-efficacy Scales* (2006). The overarching conceptual framework was based on the interrelationships between confidence and competence as discussed by Bandura (see chapter four).

The four areas relating to multi-causality: domain specification, gradations of challenge, perceived collective efficacy and content validity followed Bandura's *Guide for Constructing Self-efficacy Scales* (2006). These factors were inter-related, so each one was focused upon to assist with video analysis and help develop an understanding of participants' self-efficacy for teaching music in the field. The combined evidence from each of these areas was used to create an overall picture of self-efficacy levels demonstrated by participants in the field. Each area was broken down into coding as a guide for collecting information.

5.3.1 Domain Specification and Gradations of Challenge

Bandura (2006) stated: "the efficacy scales must be linked to factors that, in fact, determine quality of functioning in the domain of interest" (p. 5). Given that the focus of this study was on participants' self-efficacy to teach music, the latter was broken down into simple observable elements of beat, rhythm, pitch, tempo, dynamics, harmony, timbre, singing and composition. Gradations of challenge reflected the level of difficulty at which activities were taught by the participants. According to Bandura (2006): "If there are no obstacles to overcome, the activity is easily performable and everyone is highly efficacious"

(p. 5). In this case, did participants take the safe option and teach simple rhythms on the drums indicating a basic level of competence? Or did they attempt more complex tasks, for example, combining rhythm and pitch in melody making, or two-part coordinated rhythm patterns? “People with high assurance in their capabilities approach difficult tasks as challenges to be mastered rather than threats to be avoided” (Bandura, 1994, p. 71). Therefore, indicators could be determined as pre-service teachers taking the safe option of teaching basic rhythms or, on the other end of the scale, demonstrating confidence and being more adventurous in their teaching. Accordingly, a hierarchy of taught music elements was created with basic beats and rhythms as the lowest level of challenge, and timbre, dynamics, tempo and pitch embedded into the tuition, indicative of a higher-level challenge. Harmony and composition were designated as the most challenging elements to teach.

Table 29: *Instances of Music Elements Taught*

Gradations of Challenge from Left to Right									
PS Teacher	Beat	Rhythm	Timbre	Dynamics	Tempo	Pitch Melody	Harmony	Composition	Total
1	x	x							2
2	x	x							2
3	x	x					x		3
4	x	x				x	x		4
5	x	x					x		3
6	x	x	x		x	x	x	x	7
7	x	x	x		x	x	x	x	7
8	x	x	x		x	x	x		6
9	x	x	x		x	x	x		6
10	x	x	x	x	x	x		x	7
11	x	x	x	x	x	x		x	7
12	x	x	x	x	x	x		x	7
13	x	x	x	x	x	x		x	7
14		x	x	x		x		x	5
15		x	x			x		x	4
16		x	x	x	x	x		x	6
17		x			x	x		x	4
18	x	x			x		x		4
19	x	x			x		x		4
20	x	x			x		x		4
21	x	x	x		x		x		5
22	x	x	x		x		x		5
23	x	x	x		x		x		5
24	x					x	x		3
25	x					x	x		3
26	x					x	x		3

A report was generated in NVivo by creating a Matrix Coding Query with participants listed against observed instances of the music elements taught (QSR international, 2012). The table was created with lower levels of challenge in the left-hand columns (beat and rhythm) moving through to higher levels of challenge in the right-hand columns (harmony and composition). Coding results for the instances of musical elements taught by pre-service teachers are presented in Table 29.

The matrix indicated a variety of musical elements were being taught and suggested that effective and appropriate musical skills were being utilised, along with a gradation of music skills moving beyond a simple basic beat. Of the 26 participants, seven were observed teaching two or three elements of music, while the remaining 19 participants attempted more complex tasks in their lessons. The results showed that most participants demonstrated confidence in their ability to teach music.

5.3.2 Multi-Causality

Bandura (n.d.) stated: “If self-efficacy scales are targeted to factors that, in fact, have little or no impact on the domain of functioning, such research cannot yield a predictive relation” (p. 5). If the acquisition of music skills did not translate into effective teaching of music in this study, the assumption that self-efficacy to teach music is increased as a result of music tuition would be incorrect. The video data provided evidence of the effectiveness of music tuition for teaching music and subsequent student engagement and learning. The first factor identified was the type of teaching that was occurring. The second factor was evidence of student engagement and learning, and demonstration of the effectiveness of the teaching provided by the pre-service teacher. For example, guided instruction/play may be used to help students construct their learning as described by Tumilty (2017):

> With guided instructional teaching practices, the students take an active role in the educational process and the instructor acts as a facilitator or guide. With guided instruction, students learn from their experiences, making it an inquiry-based or discovery-based model of teaching. (Guided instruction, para.1).

Codes for teaching strategies included free play, guided play and direct instruction. The difference between free play and guided instruction/play is that free play enabled students to explore with minimal teacher intervention, while guided play is assisted by interaction between instructors and the learning. Both free and guided play are student-centred learning models, as opposed to direct instruction which is teacher-centred and where the teacher delivers information to students via instructions, demonstrations and talks (Tumilty, 2017). Teachers who involve their students in meaningful discussion about their learning are examples of inclusive and more student-directed teaching (Tumilty, 2017) A report was generated in NVivo by creating a Matrix Coding Query, with participants listed against observed instances of free play, guided play and direct teaching (QSR international, 2012). The results based on Tumulty's (2017) discussion of teaching strategies are presented in Table 30.

Table 30: *Identification of Observed Teaching Strategies*

PS Teacher	A : Introduction	B : Free Play	C : Guided Play	D : Direct Teaching	E : Discussion	F : Conclusion	TOTAL
1	X	X	X	X		X	5
2	X	X	X	X		X	5
3	X	X		X			3
4	X	X		X		X	4
5	X		X	X		X	4
6	X	X	X	X		X	5
7	X	X	X	X		X	5
8	X	X	X	X		X	5
9	X	X	X	X		X	5
10	X			X		X	3
11	X			X		X	3
12	X			X		X	3
13	X			X		X	3
14	X		X	X	X	X	5
15	X		X	X	X	X	5
16	X		X	X	X	X	5
17	X		X	X	X	X	5
18	X			X	X	X	4
19	X			X	X	X	4
20	X			X	X	X	4
21	X			X	X	X	4
22	X			X	X	X	4
23	X			X	X	X	4
24	X			X	X	X	4
25	X			X	X	X	4
26	X			X	X	X	4

The matrix revealed a broad range of strategies were employed by pre-service teachers to facilitate meaningful musical experiences for their students. The effectiveness of the teaching strategies was measured via observation of students' engagement in the lesson.

Coding was created for observations of the students' engagement in the lesson, including evidence of learning, students being inattentive, off task, and/or disruptive. Coding was based on timed evidence of observed classroom engagement, timed evidence of student learning from their responses to the teacher, demonstrated application of skills to set tasks, and timed instances of inattentive or disruptive behaviour by students in the classroom. A report was produced in NVivo by creating a Matrix Coding Query with participants listed against observed instances of students' learning and engagement. The results are presented in Table 31.

Table 31: *Total Observed Student Learning and Engagement (Minutes and Seconds)*

Engaged and motivated student(s)	Evidence of learning	Inattentive students	Disruptive students	Students off task bored
661.16	407.08	17.89	0.26	11.14

The results indicated high levels of engaged and motivated students, and a relatively high degree of effective teaching, indicating that pre-service teachers were, for the most part, effective in teaching music to their students.

5.2.3 Perceived Collective Efficacy

Schools are diverse social systems where perceived collective efficacy affects motivation, perseverance and performance (Bandura, 2006). Participants in this study acted as agents with potential to influence their own actions and student learning in learning activities or events (Bandura, 2011). Coding was developed to seek out evidence of participant's acceptance of the teaching environment (professional and organised), their ability to persevere with student learning (motivating, inclusive, supportive) and level of performance when a situation presented itself or action was required (keeping control, managing difficulties, affirmative/positive attitude, modelling and risk-taking). In viewing and reviewing video observations, sixteen pre-service teachers appeared to take advantage of learning opportunities created by student questions, actions and comments, while five pre-service teachers missed similar opportunities. Wiggins and Wiggins (2008, p. 16) describe these opportunities as "teachable moments" – this category was added to the coding. A report was created in NVivo by creating Matrix Coding Query, with participants listed against observed instances of teaching strategies (QSR international, 2012), as shown in Table 32.

The observed behaviour showed that all the pre-service teachers dressed appropriately and demonstrated a professional approach to the practicum. Many took advantage of teachable moments and took risks, and the majority were supportive and inclusive in their approach. Out of 26 participants, three were observed using minimal strategies to engage student learning (three out of ten), while another six participants were observed using four teaching strategies.

Table 32: *Quality of Teaching Strategies*

PS Teacher	Professional	Organised	Inclusive	Motivation	supportive	Teachable Moments	Affirmative	Managing difficulties	Modelling	Risk Taking	TOTAL
1	1	1	1	0	1	0	1	1	0	0	6
2	1	1	0	1	1	0	0	1	1	1	7
3	1	1	0	1	0	1	0	1	1	0	6
4	1	1	1	1	1	1	0	1	0	1	8
5	1	1	0	1	1	0	0	1	0	0	5
6	1	1	1	0	1	0	1	0	0	1	6
7	1	1	1	0	1	0	1	0	0	1	6
8	1	1	1	0	1	0	1	0	0	1	6
9	1	1	1	0	1	0	1	0	0	1	6
10	1	0	1	0	1	1	0	0	0	1	5
11	1	0	1	0	1	1	0	0	0	1	5
12	1	0	1	0	1	1	0	0	0	1	5
13	1	0	1	0	1	1	0	0	0	1	5
14	1	0	1	1	1	1	1	0	0	1	7
15	1	0	1	1	1	1	1	0	0	1	7
16	1	1	1	1	1	1	0	0	1	1	8
17	1	1	1	1	1	1	0	0	1	1	8
18	1	0	1	0	0	1	0	0	0	1	4
19	1	0	1	0	0	1	0	0	0	1	4
20	1	0	1	0	0	1	0	0	0	1	4
21	1	0	1	0	0	1	0	0	0	1	4
22	1	0	1	0	0	1	0	0	0	1	4
23	1	0	1	0	0	1	0	0	0	1	4
24	1	0	1	0	1	0	0	0	0	0	3
25	1	0	1	0	1	0	0	0	0	0	3
26	1	0	1	0	1	0	0	0	0	0	3

1 = Observed   0 = Not observed

The remaining 16 participants demonstrated five or more teaching strategies. In addition, five of the 16 participants were observed applying seven or more teaching strategies. The results indicate that for the most part, pre-service teachers demonstrated motivation and perseverance in a professional manner to teach to the best of their ability.

5.3.4 Summary of Video Data Findings

Stage two investigated multi-causality, domain specification and gradations of challenge, as well as perceived collective efficacy to develop an understanding of participants' attitudes towards teaching music in the field (Bandura, 2006). Observations of multi-causality in the video footage indicated that pre-service teachers were effective overall in teaching their students. The range of domains taught (beat, rhythm, pitch, tempo, dynamics, harmony, timbre, singing and composition) and the gradations of challenge in teaching these domains indicated a majority of participants demonstrated a degree of confidence in their ability to teach music. Perceived collective efficacy was observed in the majority of pre-service teachers' displays of motivation, perseverance and professionalism.

Analysis of the data indicated the majority of pre-service generalist primary teachers were able to teach music effectively in the field after participation in the music module involving looping technology. A range of musical elements were well taught in a professional manner by the majority of participants. Self-reflection surveys were analysed to assess the impact of the looping technology intervention by the participants themselves.

5.4 Stage Three: Self-Reflection Surveys

5.4.1 Content Validity

Stage three investigated the insights of participants with regard to their teaching experiences in order to add validity to the observations in stage two. Pre-service teachers were invited to complete a self-reflection survey based on the *See Think Wonder* Visible Thinking Routine (Harvard Graduate School of Education, 2013). The four guiding questions were:

1. SEE (Observational) – What did I do?
2. THINK (Inner focus) – How do I think I went?
3. THINK (Outer focus) – How did the children react?
4. WONDER (Transformative) – What might I change in future?

The four questions were linked to four areas of multi-causality (think –inner/outer focus), domain specification and gradations of challenge (see-observational), and perceived collective efficacy (wonder), to substantiate the video findings and provide a measure of content validity (Bandura, n.d.). By examining participants' statements for words similar to "will do" and "can do" (Bandura, 2006, p. 2), their responses were categorised as strong/ convincing, positive, timid/doubtful, or inconclusive. Twenty-six participants returned self-reflections. Prior to coding, responses were collated according to the four questions detailed below.

5.3.2 SEE (observational) – What Did I Do?

Prior to participants' practicum experience and after the five-week music module with a looping technology intervention, they were provided with information on the students' backgrounds and experiences in music and varying skill levels, as well as written lesson examples on using *GarageBand* to teach musical elements. Their attempts to facilitate activities of varying levels of difficulty are an indication of Bandura's gradations of challenge (2006, p. 5). Responses were coded according to whether participants were specific about what they were trying to achieve (domain specifications) and the level of difficulty of the task (gradations of challenge). For the purpose of reporting the findings, responses were grouped by actions rather than individual participants.

In their self-reflections, five participants responded with general comments relating to *GarageBand* or investigating music in general terms. Samples of these comments included:

> "I explored *GarageBand* with the students."
>
> "I watched what the children were doing and (was) seeing if they could follow my instructions"
>
> "I used iPads to engage students with *GarageBand*" (pre-service teachers' self-reflections, 2013).

Four responses were more direct but did not specifically mention any musical direction, such as keeping the beat or learning a rhythm. For example:

> "Explained the musical activity and monitored the use of the iPad"
>
> "I explained the activity and helped guide the students through the music activity and use of the iPad" (pre-service teachers' self-reflections, 2013)

Nine responses specifically related to teaching musical skills such as beat, rhythm or pitch. For example:

> "What I did during the lesson was quite focused, learning a rhythm and playing it on the drums. It is another way to teach students how to learn a rhythm. As I played with *GarageBand* more, I learned how to develop songs and how to use the smart drums to create an easy rhythm."
>
> "I facilitated learning a rhythm and playing it on the drums. It is another way to teach students how to learn a rhythm" (pre-service teachers' self-reflections, 2013)

Six responses related to creating music, for example:

> "The time was spent on the keyboard and sampler. The students were engaged with learning their notes and playing hot cross buns. Noises with our voices were used to create music."
>
> "I noticed that the children I was working with were very interested in *GarageBand*. They were willing to work together to create different sounds and music. They did very well" (pre-service teachers' self-reflections, 2013).

There were two blank responses to this question. Overall, responses indicated most participants were confident enough to try and teach specific musical elements such as beat and rhythm, while six participants had sufficient confidence to work beyond simple rhythms and beats.

5.4.3 THINK (inner focus) - How do I think I went?

The self-reflective data were explored for evidence of understanding the effectiveness of the teaching undertaken and any indications of multi-causality in participants' responses (Bandura n.d.). That is, did the participants believe they were teaching music effectively? Responses to how well they felt they had performed were coded in relation to the level of success they thought they had achieved. Three participants indicated there was insufficient time to complete their teaching task:

> "I think I went okay. Time was a factor that didn't allow me to extend much. I felt a bit rushed. Otherwise forgetting/not knowing the children's names was also a negative."
>
> "I was a little nervous and felt a little rushed" (pre-service teachers' self-reflections, 2013).

One response indicated disappointment in the children's ability to respond to the task:

> "Before taking the lesson using the iPads I felt at ease, as the task was a simple activity teaching a basic rhythm to several students. After taking the lesson I was slightly discouraged as most of the students were unable to repeat the rhythm on the iPad drum kit" (pre-service teachers' self-reflections, 2013)

Six responses indicated moderately positive feelings, such as:

> "Quite well, the children were well behaved though they knew more about the application than me."
>
> "I felt it went quite well because they were able to complete the activity with a proficient amount of coordination" (pre-service teachers' self-reflections, 2013)

Sixteen responses indicated very positive feelings, for example:

> "Very well! Students learned the content very quickly!"
>
> "I had an awesome time and I feel the children interacted 100% and had fun."
>
> "The main gain I obtained from this experience was the realisation that I am capable enough to teach music to a group of students, not at a specialist level but at a generalist teacher level. I came to realise that I don't have to play an instrument at an expert level to include music in my teaching as I personally believe that a general understanding of rhythm and notation teamed with enthusiasm and passion are skills enough" (pre-service teachers' self-reflections, 2013).

Overall, responses indicated most participants were positive in their beliefs about teaching music effectively with the assistance of technology.

5.4.4 THINK (outer focus) – How did the Students React?

In addition to participants' beliefs that they had succeeded, their reflections on their students' reactions were almost all positive. Only one pre-service teacher raised issues, mainly related to technical problems:

> "The students participated well, even with the problem of the speakers being too soft. The common thing with technology is that sometimes it will stop working and there were a couple of instances of technical glitches happening, but this is something that happens with technology" (pre-service teachers' self-reflection, 2013).

The remaining 25 responses were very positive, as highlighted by the following comments:

> "They really enjoyed it – they said so! They displayed great teamwork, turn taking and sharing ideas".

> "The children enjoyed the activity, but I had a child who was a bit shy and never wanted to play at first, but did later on."

> "Children were fantastic. The responded positively and interacted well, they shared the iPads very well between themselves."

> "Engaged, excited and eager to participate." (pre-service teachers' self-reflections, 2013).

Of these 25 responses, six indicated learning had occurred. For example:

> "The students were thoroughly engrossed in the process as they actively engaged themselves in the lesson using the iPad, specifically being the *GarageBand* drum and guitar options, to play a basic rhythm (Snake Charmer). The students regularly expressed their eagerness and enthusiasm when using the iPads and all students willingly participated in the lesson"

> "I felt empowered by the whole experience as I realised that the iPad/*GarageBand* technology enables all children to create a basic rhythm regardless of their musical talent and equips generalist teachers with the resources and self-belief to do so."

> "The children really enjoyed themselves and were engaged and excited to show me what they could do and explain what they were doing" (pre-service teachers' self-reflections, 2013).

Participant responses indicated they perceived the children had responded positively to music involving the use of a looping technology.

5.3.5 WONDER – In Future

Participants' responses to questions about what they might do in future were coded to obtain an overall understanding of their confidence and commitment to teach music in their classrooms, since perceived collective efficacy affects motivation, perseverance and performance (Bandura, 2006). Initial coding was based on Bandura's work on self-efficacy, The Exercise of Control (1997a) and Self-Efficacy (1994), to provide an indication of the resilience, willingness and adaptability of participants to succeed (Bandura, 1986; Gu & Day, 2007; Le Cornu, 2009). Comments were recorded in the following categories: 1) inconclusive; 2) low; 3) moderate; and 4) high. Inconclusive comments were generally non-committal or not relevant to music. For example:

> "I will use an iPad to engage students before instruction or as a reward."

> "iPads make a good resource in the classroom and help to engage" (pre-service teachers' self-reflections 2013).

Two comments were deemed to be in the low range, since they lacked conviction, utilised words such as "may" or "would like to", and referred to potential without committing to anything, as indicated by the following example:

> "I think it helped me understand how different children learn and how to adapt my teaching strategies" (pre-service teacher's self-reflection, 2013).

While some responses gave the impression of capability, such as use of the word "may", other responses contained words more akin to "will" thus giving a stronger sense of intention. Examples of comments in the moderate range are as follows:

> "I would feel confident in incorporating musical skills into my classroom teaching."

> "I would feel more comfortable with doing music lessons in the class."

> "I feel I would be able to integrate music on the iPads in my future classroom. I feel it is a very interactive and engaging exercise I could perform with the students" (pre-service teachers' self-reflections, 2013).

Stronger responses include the following example in the high range:

> "Yes, I will do this in the future because they loved the experience, they were eager to play their own version" (pre-service teacher's self-reflection, 2013).

Responses were coded on a matrix for resilience, willingness and a commitment to teach music in the future. These are shown in Table 33. Moderate to high responses were deemed to indicate resilience, willingness and commitment.

Table 33: *Categories of Self-Reflective Comments*

PSTeacher	Inconclusive	Low	Moderate	High
1			X	
2	X			
3			X	
4			X	
5	X			
6			X	
7	X			
8				X
9		X		
10				X
11		X		
12			X	
13				X
14				X
15				X
16			X	
17				X
18			X	
19				X
20				X
21				X
22			X	
23		X		
24			X	
25				X
26			X	

The majority of responses were in the moderate to high columns, suggesting that written reflections offered positive indicators of motivation, resilience and commitment.

5.4.6 Summary of Stage Three Findings

The findings from stage three show the majority of participants were confident enough to teach specific musical elements such as beat and rhythm (domain specification and gradations of challenge), and were able to teach music with the assistance of technology. These participants reported largely positive experiences in that children responded well to the looping technology (multi-causality). Importantly, the majority of participants indicated a commitment to teaching music in the future (an indication of collective efficacy); and the results corroborated the findings from the video footage, offering a measure of content validity to the findings.

5.5 Answering the Research Questions

Stage one of the research, a quantitative statistical study, addressed the first research question:

1) What impact does a music looping technology intervention have upon pre-service generalist teachers' self-efficacy to teach music in primary schools compared with a traditional module of instruction?

The AMUSES survey indicated similar pre-test scores for both the control group (4.47) and the experimental group (4.46), however, the control group increased post-test to 5.02, while the experimental group had a higher increase to 5.32. Based on these results, the survey indicated the looping technology intervention had a small but significant impact upon pre-service generalist teachers' self-efficacy to teach music in primary schools.

The second research question required observation in the field:

2) In what ways does a music looping technology intervention impact pre-service generalist teachers' self-efficacy to teach music as evidenced during a practicum placement?

The video data, captured in a practicum setting, showed evidence of enhanced self-efficacy to teach music, and this was reinforced by pre-service teachers' self-reflections. It appeared that improved pre-service generalist teachers' self-efficacy beliefs to teach music as a result of the looping technology intervention had translated into the practicum setting. The findings are further discussed in chapter six.

5.6 Conclusion

Chapter five presented data from the three research stages, indicating improvement in the efficacy belief of the experimental group over the control group, concluded from a comparison of results between the AMUSES survey, later video evidence in the field, and the confirmation of participants themselves.

Chapter six discusses the findings in further detail and makes recommendations for future research into music training for pre-service teachers.

Chapter Six: Discussion of the Findings

6.1 Introduction

This chapter discusses the findings presented in chapter five, commencing with an overview of the three data-collection stages: the quantitative quasi-experimental survey, qualitative analysis of observations in the field, and qualitative analysis of participants' self-reflections. It also references past research and the relevant literature on pre-service generalist teaching in tertiary institutions in relation to music education and technology. Triangulation of the data is described, followed by the implications of the findings, before concluding with recommendations for future pre-service teacher education practice.

6.2 Discussion of the Data

6.2.1 Stage One Overview: Quasi-experimental Survey

In stage one, a pre- and post-test instrument was employed to answer the first research question. The survey was conducted with control and experimental groups, to measure the impact of an intervention of looping technology on pre-service teachers' self-efficacy to teach music after one five-week module of music study. The control group completed a pre-and post-test survey during the module of music tuition as part of their normal Bachelor of Education, while the experimental group completed the same pre-and post-test survey under similar conditions, with the addition of a looping technology intervention. The findings presented in chapter five highlighted differences in both groups' pre- and post-test results, with a benchmark significance value of $p<0.05$ for the difference between the groups (Allen & Bennett, 2008).

The results showed statistically significant increases in the levels of self-efficacy to teach music for both groups. However, the use of Cohen's *d* to examine the effect difference between the pre- and post-test means of both groups (Allen & Bennett, 2008) reflected a significant result for the experimental group ($d = 0.98$), as compared with the control group's moderate result of $d = 0.6$. The matched-pair design (both experimental and control cohorts were taught by the same tutor who delivered the same content in the same manner in similar tutorial environments) was intended to reduce the intrusion of variables such as content, delivery, environment and tutor (Creswell, 2014). The conclusion can therefore confidently be reached that the greater increase in self-efficacy of the experimental group was due to the impact of the looping technology intervention, as presented in Figures 21, 22 and 23. Figure

21 shows a comparison of overall mean between pre- and post-test results for both groups, clearly indicating a greater increase for the experimental group.

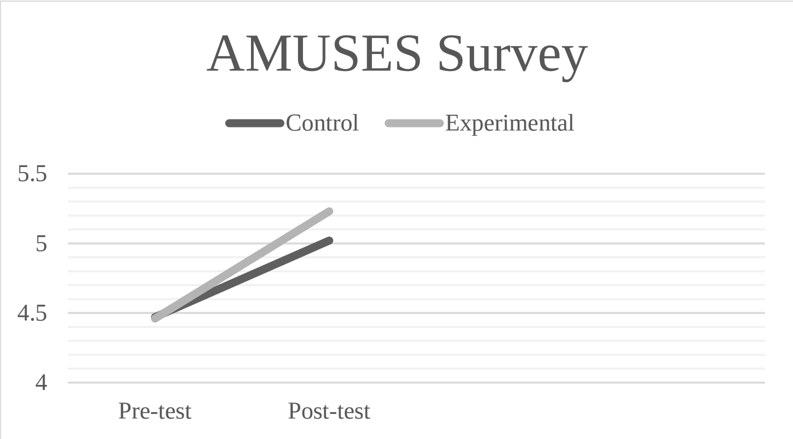

Figure 21: Comparison of Mean between Pre- and Post-test Results

Figure 22 presents the mean difference between pre- and post-test results for both groups, clearly showing a greater increase for the experimental group.

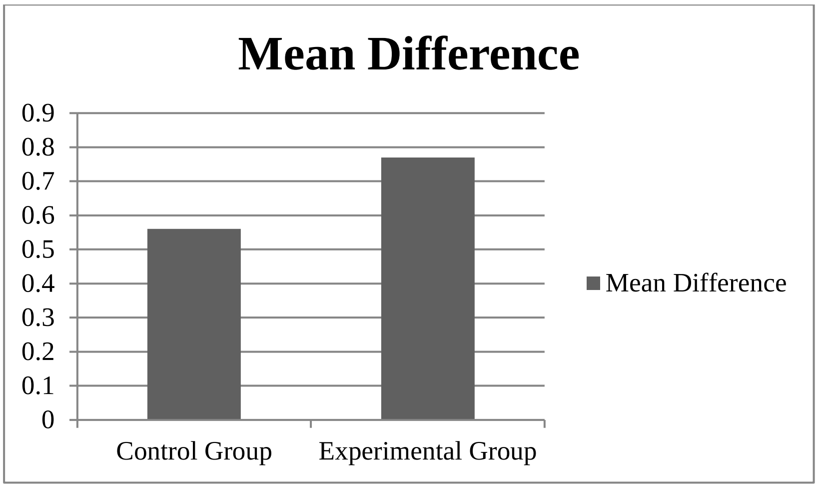

Figure 22: Mean Difference between Pre- and Post-test Results

Figure 23 presents Cohen’s *d* comparisons between the overall mean differences for the control and experimental groups.

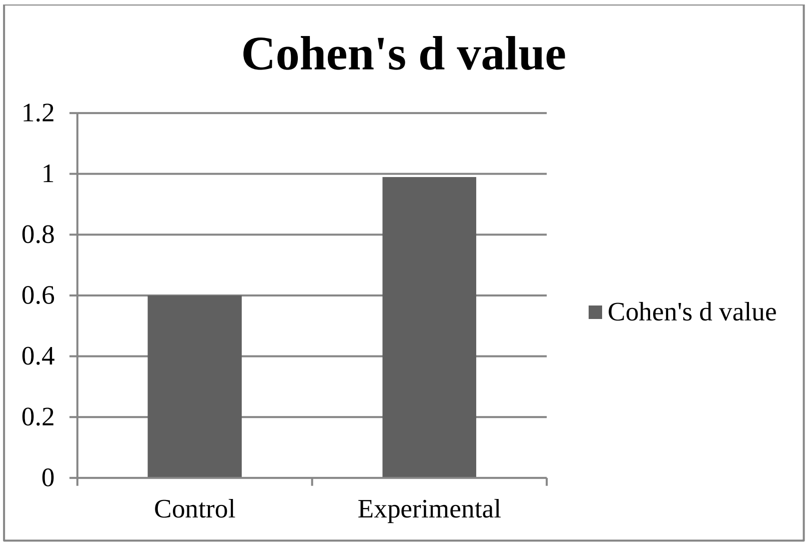

Figure 23: Cohen’s *d* Comparison between Control and Experimental Scores

These results indicate that the impact of technology in improving pre-service teacher’s levels of self-efficacy was not due to chance or luck (Allen & Bennett, 2008). Both the control and experimental groups’ pre-test scores of 4.47 and 4.46 respectively (on a 7-point scale) indicated moderate levels of self-efficacy prior to the commencement of the study and moderately higher levels on completion (5.02 and 5.23 respectively). In view of Holden and Button’s (2006) report on music as the teaching area with the lowest confidence for pre-service teachers, the results of this study suggest self-efficacy was higher than the low levels reported in the literature (Garvis, 2013; Jeanneret & Stevens-Ballenger, 2013; Lowe et al., 2017; Russell-Bowie, 2002; Sinclair et al., 2012). Whilst not ideal, the technology intervention did appear to have a positive impact on the self-efficacy levels of participants and offered general support that improved pre-service teachers’ levels of self-efficacy to teach music.

6.2.2 Survey Parts A and B

The overall pre- and post-test survey results indicated a more positive impact of technology and increased self-efficacy ratings for the experimental group than for the control group. There were three sections to the AMUSES survey: Part A focused on self-beliefs in musical competence; Part B focused on teaching confidence, and Part C examined aptitude and attitude to teaching music. As noted by Bandura (1986), competence requires not only skills but also confidence to put these skills into practice. Accordingly, Parts A, B and C investigated domain specification and causality, gradations of challenge, content validity and perceived collective efficacy (Bandura, 1986, 2006). Table 34 compares the results of the different parts of the survey for the two groups.

Table 34: *Comparison of Control and Experimental Group Pre- and Post-test Means: Parts A, B and C of AMUSES Survey*

Paired Sample Statistics

			Mean	N	Std. Deviation	Std. Error Mean
PART A SURVEY N = 46	Pair 1	Control - Pre	4.5540	46	1.11592	.16453
		Control -Post	5.2745	46	1.04231	.15368
N = 50	Pair 2	Experi-Pre	4.4600	50	.94068	.13303
		Experi-Post	5.3200	50	.84518	.11953
PART B SURVEY N = 46	Pair 3	Control-Pre	4.2368	46	1.21492	.17913
		Control-Post	5.0353	46	1.02119	.15057
N = 50	Pair 4	Experi-Pre	4.2904	50	.91987	.13009
		Experi-Post	5.3150	50	.84146	.11900
PART C SURVEY N = 46	Pair 5	Control-Pre	5.2663	46	.90431	.13333
		Control-Post	5.4511	46	1.01738	.15000
N = 50	Pair 6	Experi-Pre	5.2900	50	.99278	.14040
		Experi-Post	5.9389	50	.82578	.11678

Part A, domain specification and gradations of challenge, investigated self-beliefs about musical skills; for example, simple clapping in time (beat), clapping simple rhythms and singing in tune (pitch), before exploring more complex task-related beliefs like compositional and creative work. For the control group, the module experience alone improved results ($t = -3.108$, $p = .003 < 0.05$). However, the experimental group, with the technology intervention, had a greater increase ($t = -6.129$, $p < .001$). Moreover, relevant histograms indicated the normality of score assumptions was not violated for either group. A comparison of Part A pre- and post-test results for both groups is presented in Figure 24.

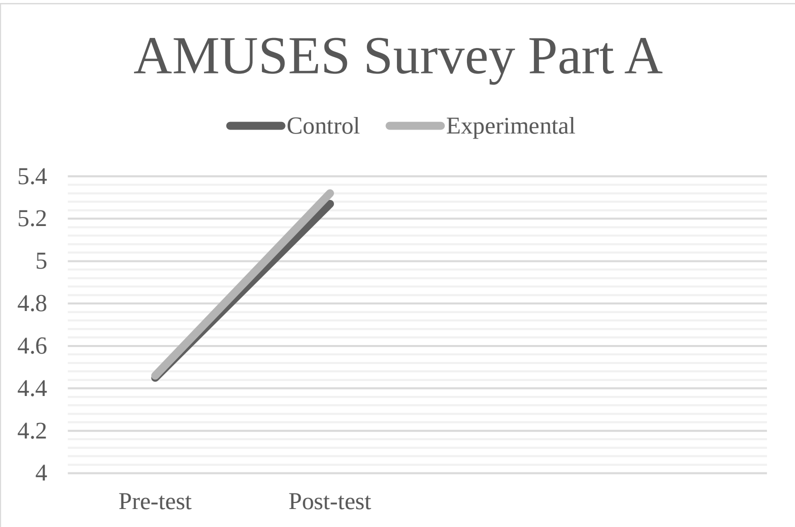

Figure 24: Comparison of Pre- and Post-Test Mean: Survey Part A

Part A of the survey indicates the experimental group had a slightly higher increase than the control group for belief in their musical competency levels. Figure 25 illustrates the mean difference in pre- and post-test results.

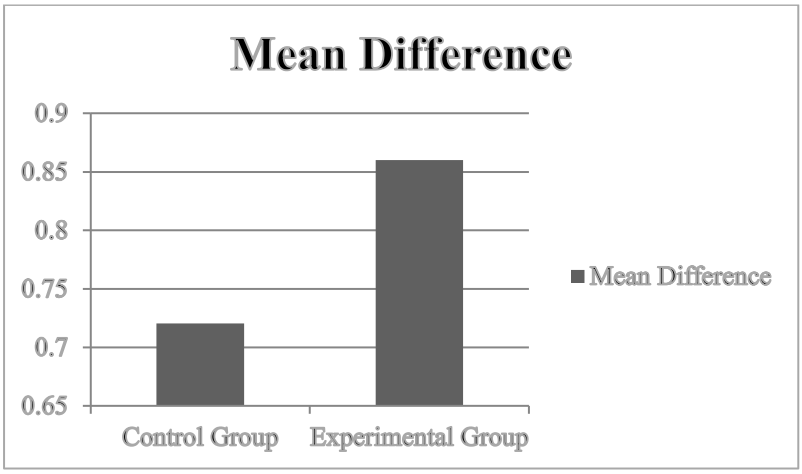

Figure 25: Mean Difference between Pre- and Post-test Results Part A

Cohen's *d* was used to further assess the difference between pre- and post-test means of the control and experimental groups, illustrating a greater increase for the experimental group as presented in Figure 26.

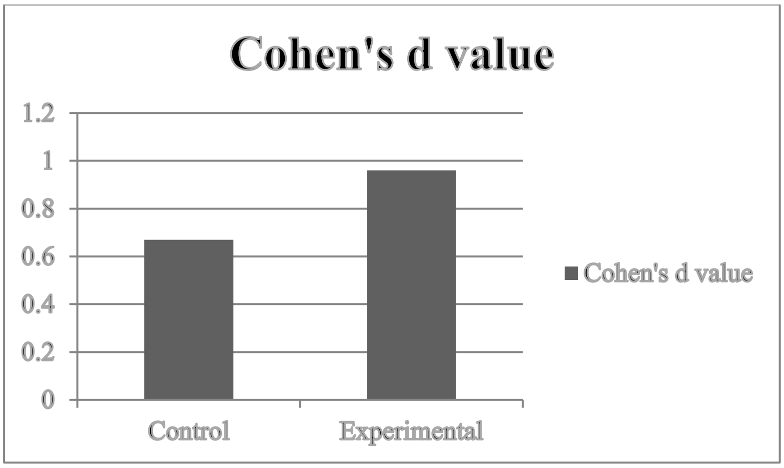

Figure 26: Cohen's *d* Comparison between Control and Experimental Groups: Survey Part A

The control group returned a score above the medium range (*d* = 0.6), while the experimental group achieved a high-range score (*d* = .98). This difference in Cohen's *d* values confirmed the experimental group's statistically greater improvement in their musical competency self-belief.

Part B of the survey contained questions about participants' self-beliefs in their ability to teach simple concepts, and addressed self-efficacy causality; that is, whether self-efficacy in music skills translates into self-efficacy for teaching these skills (Bandura, 2006). These questions were designed in parallel with part A, for example, question three in part A asked if the participant could "clap a simple rhythm", while the equivalent question in part B asked participants if they believed they could "lead a class in clapping a simple rhythm". This was intended to provide an indication of competence along with confidence to teach music (Wiggins and Wiggins, 2008). While the difference between the pre-and post-test scores for the control group was not significant (t = -3.506, p = .296), the experimental group responses (t = -7.954, $p < .001$) indicated a greater increase in their self-belief to teach some musical elements. A comparison of pre- and post-test means for both groups is shown in Figure 27.

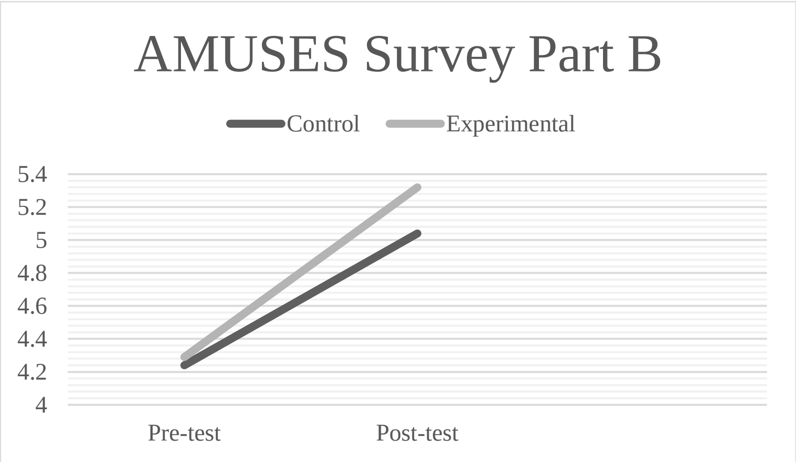

Figure 27: Comparison of Means between Pre- and Post-test Results: Survey Part B

The greater increase in the experimental group's self-efficacy to teach is indicated in Figure 28, which illustrates the mean difference between pre- and post-test results.

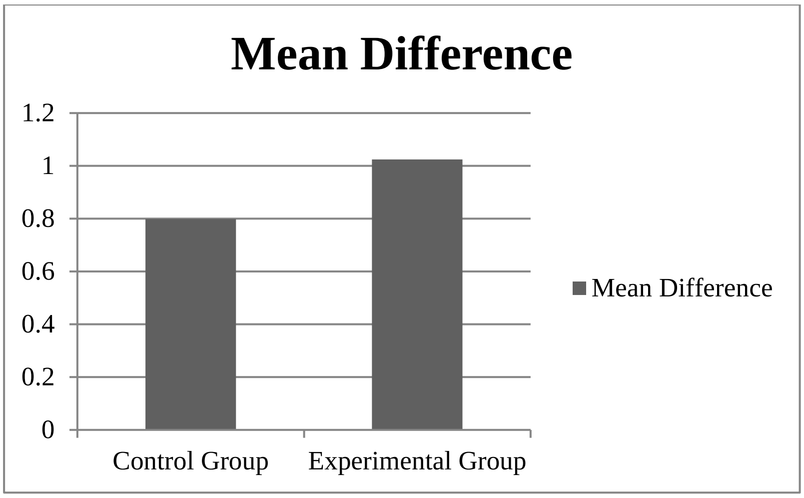

Figure 28: Mean Difference between Pre- and Post-test Results Part B

Cohen's *d* was applied to both groups in Part B to assess the difference between pre- and post-test means of the control and experimental group. The result was a greater increase for the experimental group as presented in Figure 29.

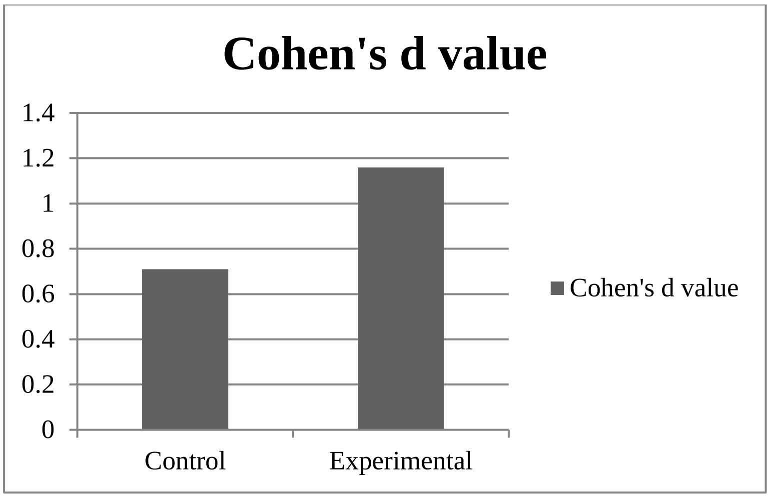

Figure 29: Survey Part B: Cohen's *d* Comparison between Control and Experimental Groups

The control group returned a score well above the medium range ($d = 0.71$), while the experimental group's results were significantly greater and well above the high range ($d = 1.16$), a further indication that the technology intervention fostered the experimental group's self-belief in musical teaching skills.

6.1.3 Comparison between Questions Parts A and B

Part A of the survey investigated domain specification in parallel with Part B which investigated self-efficacy levels to teach music. A comparison between part A (questions 1 -

10) and part B (questions 11- 20) provided insights into participants' perceptions about their strengths and weaknesses; and the progress achieved by completing the study module, as well self-efficacy multi-causality in the transfer of music skills to teaching skills (Bandura, 2006). Both parts A and B contained gradations of challenge, with more complex skills explored as the survey progressed (Bandura, 2006). The survey utilised a 7-part Likert scale, and for discussion purposes, mean at the mid-point of 4 is described as medium, means above 4 as moderately high, above 5 as high and above 6 as very high. Conversely, means below 4 are described as moderately low, below 3 as low and below 2 as very low. Part A and B paired questions are shown in Table 35, together with their gradations of challenge.

Table 35: *Parts A and B Comparison of Paired Questions*

AMUSES Survey Part A	AMUSES Survey Part B
1. I consider myself to be musically skilled.	11. I think I have the basic skills to be able to teach some music in a classroom.
2. I consider myself to be musically creative.	12. I am not confident enough to be able to incorporate music into creative classroom activities.
3. I can clap a simple rhythm.	13. I believe I could lead a class in clapping simple rhythms.
4. I cannot clap in time with music.	14. I don't believe I can teach a class how to write simple rhythms.
5. I can read and write simple rhythms.	15. I think I could teach my class to read and write music.
6. I can sing a well-known song.	16. I would be happy to lead a classroom of children in singing a song.
7. I cannot sing in tune.	17. I do not have the confidence to be able to sing in front of any classroom of children.
8. I can create simple pieces of music.	18. I think I could teach my class how to create simple pieces of music.
9. I don't know how to put musical ideas down on paper.	19. I would not be able to facilitate a lesson where children put musical ideas down on paper.
10. With practice I can become more musically skilled.	20. With practice I could become skilful enough to teach music in a classroom.

Question 1 examined participants' self-perceptions of musical skills, while question 11 examined participants' beliefs about teaching basic musical skills. The mean change for the control group (1.26) showed a small improvement, but the average mean post-test was still moderately low at 3.98. Similarly, the mean change for the experimental group (0.78), indicated a small improvement in self-belief, but again, the mean post-test was medium at 4.1.

When compared with question 11, the mean difference for the control group (1.35) showed a small improvement in self-belief to teach music, as against 1.29 for the experimental group. Interestingly, the post-test mean was moderately high for both the control and experimental groups (5.39), suggesting both groups' general beliefs about their music skills and teaching skills increased slightly after completing the music module. The differences are shown in Figure 30.

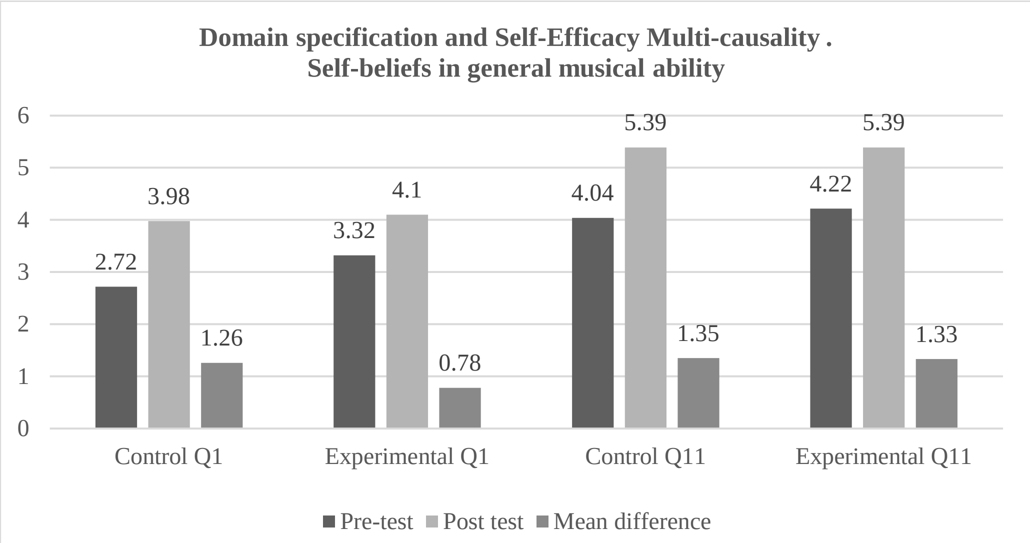

Figure 30: Comparison of Pre- and Post-Test Means for Questions 1 and 11

Question 2 and 12 were also general questions examining participants' self-beliefs in their musical creativity and whether they would incorporate music into their classroom activities. The results were similar to questions 1 and 11. For question 2, the mean difference for the control group (1.6) indicated a small improvement in musical creativity self-belief, compared with 1.16 for the experimental group. The post-test mean for both groups was moderately high (control group = 4.15, experimental group = 4.36). When compared against question 12, the mean difference for the control group (1.33) indicated a small improvement as did 1.52 for the experimental group. The post-test mean for both groups was again moderately high (control group = 5.72, experimental group = 5.76), suggesting that both groups experienced small improvements in their general beliefs towards music creativity. However, the experimental group indicated a marginally stronger response for creative music teaching, offering a degree of verification to the support of technology for creative learning in education (Acker et al., 2015; Kardos, 2012; Kraus, 2012; Webster, 2016a, 2016b; Williams & Webster, 2006). The results are presented in Figure 31.

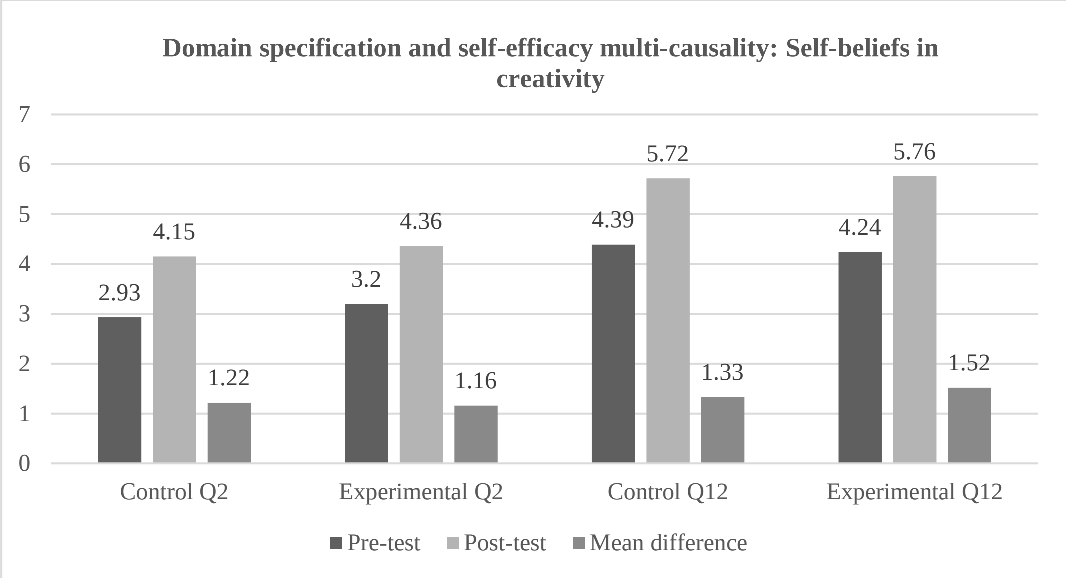

Figure 31: Comparison of Pre- and Post-test Means for Questions 2 and 12

Questions 3 to 7 examined participants' self-beliefs in relation to specific musical skills (beat, rhythm and pitch), while questions 13 to 17 investigated their self-beliefs to teach these skills. Control group mean differences, post-test mean, and significance are presented in Table 36.

Table 36: *Control Group Mean Differences, Post-test Mean and Significance for Questions 3 to 7 and 13 to 17*

CONTROL GROUP							
Music skills				Teaching music skills			
N=46	Mean Pre-Post test	Mean diff.	Sign.		Mean Pre-Post test	Mean diff.	Sign.
Rhythm/Beat (Q3)	6.02-6.17	0.15	.483*	Rhythm/Beat (Q13)	5.89-6.13	0.24	.323*
Rhythm/Beat (Q4)	6.11-6.41	0.3	.257*	Rhythm/Beat (Q14)	3.87-5.02	1.15	.002*
Notation (Q5)	3.11-4.39	1.28	.001*	Notation (Q15)	3.07-4.0	0.93	.011*
Singing General (Q6)	5.57-5.82	0.25	.392*	Singing General (Q16)	5.02-5.39	0.37	.264*
Singing Skills (Q7)	4.14-4.57	0.43	.330*	Singing Skills (Q17)	4.47-5.52	0.78	.225*

The control group's post-test mean for questions 3 to 7 were very high for simple beat and rhythm (6.17 and 6.41); moderately high for writing simple notations (4.39); and high for singing (5.82). Interestingly, while all mean differences were small, self-belief in writing music notation showed the only statistically significant increase. Similarly, for questions 13 to 17 teaching music notation showed a medium mean of 4.0 at the post-test stage. However, teaching beat produced a very high post-test mean (6.13); teaching rhythm had a high mean (5.02); as did teaching singing (5.39 and 5.52). There was a statistically significant increase in teaching notation, along with rhythmic teaching self-belief ($p < .05$); and no statistically significant increases for teaching singing. Overall, the results indicated that after completion of the music module, the control group showed some improvement in self-efficacy for writing simple notations and simple singing skills. The experimental group's mean difference, post-test mean, and significance are presented in Table 37.

Table 37: *Experimental Group Mean Difference, Post-Test Mean and Significance for Questions 3 to7 and 13 to 17*

EXPERIMENTAL GROUP							
Music skills				Teaching music skills			
N=50	Mean Pre-Post test	Mean diff.	Sign.		Mean Pre-Post test	Mean diff.	Sign.
Rhythm/Beat (Q3)	5.78-6.42	0.64	.000*	Rhythm/Beat (Q13)	6.0-6.3	0.3	.000*
Rhythm/Beat (Q4)	5.7-6.36	0.66	.003*	Rhythm/Beat (Q14)	3.98-5.38	1.4	.062*
Notation (Q5)	3.5-4.94	1.44	.000*	Notation (Q15)	3.32-4.0	0.68	.008*
Singing general (Q6)	5.14-5.68	0.54	.038*	Singing general (Q16)	5.26-5.68	0.42	.126*
Singing skills (Q7)	4.02-4.68	0.66	.079*	Singing skills (Q17)	3.78-5.56	1.78	.000*

The experimental group's post-test means for questions 3 to 7 were very high for beat and rhythm (6.42 and 6.36); moderately high for writing simple notation (4.94); high for general singing (5.68); and moderately high for singing in tune (4.68). While all mean differences were small, there were statistically significant increases for rhythm, beat and writing music notation skills ($p < .05$) but not for singing skills, which is consistent with the control group's responses. In relation to questions 13 to 17, the post-test mean for teaching music notation was moderately high (4.94); teaching beat was very high (6.3); teaching rhythm was high (5.28); and teaching singing was high (5.68 and 5.56). Teaching notation, rhythm and beat were all statistically significant ($p < .05$).

The results indicated that after completing the music module, the experimental group had a statistically significant improvement in self-efficacy for writing and teaching simple notations, along with rhythm and beat, and teaching rhythm and beat. Despite an anomaly in there being no statistical change for facilitating general singing as opposed to teaching singing skills, the responses suggest the music module had a greater impact on the self-efficacy belief of the experimental group over the control group, particularly in teaching rhythm and beat. This finding appears to indicate that the looping technology intervention increased self-efficacy levels in rhythmic music ability as well as teaching rhythmic music skills, and aligns with other reported benefits of looping technologies for engaging and motivating the learning of basic skills in a practical and authentic manner (Gouzouasis, 2005; Kuzmich, 2012; Uer et al., 2017; Zhukov, 2015). The differences between mean scores is visually summarised in Figure 32 and highlights the greater improvement in experimental group ratings.

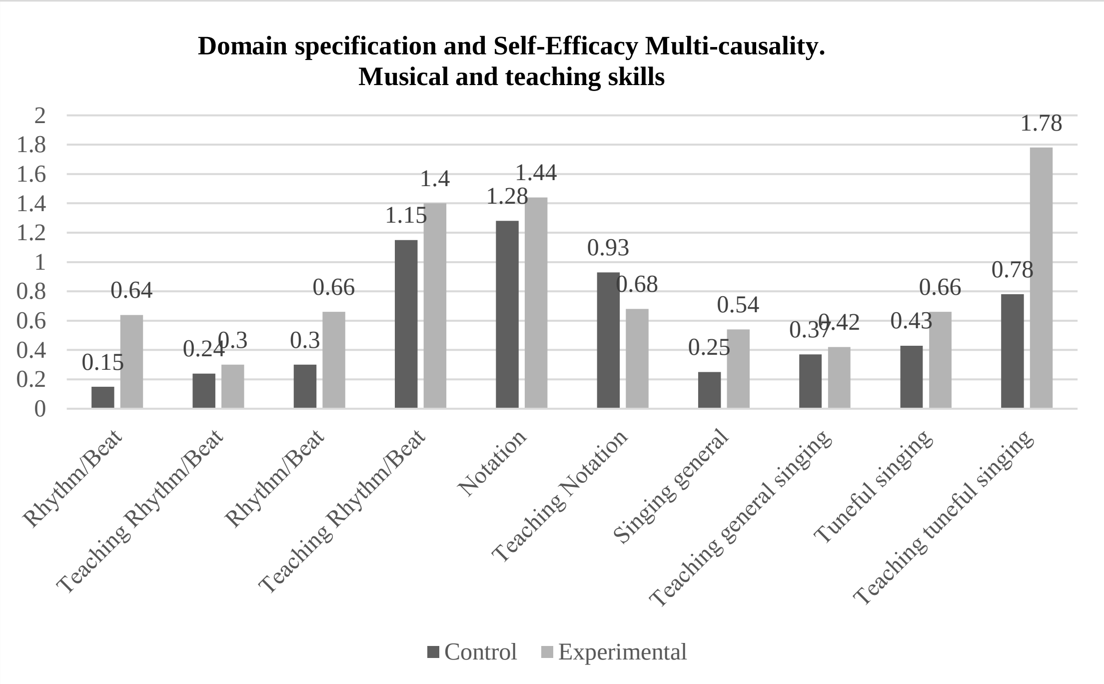

Figure 32: Control and Experimental Mean Differences for Musical and Teaching Skills

6.2.3.1 Gradations of Challenge

Questions 3 to 7 elicited responses in relation to basic musical skills, while questions 8 and 9 investigated gradations of challenge for more complex skills required to create music and notate musical ideas (as opposed to notating simple rhythms) (Bandura, 2006). Questions 18 and 19 examined self-beliefs in teaching students to create music and notate musical ideas, and questions 10 and 20 examined beliefs about challenges to extending music and music teaching skills in the future.

Question 8 explored participants' responses to creating music. The control group's mean difference (1.24) was statistically significant, with a moderately high post-test mean of 4.48. When paired against question 18 (teaching students to create music), the control group's mean difference (1.09) was statistically significant, while the post-test mean was moderately high at 4.46. The experimental group's results were broadly similar. Question 8 returned a statistically significant mean difference of 2.04, and a moderately high post-test mean of 4.22. In the same vein, question 18 returned a statistically significant mean difference (1.32) and a moderately high post-test mean (4.94). These results indicate lower self-efficacy levels for creating and teaching creative music, than for basic music skills and teaching the latter. While there were statistically significant post-test improvements in creative skills, self-efficacy levels for teaching remained quite low. However, the experimental group results indicated a small improvement over the control group. Pre- and post-test means and mean differences for questions 8, 9, 18 and 19 are presented in Figure 33.

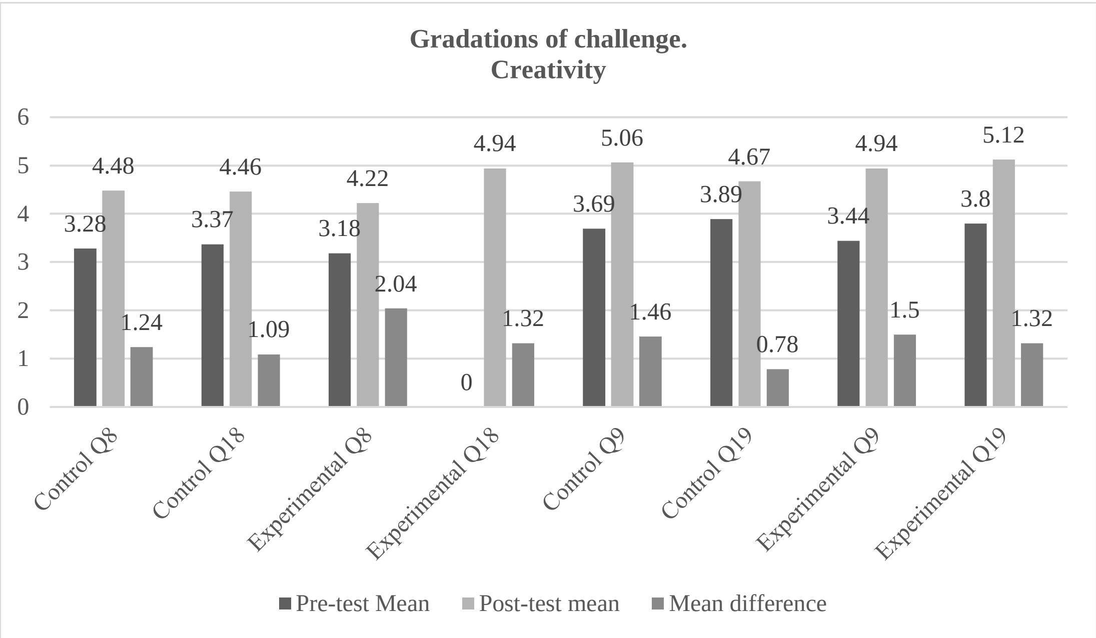

Figure 33: Pre- and Post-test Means and Mean Differences for Questions 8,9,18 and 19

In support of the literature, the findings of this study suggest looping technology may have a positive influence on the creative process (Acker et al., 2015; Kuzmich, 2012; Webster, 2016b; Williams & Webster, 2006). This implies that ICT can be used as a constructivist tool for "learning with" and "learning through" technologies (Stewart et al., 2010, p. 10) to support the creative learning process (Kardos, 2012).

Questions 10 and 20 looked at beliefs about music teaching in the future. Question 10 investigated whether participants believed they could improve their musical skills with practice, and question 20 examined whether participants believed that, with practice, they could become better music teachers. Control group responses for question 10 returned a statistically significant mean difference of 0.61, and a high post-test mean 5.91. The mean difference for question 20 was not statistically significant at 0.24, returning a high post-test mean of 5.5.

The experimental group returned a statistically insignificant mean difference (0.38), and high post-test mean of 5.88 for question 10. Question 20 produced a statistically significant mean difference (0.82) and a high post-test mean of 5.58.

These results suggest both groups held moderately high self-efficacy beliefs in their ability to improve their skills and their teaching with practice, in the future. While the control group showed a greater increase for developing musical skills, the experimental group indicated a greater improvement in belief about improving their teaching skills with further practice. Pre- and post-test means and mean differences for these items are presented in Figure 34.

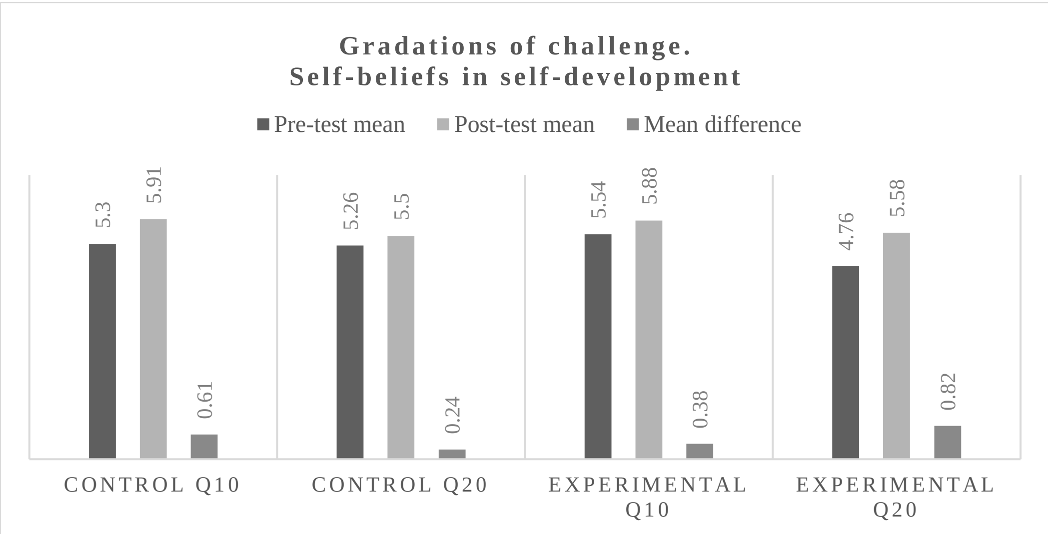

Figure 34: Pre and Post-test Means and Mean Differences for Questions 10 and 20

In summary, the experimental group's self-belief in their ability to master gradations of challenge increased more than the control group's after participating in the music module. However, overall, both groups only returned self-efficacy ratings in the moderate range.

6.2.4 Survey Part C

Teaching is a demanding occupation and requires resilience beyond mere basic competencies, whereby teachers need to call on subskills to manage often stressful and unpredictable scenarios (Bandura, 1986; Gu & Day, 2007; Le Cornu, 2009). Part C of the AMUSES survey investigated operative efficacy in a perceived collective belief that success is possible (Bandura, 1986, 2006). For example, question 22 looked for evidence of fear of failure; and question 26 looked for indications of adaptability and willingness to attempt to teach music at all. Importantly, the control group's scores indicated lower levels of adaptability and willingness to improve their teaching skills as compared with medium-high levels in the experimental group. For the control group, results were significantly different ($t = -3.696$, $p = .001 < .05$), and in the low range. For the experimental group, the results were also significantly different ($t = -3.368$, $p = .001 < 0.05$) but well above the medium range.

This may be an indication of the potential of technology to foster skill development, in turn leading to greater willingness and adaptability to teach music in the long-term. Pre- and post-test means for these items are presented in Figure 35.

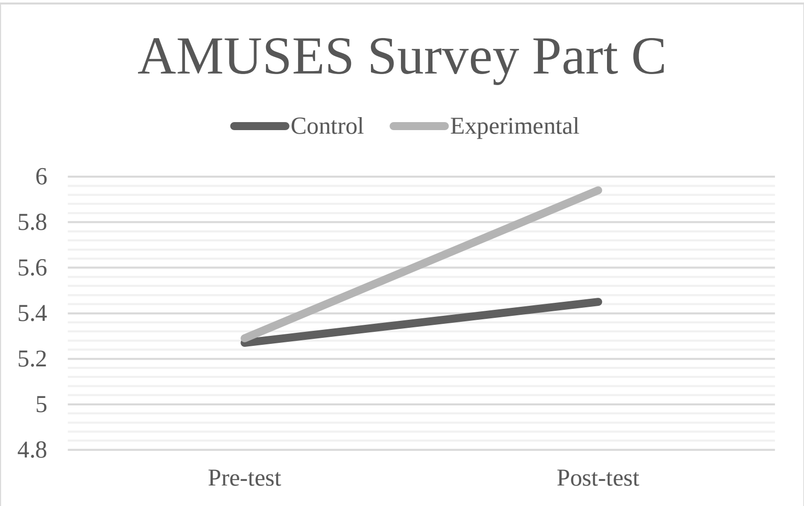

Figure 35: Survey Part C - Comparison of Pre- and Post-test Means

Mean differences for these items are presented in Figure 36 and highlights the greater increase for the experimental group.

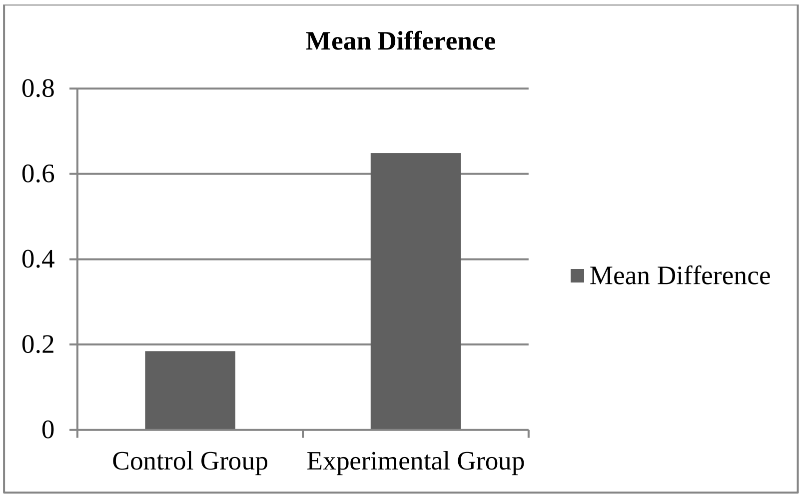

Figure 36: Mean Differences of Pre- and Post-test Results Part C

Cohen's *d* was applied to part C of both groups to assess differences between pre- and post-test means between them, and as shown in Figure 37, highlights a greater increase in the experimental group.

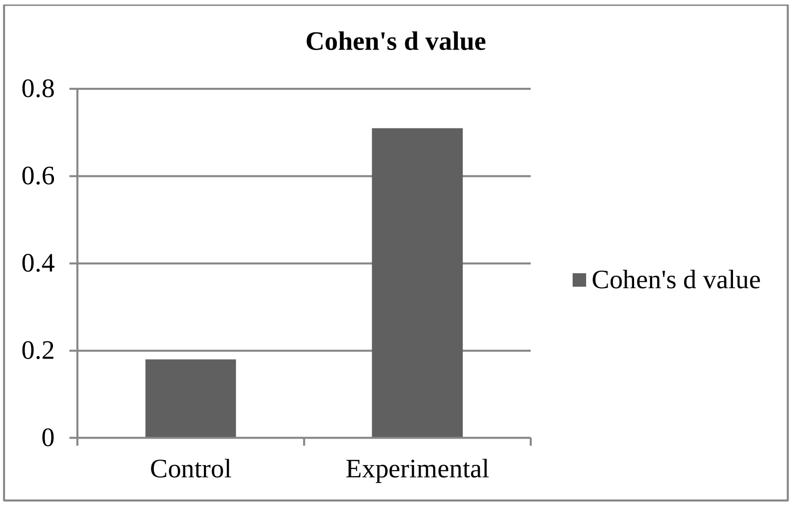

Figure 37: Cohen's *d* Comparison between Control and Experimental Scores for Part C

The difference between Cohen's *d* values confirmed that the experimental group registered a greater significant increase in their attitude and aptitude to music teaching.

6.2.5 Examination of Questions in Part C

Examining individual and groups of questions in part C of the AMUSES survey offered rich insights into the operative efficacy and collective self-efficacy beliefs of both groups (Bandura, 2006). These are discussed below.

6.2.5.1 Operative Efficacy

Questions 21 and 25 to 28 investigated beliefs about participants' abilities to overcome obstacles and take risks in teaching music:

21 - The fear of failure will prevent me from attempting to teach any music in a classroom.
25 - I will use music in different ways to create a friendly and stimulating learning environment.
26 - I will probably only play music in the background.
27 - I would be happy to incorporate music into my teaching.
28 - I believe music is too difficult a subject for me to teach.

For question 21, the control group returned a statistically insignificant mean difference (0.52) and a moderately high post-test mean (5.26). The experimental group returned a statistically significant mean difference (0.83) and a moderately high post-test mean (5.69). Overall, the results suggested that, while the control group maintained a moderate level of self-efficacy in overcoming fear of failure, the experimental group improved their self-efficacy in overcoming fear of failure to a moderately high level.

Question 25 investigated the willingness of participants to use music for creating friendly and stimulating learning environments. The control group returned a statistically insignificant mean difference (0.24) and a moderately high post-test mean (5.63); while the experimental group returned a statistically significant mean difference (0.68) and a moderately high post-test mean (5.76). These results revealed the control group maintained a moderately high willingness to use music for creating stimulating learning environments, while the experimental group increased their self-efficacy levels in this area to a moderately high level.

Similarly, question 26 looked at whether participants would use music in ways other than merely in the background. The control group returned a statistically insignificant mean difference (-0.34) and a medium post-test mean (4.74). The experimental group returned a statistically insignificant mean difference (0.44) and a moderately high post-test mean (5.52). This suggests that the experimental group maintained a moderate level of self-efficacy related to using music in ways other than merely in the background; while the control group exhibited lower levels of self-efficacy.

Questions 27 and 28 examined participants' self-beliefs in their levels of comfort to teach music. For question 27, the mean difference for the control group (0.11) was not statistically significant, with a moderately high post-test mean (5.72). Similarly, the mean difference for the experimental group (0.19) was not statistically significant, with a moderately high post-test mean (5.77). Both groups therefore maintained roughly comparable comfort levels of self-efficacy.

For question 28, the control group mean difference (-0.09) was statistically insignificant, with a moderately high post-test mean of 5.00; as was the mean difference for the experimental group (0.55) with a moderately high post-test mean (5.61). The results show that the control group maintained a moderately high level of self-efficacy, while the experimental group marginally increased their self-efficacy slightly from moderately high. Pre- and post-test means and mean differences for these items are presented in Figure 38.

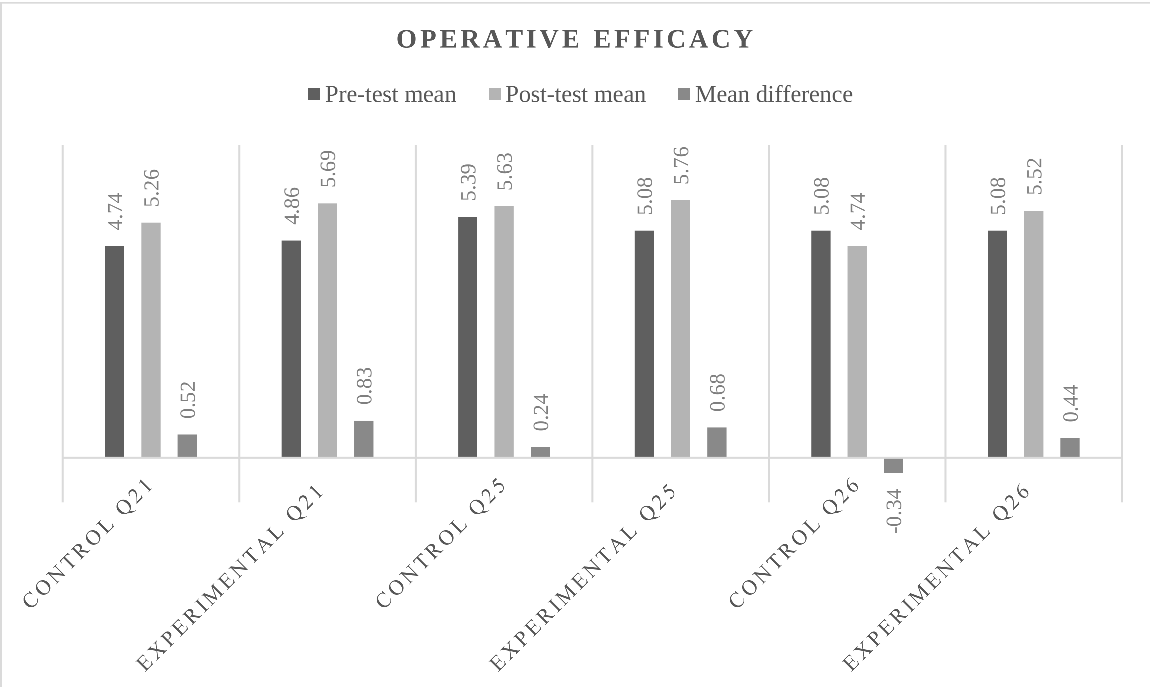

Figure 38: Pre- and Post-test Means and Mean Differences for Questions 21, 25, 26, 27 and 28

Question 29 explored participants' beliefs in further training to enable their teaching of music. The mean differences for both groups (control = -0.15, experimental = - 0.13) were not statistically significant; with the control group returning a moderately high post-test mean of 5.48, and the experimental group, moderately higher at 5.65. These results indicate that both groups' moderately high levels of self-efficacy in their capacity to improve their music teaching remained largely unchanged.

Question 24 examined an increased desire of participants to improve their music teaching skills. The mean differences for both groups (control = 0.35, experimental = -0.04) were not statistically significant. The control group returned a low post-test mean (3.2) compared with the experimental group (2.96). The results show both groups maintained low levels of self-efficacy to upskill in music teaching, effectively unchanged from pre- to post-test.

Overall, the findings indicated moderate levels of resilience and self-beliefs to teach music in both groups, and no real improvement after participating in the music module; as well as low levels of self-efficacy to upskill, which remained unchanged from pre- to post-test. However, it is possible that this may change with longer interventions.

6.2.5.2 Perceived Collective Efficacy

Questions 22, 23 and 30 explored an inherent belief that only music specialists should teach music. The questions were:

Q22 - I am hoping that there will be a music specialist in my school so I won't have to teach any music at all.

Q23 - I am hoping to teach music in my classroom whether or not there is a school music specialist.

Q30 - Generalist teachers should not be expected to teach specialist subjects like music.

Responses to questions 22 and 23 hinted at participants' self-beliefs about their confidence to teach music, despite having a music specialist in the school; while question 30 investigated a collective belief that generalist teachers should or should not be expected to teach music. For question 22, the mean differences for the control group (0.44) and the experimental group (0.38) were not statistically significant. The post-test mean for the control group at moderately high (5.26) and the experimental group at moderate (4.12) suggested little change, the former maintaining a moderately high level of self-efficacy and the latter, low self-efficacy. No reason for this difference between groups were apparent from the survey.

Conversely, for question 23, the mean difference for the control group (0.35) was not statistically significant, while the mean difference for the experimental group (0.73) was statistically significant. The control group returned a medium post-test mean of 4.8 compared with a moderately high experimental group post-test mean (5.01), indicating greater willingness on the part of the experimental group to teach music regardless of the presence of a music specialist teacher or not.

Results for questions 22 and 30 showed little change. The mean differences between groups (control = -0.41, experimental = -0.29) were statistically insignificant. The control group returned a medium post-test mean (4.7) as compared with the experimental group's moderately high post-test mean (5.39). While largely unchanged, the findings suggest the experimental group was marginally more positive about generalist teachers teaching music. Pre- and post-test means and mean differences for these items are shown in Figure 39.

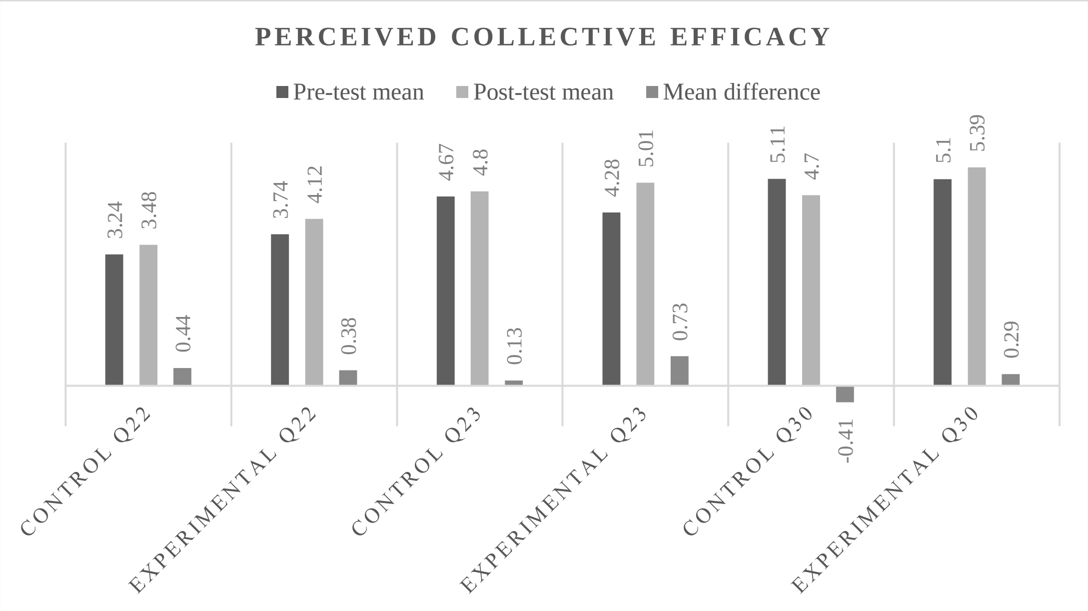

Figure 39: Pre- and Post-test Means and Mean Differences for Questions 22, 23 and 30

In summary, the results suggest the groups maintained largely unchanged and moderate-range efficacy ratings regarding generalist teachers teaching music in schools, with the experimental group rating slightly more positive. After applying Cohen's *d* across the three stages of the survey, see Figure 40, a clearer indication of the subtle differences in ratings between the groups became apparent. In general, Cohen's *d* confirmed a slightly more positive outlook for the experimental group.

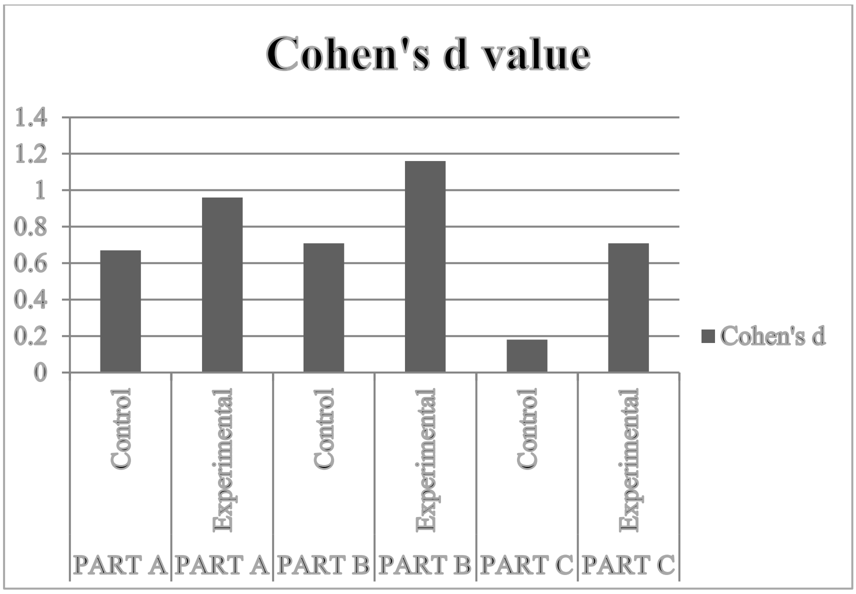

Figure 40: Cohen's *d* Comparison of Survey Parts A, B and C

6.2.6 Summary

The results indicated a concurrent improvement in skills and teaching self-beliefs for both groups over the course of the music module. As music skills increased, so did music teaching efficacy. There also appeared to be a marginal increase in operative efficacy for music teaching in both groups. In the context of this study, the higher self-reported increase in the experimental group in terms of skills and teaching efficacy, may suggest a greater level of confidence and competence of experimental group members to teach music after graduation.

While both groups exhibited some improvement in their levels of self-efficacy to teach music, the technology intervention for the experimental group appeared to have increased self-efficacy to a greater extent. Therefore, it can reasonably be concluded that the music looping technology intervention had a positive impact upon pre-service generalist primary teachers' self-efficacy to teach music, particularly in the area of creative and compositional work.

Despite reported levels of moderate post-test self-efficacy located at the 5-point mark on a 7-point Likert scale, the level of improvement was encouraging. While these results were not unequivocal, they did allow the researcher to answer the first research question in the affirmative, particularly in comparison with the control group, confirming a positive impact of looping technology intervention.

The next two research stages involved gathering qualitative data in a practicum setting that allowed for in-practice observation and contributed depth and understanding to the findings.

6.3 Stage Two: Qualitative Observations in the Field

Stage two of the study involved video capture in the field. Answering the second research question required gathering evidence about pre-service teachers' self-efficacy in a practicum setting after completing the music looping technology intervention. Qualitative data were collected via video capture in a familiar situation (Derry et al., 2010; Johnson & Onwuegbuzie, 2004), aimed at observing the transfer of musical skills and enhanced self-efficacy in teaching practice in the field (Castellan, 2010).

Video capture occurred in semester two, 2013, and involved 41 third-year pre-service teachers in the experimental group out of a total cohort of 52, who volunteered for the second stage. Only pre-service teachers from the experimental group were invited to participate since the research was aimed at investigating the results of the looping technology as evidenced in the field. Of the group, 26 pre-service teacher participants were captured on video, determined by where they situated themselves in the classroom.

6.3.1 Domain Specification and Gradations of Challenge

Specifications for music teaching were broken down into elements of beat, rhythm, pitch, tempo, dynamics, harmony, timbre, singing and composition. The levels of challenge undertaken by pre-service teachers assisted with establishing a framework for gauging self-efficacy; indicators being their choice of taking the safer option and teaching basic elements or having the confidence to be more adventurous in their teaching. Coding was described in chapter five. The results of music teaching self-efficacy indicated that four pre-service teachers opted for a low range of difficulty (0-4); nine were in the moderate range; and thirteen were in the high range (6 -10). The results are shown as percentages in Figure 41.

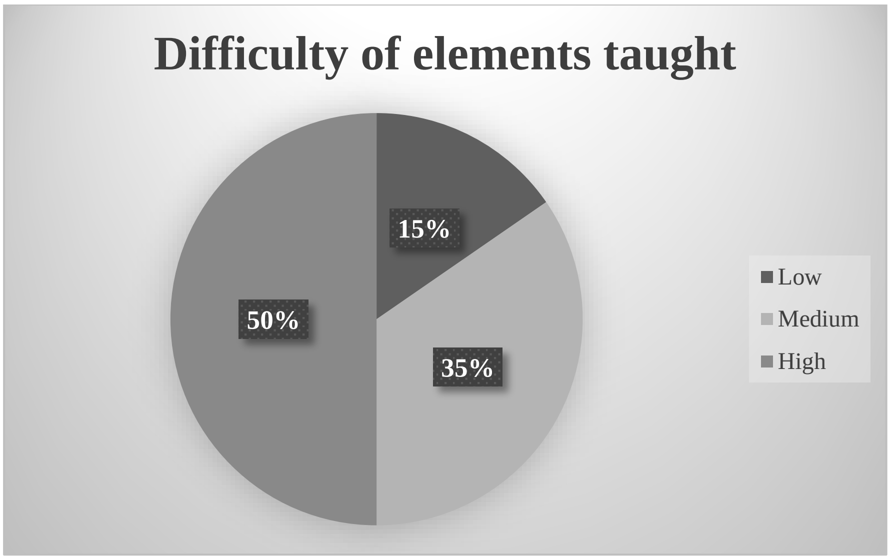

Figure 41: Range of Efficacy Levels Based on Degree of Difficulty of Teaching Elements

Figure 41 shows the majority of participants chose moderate to high levels of difficulty for tasks undertaken (Bandura, 1994), video analysis providing the main source of observation for gradations of challenge. Importantly, 10 out of the 26 pre-service teachers encouraged creative work by facilitating compositional tasks with their students, supporting the findings from part B of the survey data that evidenced increased teaching self-efficacy from the looping technology intervention, particularly in the facilitation of creative music activities. All pre-service teachers facilitated some form of rhythmic and beat activities in line with part A of the survey, once again implying that the looping technology intervention may have contributed to observable improvements in self-efficacy beliefs about musical abilities.

6.3.2 Multi-causality

In the context of this study, multi-causality describes not only the types of activities being taught but also the effectiveness of the teaching; in other words, whether developing music skills influenced teaching music skills (Bandura, 1994). A variety of teaching strategies were examined, along with assessments of students' engagement and learning as discussed in chapter five. Assessed strategies included an introduction to the topic (motivation), free play, guided play, direct teaching, classroom discussion and conclusion (recapitulation) (Tumilty, 2017). Out of the participants, 21 were observed incorporating four to five teaching strategies; five of these incorporated three teaching strategies. The number of strategies used is presented in Figure 42.

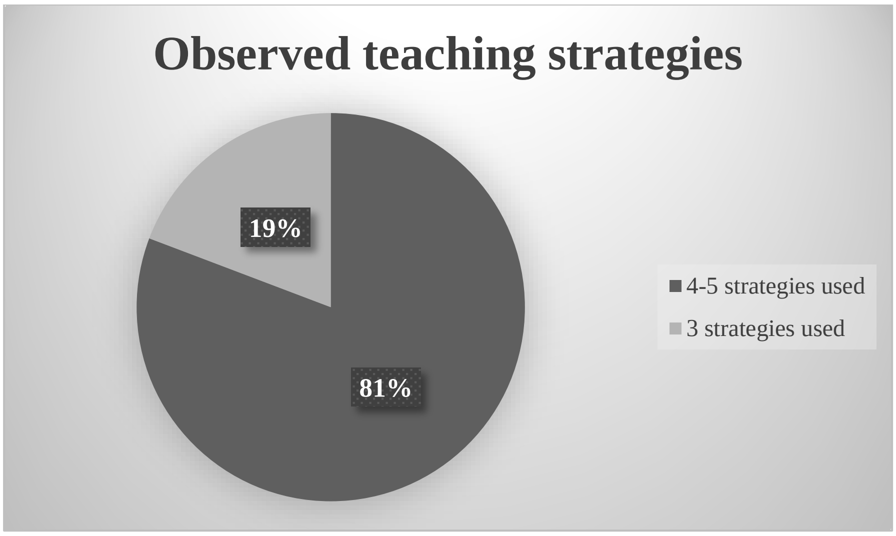

Figure 42: Number of Teaching Strategies Utilised

While this was a positive development, teaching strategy alone is ineffective if implementation results in poor student engagement (Ritchie & Williamon, 2011). Video evidence relating to levels of student engagement appeared very high throughout the lessons, as shown in Figure 43.

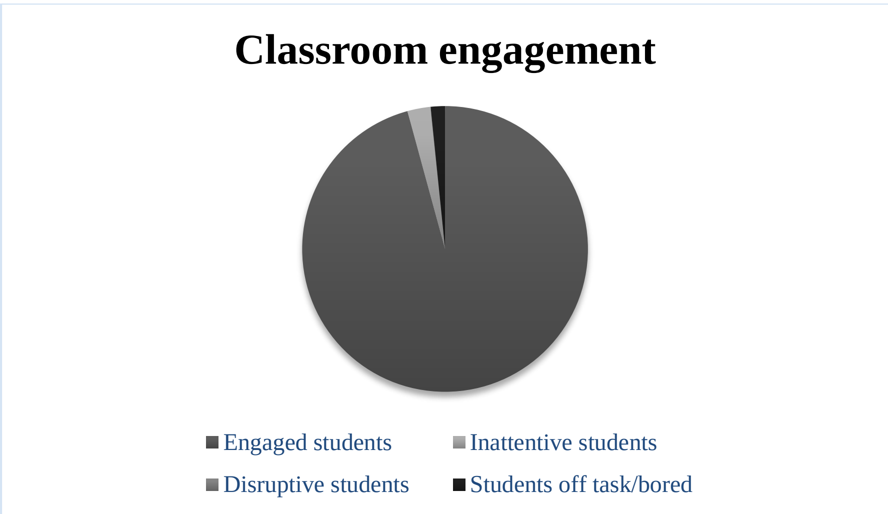

Figure 43: Overview of Levels of Student Engagement

High levels of student engagement were observed when iPads were employed by the pre-service teachers for teaching and learning experiences in all activities. One rare exception involved a student with Autism Spectrum Disorder; however, in a later session, the same student surprised the pre-service teacher by re-engaging in the task. The regular classroom teacher described this event as a “surprising and incredibly encouraging development” (Weldon, private correspondence). However, effective teaching is not only about teaching strategies and student engagement, but also about teacher impact on student learning, and in this regard, video evidence of learning is presented in Figure 44.

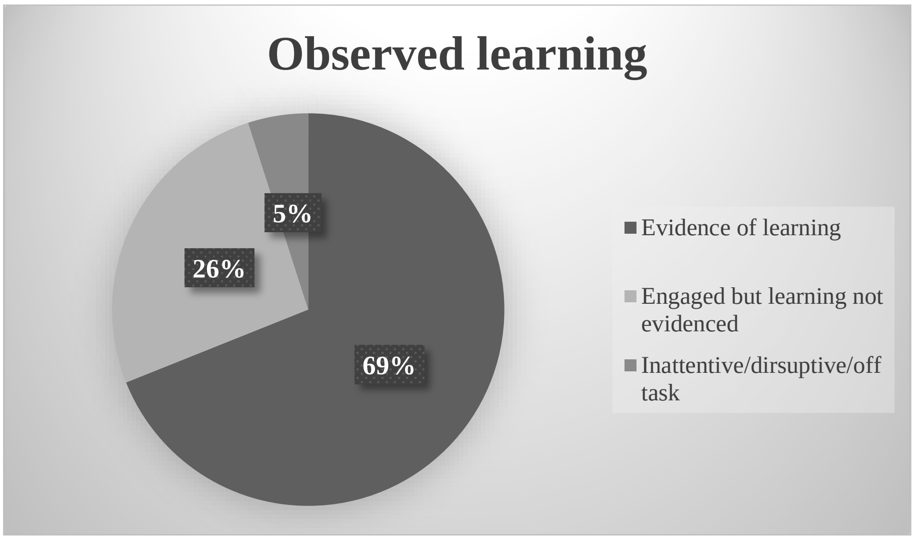

Figure 44: Levels of Student Learning

Many pre-service participants were observed using the looping technology on *GarageBand*, as used in the music module, to facilitate student learning. On occasions, they scaffolded the learning by keeping the beat or counting out loud as the students practiced their iPad skills, enabling them to practice and improve their musical skills along with their fine-motor control. The high number of pre-service teachers who took advantage of these opportunities support the experimental group survey results indicating increased music teaching self-efficacy (Bandura, 1994). Sixteen pre-service teachers were observed in these “teachable moments” as described by Wiggins and Wiggins (2008, p. 16) and outlined in chapter five, equating to 62% of the group engaging in higher levels of teaching strategies. Not only were the students engaged, but the majority also demonstrated learning and understanding from their observed responses and practical work. Of the remaining participants, only three were observed incorporating minimal teaching strategies. Overall, these findings suggest a reasonably comfortable level of self-efficacy among the majority of the pre-service group in a practicum situation, as presented in Figure 45.

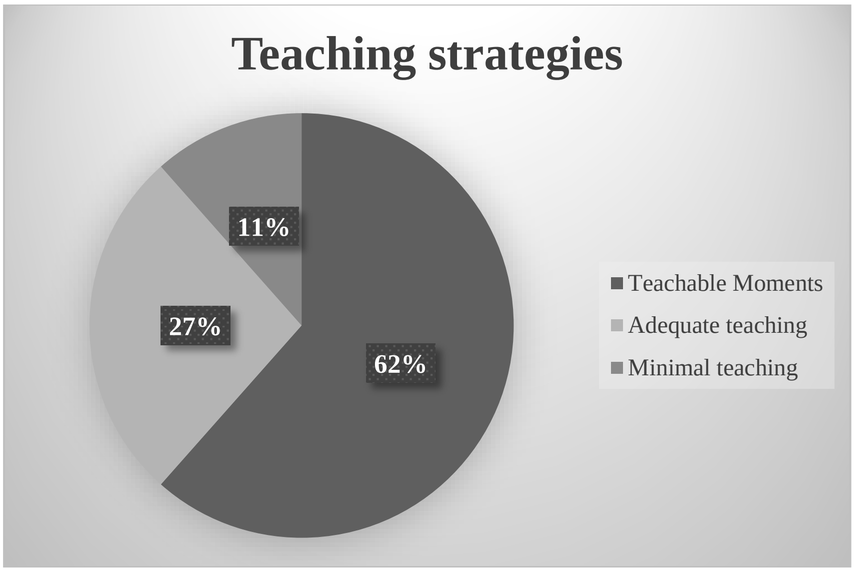

Figure 45: Teachable Moments as Evidence of High Self-efficacy

Taking into consideration the combination of teaching strategies, student engagement and observed learning, 50% of pre-service teachers attempted to teach high-level musical skills, 62% incorporated high-level teaching strategies, and 69% of students demonstrated learning in video observations of their responses and practical work. Positive multi-causality therefore showed high levels of self-efficacy in the practicum setting.

6.3.3 Perceived Collective Self –efficacy

Perceived collective self-efficacy affects motivation, perseverance and performance, and can be evidenced in diverse systems, such as schools (Bandura, 2006). To observe and record perceived collective self-efficacy, data were analysed for evidence of professional organisation, perseverance with students' learning (motivating, inclusive, supportive) and levels of performance (keeping control, managing difficulties, affirmative/positive, teachable moments, and risk-taking).

Observable evidence of professional organisation was recorded: nine pre-service teachers' were in the low range (0-4); four were in the moderate range and twelve were in the high range (6 -10), as presented in Figure 46.

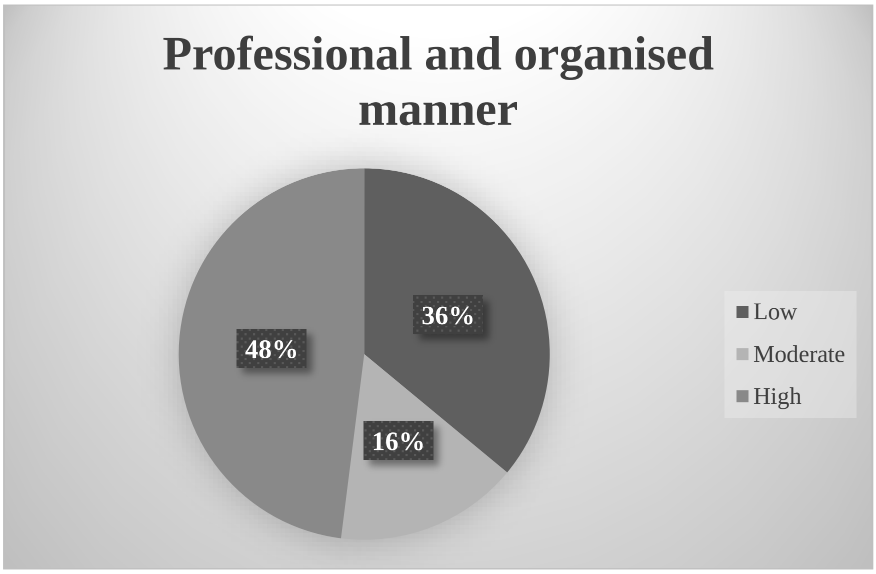

Figure 46: Observed Professional Behaviour

With 64% of pre-service teachers displaying moderate to high collective efficacy, the findings appear to support part C of the AMUSES survey, where participants indicated that looping technology intervention had increased their collective beliefs about teaching music, along with an increased willingness to adapt and take risks in teaching music.

6.4 Stage Three: Self-reflection Surveys - Content Validity

Pre-service teachers were invited to complete a self-reflection survey immediately after completion of their practicum, based on the *See Think Wonder* Visible Thinking Routine (Harvard Graduate School of Education, 2013). This comprised four guiding questions:

1. SEE (observational) – What did I do?
2. THINK (inner focus) – How do I think I went?
3. THINK (outer focus) – How did the students react?
4. WONDER (transformative) – What might I change in future?

The four questions relate to the four areas of coding in Bandura's *Guide for Construction of Self-efficacy Scales*, namely: multi-causality (think – inner/outer focus); domain specification and gradations of challenge (see – observational); and perceived collective efficacy (wonder) to substantiate or otherwise the video findings and provide a degree of context validity. Written responses were coded according to strong/convincing, positive, timid/doubtful and inconclusive. For example, strong responses contained words similar to "will do", positive responses contained words similar to "can do", and timid responses contained words synonymous with "may do" (Bandura, 2006, p. 2).

6.4.1 Domain Specification and Gradations of Challenge (Observational)

The first question asked: What did I do? (See - observational). Responses were coded according to whether participants were specific about what they were trying to achieve (domain specification) and the level of difficulty engaged (gradations of challenge), with levels categorised as minimal, low, medium and high. Five of the responses were general in nature and used phrases like “I explored” or “I used”, while four responses were more direct and used general phrases like “I explained the use of the iPad” or “I explained the activity”. Nine responses specifically addressed teaching one or more musical elements, such as “I was quite focused on learning a rhythm” or “I facilitated learning a rhythm”, while six responses related directly to the facilitation of music creation, such as “the students were engaged with learning their notes or worked together to create different sounds and music” (pre-service teacher self-reflections, 2013). An overview of see-observational coded response levels is shown in Figure 47.

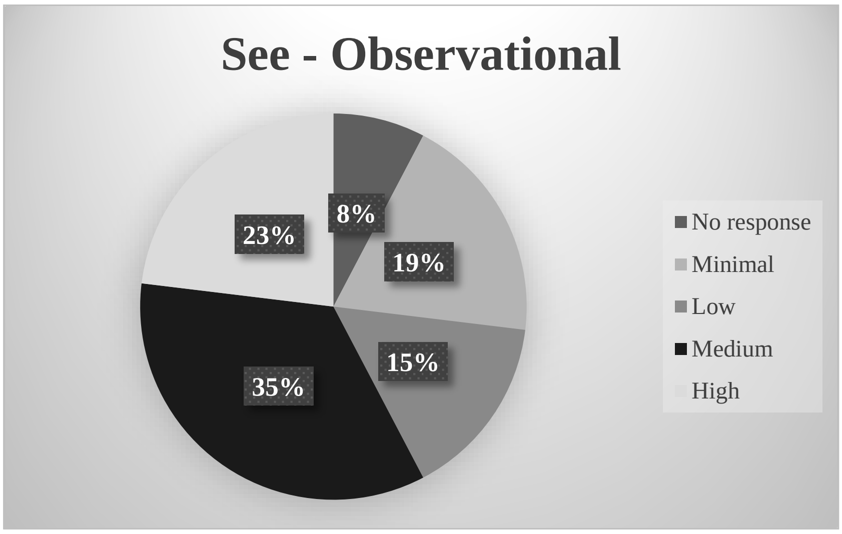

Figure 47: See - Observational Coded Response Levels

While most responses indicated participants attempted to teach specific musical elements such as beat and rhythm, the six high-level responses pointed to confidence in extending their knowledge further, and supported the video data of ten pre-service teachers facilitating creative compositional activities, indicating high self-efficacy (Bandura, 1997a, 2006). The 58% of medium to high responses aligned with the video findings and the AMUSES survey, further confirming evidence of engagement with gradations of challenge in the music teaching practicum setting.

6.4.2 Multi-causality (Think - Inner Focus)

The second self-reflection survey question asked: “How do I think I went? (Think - inner focus). Responses revealed participants’ self-belief in their teaching effectiveness, given they had only been equipped with basic music skills during a five-week music module. Responses were coded as low, moderate or high, according to the level participants believed they had attained. Three low responses cited insufficient practicum teaching time: “Time was a factor that didn’t allow me to extend much” and “I felt a little rushed”. Six responses indicated moderate success: “[It went] quite well” and “I felt it went quite well”; while sixteen responses indicated successful teaching: “(I went) very well” and “I am capable enough to teach music to a group of students” (pre-service teacher self-reflections, 2013). An overview of the think – inner focus coded response levels is shown in Figure 48.

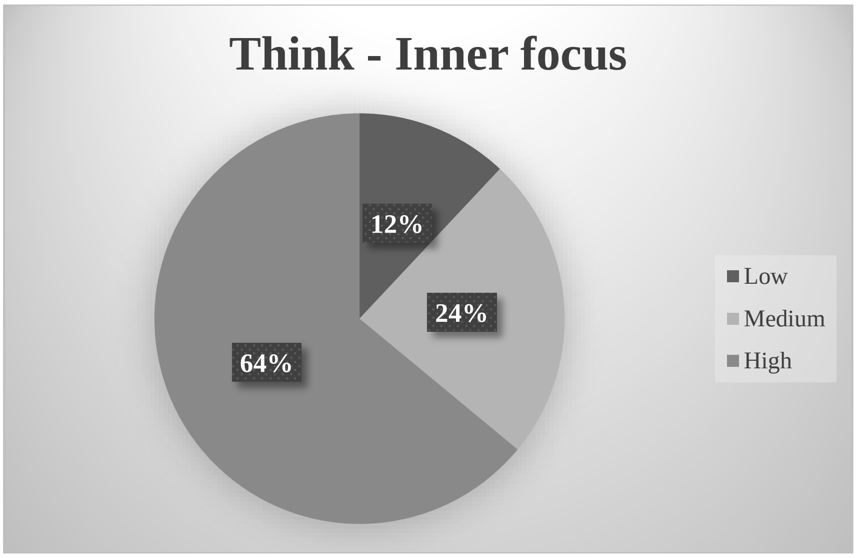

Figure 48: Think – Inner Focus Coded Response Levels

The responses indicated most participants held positive self-beliefs in their music teaching ability. This was further explored in conjunction with question 3.

6.4.3 Multi-causality (Think - Outer Focus)

The third self-reflection survey question asked: “How did the children react? (Think - outer focus). To examine the extent of participants’ beliefs about their success, their reflections on student interactions were categorised as low, medium or high. One response implied issues with inoperative technology, but the majority appeared philosophical and enjoyed reasonable success despite any difficulties, even displaying resilience and perseverance indicative of high levels of self-efficacy (Bandura, 1994). Twenty-five participants reported high levels of student engagement, for example:

They displayed great teamwork, turn taking and sharing ideas and (Students) were engaged and excited to show me what they could do (pre-service teacher self-reflection, 2013).

The number of responses indicating that the technology itself was a student motivator and iPad/*GarageBand* technology enabled all children to create basic rhythms regardless of their musical talent concurred with the findings of Jaffurs (2004). Figure 49 shows an overview of think - outer focus coded response levels.

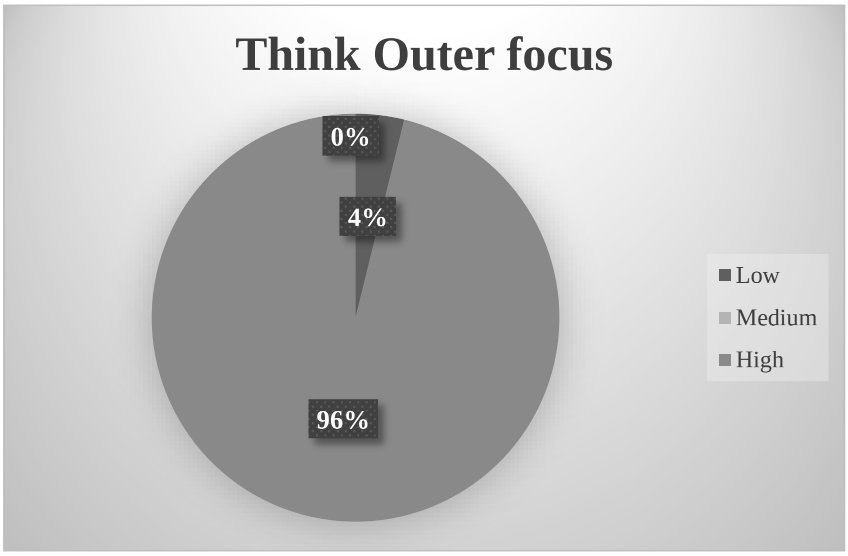

Figure 49: Think – Outer Focus Coded Response Levels

High levels of student engagement coincided with strong responses from participants regarding their teaching effectiveness, suggesting positive teaching experiences for most of them and high ratings for their perceived impact. The results largely confirmed the video evidence and the AMUSES data, showing positive multi-causality indicative of high levels of self-efficacy in the practicum setting.

6.4.4 Perceived Collective Efficacy (Wonder - In Future)

The fourth self-reflection survey question asked: “What might I change in future? (Wonder - in future). Pre-service teachers’ comments indicating motivation and commitment (perceived collective efficacy) were categorised as: 1) inconclusive; 2) low; 3) moderate or 4) high (Bandura, 1994). Three responses were considered inconclusive because they gave no indication of future music teaching intentions; a further three responses lacked strong conviction due to the use of terms such as “may” and “would like to”. Ten responses were rated moderately, as they used terms similar to “will do”*;* while ten high-rating responses not only committed to teaching music in the future, but also indicated enthusiasm in students' reactions to the lesson:

> Yes I will use iPads in the future because they [students] loved the experience, they were eager to play their own version (pre-service teacher self-reflections, 2013).

Figure 50 shows an overview of wonder – in future coded response levels.

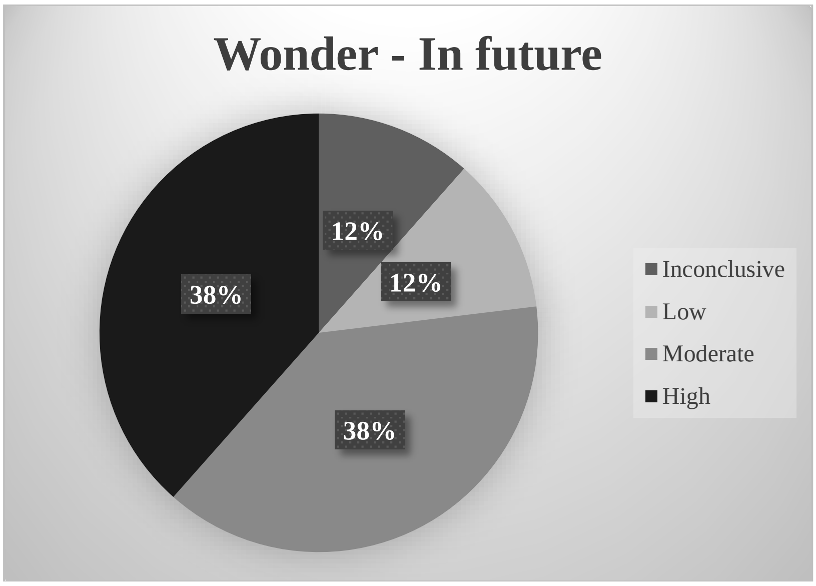

Figure 50: Wonder – In Future Coded Response Levels

The 76% of moderate to high responses show positive indications of motivation, resilience and commitment, and a high level of perceived collective efficacy, again supporting the video evidence and survey findings.

6.5 Discussion of Combined Areas of Self-efficacy

Multi-causality, domain specification and gradations of challenge, perceived collective efficacy and content validity are all inter-related, and offered a framework for the video and self-reflection analysis to reach an understanding of participant's self-efficacy for teaching music in the field (Bandura, 1994; Bandura, 2006). In viewing the video data, the majority of pre-service teachers appeared to be in control and were unflustered by musical or technical issues while teaching their students. All appeared supportive and understanding. Levels of presence and risk-taking generated considerable interest, with 22 participants appearing assured, and others, calm and relaxed. While a large number of pre-service teachers taught concepts that were musically simple and safe, it is important to remember that they were generalists, not music specialists. Nevertheless, a significant number did take more risks and were adventurous in facilitating concepts. In particular, higher level creative compositional endeavours, supported by the looping technology intervention as verified in the survey data, were observed in ten pre-service teachers in the practicum setting, clear indicators of positive self-efficacy (Bandura, 1994). It is also highly likely that the open-ended nature of iPad technology and the *GarageBand* application enabled pre-service teachers to take advantage of these opportunities, especially when working with students from a variety of backgrounds and experiences (Apple, 2017a; Weldon, 2012; Wiggins, 2009). Video analysis also revealed sixteen pre-service teachers taking advantage of learning opportunities created by students' questions, actions and comments, while five pre-service teachers missed similar opportunities. These "teachable moments" (Wiggins & Wiggins, 2008. p.16) were added to the coding during the second round of video analysis, thereby refining the initial coding to reflect observations made during subsequent viewings of the video data (Derry et al., 2010; Erickson, 1982; Punch, 2005).

The conceptual framework in stage two provided a foundation for data analysis, while the analysis of the video footage provided richer insights into the impact of technology on assisting pre-service teachers to facilitate meaningful music experiences for their students (Derry et al., 2010; Erickson, 2006; Punch, 2005). Other important factors also became evident, such as the portability and interactive nature of iPads and the accessibility and flexibility of the software application, aligning with the assertions of Apple (2017a) and Gouzouasis (2005). Video evidence indicated that these became the focus and motivation for student learning because they interacted well with the technology (Gouzouasis, 2005; Webster, 2016b). It also appeared to ease the pressure on pre-service teachers to "be on show", and may have contributed to their readiness to take risks, in turn, promoting feelings of teaching success. As a result, some pre-service teachers may have felt more equipped to take advantage of "teachable moments" (Wiggins and Wiggins, 2008, p. 16), adding to the overall impression of positive self-efficacy levels displayed by many while facilitating musical experiences on tablet technologies in the classroom (Bandura, 1994). Accordingly, the results of stages two and three of the study (video data and participants' self-reflections) add a measure of confidence to the affirmative response for the second research question.

Stage one indicated a trend towards technology as a positive intervention for the self-efficacy of the experimental pre-service teacher group, and the video evidence and self-reflections supported this assertion in the field, thereby linking theory with practice. By combining the findings from the AMUSES survey, the practicum video and self-reflection survey provided triangulation, and the integrated strategies employed in this study add validity to the findings (Oliver-Hoyo & Allen, 2006).

6.6 Wider Implications of the Study

The primary objective of the study was to investigate whether technology can improve the self-efficacy of pre-service generalist teachers to teach music in primary schools. In view of diminishing time for music education training in Australian universities (Pascoe et al., 2005) and more responsibility on generalists to teach music in primary schools (Sinclair et al., 2012) the issue of how best to prepare pre-service teachers has remained elusive (Killian, Dye, & Wayman, 2013). Teaching competency requires both skills and self-belief (Bandura, 1986), however, music is a creative process (Mills, 1998) and creativity is a high form of human expression with innovation which requires a strong sense of self-efficacy (Bandura, 1997a). Technology has the capacity to encourage creative endeavours (Webster, 2016b; Williams & Webster, 2006), while at the same time, is a relevant tool in the modern world for young people (Sinclair et al., 2012). Open-ended music applications such as *GarageBand* can cater for a variety of individual differences in skills and experience and has the potential to change the creative musical landscape (Gouzouasis, 2005). Mobile platforms with complete mobility and connectivity, such as the iPad, create opportunities for educators to teach anywhere, anytime and in any teaching space (Kuzmich, 2012).

Observations in the practicum setting during this study supported the notion that young people engage easily with technologies (Lauricella, 2011). The findings suggest that technology increased pre-service teachers' skills and confidence to facilitate music experiences for their students, and students are receptive to this form of learning. Technologies are transforming life and education, increasing access beyond physical classroom walls, but with some reservations about the advantages, as stated by Walters and Kop (2009):

> Adapting to the prevailing digital environment has advantages in terms of greater openness, transparency, and wider access, but reservations about the decline in reading whole books, in-depth sustained study, the dangers of electronic engagement, and development of character make the overall outlook for education challenging (p. 284).

In an ideal scenario, more time and resources will be beneficial for training generalist teachers (if not specialists) and equipping them to teach music in our primary schools. Unfortunately, given the growing priority of literacy and numeracy, increased time for training teachers in the arts seems unlikely. This research has shown that technologies have the potential to engage the post-modern youth, transcend time and place, and equip generalist teachers to be self-directed learners in the 21st century.

6.7 Recommendations for Practice

Based on the findings this study makes the following recommendations:

Recommendation 1

Technology becomes an integral tool for supporting and enabling music teaching and learning for generalist pre-service primary teachers.

Technology is fast emerging as a tool or strategy to support learning (Walters & Kop, 2009) and has the potential to transform education (Bandura, 1997b). Digital access to information and instruction empowers pre-service teachers and students with greater control over their own learning outcomes (Bandura, 1997a), at the same time, supporting the development of musical skills (Zhukov, 2015). Therefore, technology can not only support pre-service teachers in their own musical development, it also offers them a tool to teach music effectively in their classrooms.

Recommendation 2

Open-ended music applications, such as a looping technology, be incorporated into tertiary training to support inclusive, creative music making at all levels of ability.

Creativity is a high form of human expression (Bandura, 1997a) and tertiary institutions must be adaptive in upskilling non-musicians while simultaneously challenging more musically able students (Mills, 1998). Looping software is one form of open-ended music technology that can overcome skills development limitations, while also creating opportunities for enhanced participation in creative music-making endeavours.

Recommendation 3

Music education for pre-service generalist primary teachers develops a constructivist philosophical approach by incorporating digital technologies.

Constructivist learning can be meaningful in authentic digital real-life situations (Chen et al., 2013; Russell-Bowie, 2015). Digital technology supports constructivist learning when used as a medium for “learning with” or “learning through”, rather than “learning from” technology (Stewart et al., 2010, p. 10). A strong philosophical understanding around the use of technology to mitigate overuse of electronic distractions has many advantages for education practice in schools (Southcott & Crawford, 2011; Walters & Kop, 2009).

Recommendation 4

Tertiary institutions further investigate and support mobile technologies such as iPads and Smartphones to ensure their effective integration into music teaching programs.

Tertiary institutions are capable of providing support for pre-service generalist primary teachers in learning how to effectively employ music technologies for their own learning as well as their students (Uer et al., 2017). Since digital technology is an evolving medium and devices are becoming smaller and more mobile (Stewart et al., 2010), tertiary intuitions should remain up to date and support the use of ever-changing technologies.

6.8 Conclusion

This study does not go so far as to suggest that technology is a complete solution for meaningful pre-service teacher music preparation, but strongly advocates for incorporating technology into music education and pedagogical practice, as it has been shown to have the capacity to increase the confidence and self-efficacy of pre-service generalist teachers to teach music.

Given the time constraints facing tertiary institutions, incorporating technology into units of study will not only help engage pre-service teachers, but also upskill them while increasing their self-beliefs and facilitating meaningful music engagement in primary schools. Based upon the findings of this study, it is recommended that open-ended, portable technologies, such as the iPad-based *GarageBand* looping technology, be incorporated into teacher training courses, particularly because they offer flexibility for individual and collective collaborative learning to occur.

Chapter Seven: Conclusions

7.1 Introduction

This chapter reviews the study and summarises the key findings. It commences by revisiting the aims of the study, the research questions and the three stages of data collection, followed by a discussion of the significance of the study, along with the limitations, before concluding with recommendations for future research.

7.2 Aims of the Study

The overarching aim of this study was to investigate the potential of music looping technology as a tool for building competence and confidence in pre-service generalist primary teachers to teach music. This is important, given the increasing responsibility for generalist primary teachers in Australia to facilitate music in their classrooms (Lowe et al., 2017; Russell-Bowie, 2009) and the diminishing time allocated to tertiary music training in pre-service primary courses, resulting in a pervasive lack of confidence and competency amongst generalist teachers to teach music effectively (de Vries, 2017).

In view of the expectation for generalist teachers to teach music despite diminished training, the emerging role of technology in education could be a key support in the teaching and learning of music (Bandura, 1997b; Chen et al., 2013; Stewart et al., 2010; Walters & Kop, 2009). Accordingly, this study was undertaken to evaluate the potential of technology, namely music looping software, to engage and upskill pre-service teachers, thereby building their self-efficacy to teach music (Williams & Webster, 2006). Looping software is an open platform technology which allows for individualised and group learning, as well as supporting creative endeavours in both modern and traditional music-making contexts (Kuzmich, 2012).

A mobile technology utilising *GarageBand* on iPad tablets was the platform employed in this study (Apple, 2017a; Kuzmich, 2012). The technology was anticipated to give pre-service teachers greater control over their own learning, leading to enhanced self-efficacy to teach music (Bandura, 1997a). In view of these considerations, the following research questions were posed:

1) What impact does a music looping technology intervention have upon pre-service generalist teachers' self-efficacy to teach music in primary schools compared with a traditional module of instruction?

2) In what ways does a music looping technology intervention impact pre-service generalist teachers' self-efficacy to teach music as evidenced during a practicum placement?

To examine the research questions, three data collection stages were undertaken:

1. Stage One: A quasi-experimental pre- and post-test control-group design, based on pre-service teachers' participation in a 5-week module of music education.
2. Stage Two: Observation and video capture of participants working in a practicum setting.
3. Stage Three: Participant's self-reflections on teaching and learning outcomes during practicum.

Stage one was conducted over a five-week module of music education in a Bachelor of Education (Primary) course and incorporated a control group and an experimental group. The content and delivery were equivalent in both groups, except that the experimental group's tutorial incorporated a looping technology intervention. Pre- and post-test survey findings revealed moderately higher self-efficacy to teach music in the experimental group compared with the control group.

Stage two was undertaken in a practicum setting with pre-service teachers drawn from the experimental group. Video analysis examined their confidence and competency in multi-modal interactions with the students (Derry et al., 2010; Flewitt, 2006) and revealed evidence of effective and confident teaching.

Stage three involved participants' self-reflections obtained immediately following the practicum to supplement the video data and add depth to the findings. A survey, based on the Harvard Graduate School of Education's *See Think Wonder* framework (2013), was analysed and verified the video data depicting improvements in participants' self-efficacy to teach music.

7.3 Significance of the Findings

The findings of this study are significant in light of: 1) the growing responsibility for generalist primary teachers to teach music in Australia and elsewhere; 2) diminished time assigned for generalist teachers' music training in tertiary institutions; and 3) the low levels of competency and confidence amongst this cohort to teach music effectively (de Vries, 2013; Jeanneret & Stevens-Ballenger, 2013; Lowe et al., 2017; Russell-Bowie, 2010). This study has revealed the potential value of music technology for building the confidence and self-efficacy of pre-service generalist primary teachers to teach music. Furthermore, placing music technology at the centre of the learning process as a teaching tool is key to the adaptability of modern learners (Leong, 2012), and at the same time acknowledges its role in participation and engagement in music in the 21st century (Roy et al., 2012). The study also revealed that technology can support creative and constructivist learning in authentic, real life situations (Chen et al., 2013; Stewart et al., 2010). This assumes greater importance at a time when educational systems are catering for self-directed learners in the current information age (Bandura, 1997b). Twenty-first century pre-service teachers should possess the skills to utilise technology as a tool for facilitating new ways of learning in their classrooms, and tertiary institutions have a responsibility to prepare pre-service teachers to acquire new technological skills and knowledge (Uer et al., 2017). After graduation, teacher training can continue to develop new areas, such as technological skills, knowledge and practices (Reid & Kleinhenz, 2015; Uer et al., 2017)

This study galvanised the potential of technology to maximise limited music training while also offering opportunities for extended learning beyond the classroom (Leong, 2012). Incorporating technology into the music module offered pre-service teachers the option of self-paced learning outside the tutorial, empowering them with greater control over their learning and self-efficacy to teach music (Bandura, 1997a). This study found that technology encouraged the experimental group to become more skilled, and therefore more competent and confident to teach music. Of wider significance is the potential of the study to inform music teacher training for the future, and advance professional development in teaching strategies that will ultimately improve the music learning outcomes of Australian students.

7.4 Limitations of the Study

While acknowledging the positive impact of the looping technology intervention upon the experimental group, the limitations of the study need to be acknowledged. Although undertaken with a degree of broader generalisation and representativeness than the immediate setting, care should be taken when applying the findings to wider situations, because teaching and learning vary in tertiary institutions and are dependent upon the context in which learning activities are undertaken. Looping technology may therefore not be appropriate in all settings.

This study was undertaken with both a control and experimental group. No pre-service teacher was excluded from the study, and an attempt was made to render the experimental and control groups as representative as possible. However, it was not possible to take into account demographic factors such as gender or cultural and family backgrounds. Furthermore, while every opportunity was taken to keep discourse between the two groups to a minimum in order to negate potential corruption of results, it should be acknowledged that there will always be differences between two groups of people, despite similarities in demographics and delivery. Temporal and contextual independence of observations (what is true in one place may not be true in another) may also be at play (Lincoln & Guba, 1984). Finally, despite every support provided to the tutor for effective incorporation of technology into her teaching methods, her actual practice could not be totally controlled.

Stage one comprised the AMUSES survey instrument, delivering pre- and post-test results. While a concerted effort was made to limit the length of the survey (Matell & Jacoby, 1972), responses may have been affected by participants' fatigue, boredom or misreading of the questions, as the instrument included a frequent mix of positively and negatively worded responses to try and minimise response bias (Rattray & Jones, 2007).

The timeframe of the study was limited by the duration and timing of the five-week music module due to university course constraints. While the difference in findings between the experimental and control groups was encouraging, running the same intervention for a longer period of time may produce more definitive results, and is therefore reported as a limitation due to the time available.

The experimental group from stage one was invited to participate in stage two. The control group was not included in stage two due to difficulties associated with available practicum locations, time constraints and limitations of student availability. While this nevertheless enabled the second research question to be addressed, it did not offer the opportunity for comparison between the experimental and control groups in the field.

Participants in stage two also participated in the reflective survey in stage three, completed on the same day as the practicum. Responses were inclined to be short and hastily written, possibly as a result of fatigue having just completed their practicum, and while still offering currency may not have included as detailed reflections as would have been possible at another time.

Participants involved in this study offered a good representation of the primary generalist pre-service teachers enrolled at the research site, but are not necessarily representative of all primary pre-service teachers across Australia.

7.5 Recommendations for Future Research

This study revealed the potential of looping technology as a tool for building competency and confidence in pre-service teachers to teach music in primary schools. While the results are encouraging, further research is required. At a time when education systems are evolving from an industrial to technological paradigm resulting in an increased need for teachers to be self-directed, lifelong learners (Bandura, 1997b), the potential of technologies to develop and enhance music education requires continued research to meet the 21st century needs of teachers and students.

This was a small-scale study, undertaken in one tertiary institution in Western Australia, and therefore further research is needed to build upon the findings and test the effectiveness of looping technology in other tertiary locations and contexts. Furthermore, this study focused on pre-service teachers in one module unit of an undergraduate Bachelor of Education (Primary) teaching course. It would be valuable to follow up on the impact of technologies on early career generalist primary teachers and their music teaching practices. Two specific aims could guide future studies:

- Does the impact of technology in building self-efficacy lead to teacher motivation to continue on with music studies beyond tertiary training? and,
- Does the incorporation of technology in reality lead to better music delivery in the primary school generalist setting?

In addition to the above recommendations and given the plight of generalist teachers attempting to be masters-of-all-trades, there is scope for investigating the potential for other types and uses of technologies in primary education. In view of the rapid rate of evolving technologies, (Stewart et al., 2010) further research is necessary to establish how tertiary institutions can best prepare pre-service teachers to incorporate technologies and facilitate new pedagogical and philosophical approaches, relevant to the 21st century (Southcott & Crawford, 2011; Uer et al., 2017).

7.6 Conclusion

It is widely recognised that music is an important aspect of education in schools and plays a vital role in a child's psychomotor, emotional, cognitive and behavioural development. Therefore, the training of generalist teachers to teach music confidently and competently is essential. This is a challenge for pre-service educators, given justified concerns about the limited time available for pre-service teacher music training.

This study suggests that technology can provide a means of addressing this concern and supporting self-directed learning. In particular, a portable digital looping technology, such as *GarageBand*, can enable greater control for pre-service teachers over their own learning, is self-paced and transcends time and place. Despite its limitations, this study has demonstrated the potential of technology to enhance pre-service teachers' self-efficacy for teaching music.

As an experienced music teacher and passionate advocate of music education in schools, the researcher hopes to have contributed to the growing body of knowledge around the use of new technologies in music education. Together with future research, this study has the potential to inform pre-service teacher training nationally and internationally, as well as encouraging professional development for primary teachers to learn key music-teaching strategies. In the words of one participant:

> This has certainly increased my personal self-efficacy and attitude towards teaching and including music in the classroom. The main gain I obtained from this experience was the realisation that I am capable enough to teach music to a group of students, not at a specialist level but at a generalist teacher level (pre-service teacher self-reflection, 2013).

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Appendix A

ANONOMOUS MUSIC UNDERGRADUATES SELF-EFFICACY SURVEY
DO NOT PUT YOUR NAME ON THIS FORM

AGE

GENDER MALE FEMALE (Please circle one)

PART A

For each of the following statements, please circle the choice that is closest to how true you think it is for you. This is a survey on your opinion. There are no right or wrong answers.

1 = strongly disagree **4 = not sure** **7 = strongly agree**

1. I consider myself to be musically skilled	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. I consider myself to be musically creative	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. I can clap a simple rhythm	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. I cannot clap in time with music	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5. I can read and write simple rhythms	**1**	**2**	**3**	**4**	**5**	**6**	**7**
6. I can sing a well known song	**1**	**2**	**3**	**4**	**5**	**6**	**7**
7. I cannot sing in tune	**1**	**2**	**3**	**4**	**5**	**6**	**7**
8. I can create simple pieces of music	**1**	**2**	**3**	**4**	**5**	**6**	**7**
9. I don't know how to put musical ideas down on paper	**1**	**2**	**3**	**4**	**5**	**6**	**7**
10. With practice I can become more musically skilled	**1**	**2**	**3**	**4**	**5**	**6**	**7**

PART B

For each of the following statements, please circle the choice that is closest to how true you think it is for you. This is a survey on your opinion. There are no right or wrong answers.

1 = strongly disagree **4 = not sure** **7 = strongly agree**

11. I think I have the basic skills to be able to teach some music in a classroom	**1**	**2**	**3**	**4**	**5**	**6**	**7**
12. I am not confident enough to be able to incorporate music into creative classroom activities	**1**	**2**	**3**	**4**	**5**	**6**	**7**
13. I believe I could lead a class in clapping simple rhythms	**1**	**2**	**3**	**4**	**5**	**6**	**7**
14. I don't believe I can teach a class how to write simple rhythms	**1**	**2**	**3**	**4**	**5**	**6**	**7**
15. I think I could teach my class to read and write music	**1**	**2**	**3**	**4**	**5**	**6**	**7**
16. I would be happy to lead a classroom of children in singing a song	**1**	**2**	**3**	**4**	**5**	**6**	**7**
17. I do not have the confidence to be able to sing in front of any classroom of children	**1**	**2**	**3**	**4**	**5**	**6**	**7**
18. I think I could teach my class how to create simple pieces of music	**1**	**2**	**3**	**4**	**5**	**6**	**7**
19. I would not be able to facilitate a lesson where children put musical ideas down on paper	**1**	**2**	**3**	**4**	**5**	**6**	**7**
20. With practice I could become skilful enough to teach music in a classroom	**1**	**2**	**3**	**4**	**5**	**6**	**7**

PART C

For each of the following statements, please circle the choice that is closest to how true you think it is for you. This is a survey on your opinion. There are no right or wrong answers.

1 = strongly disagree **4 = not sure** **7 = strongly agree**

21. The fear of failure will prevent me from attempting to teach any music in a classroom	**1**	**2**	**3**	**4**	**5**	**6**	**7**
22. I am hoping that there will be a music specialist in my school so I won't have to teach any music at all	**1**	**2**	**3**	**4**	**5**	**6**	**7**
23. I am hoping to teach music in my classroom whether or not there is a school music specialist	**1**	**2**	**3**	**4**	**5**	**6**	**7**
24. I would like to become skilful enough to take on the role of a music specialist	**1**	**2**	**3**	**4**	**5**	**6**	**7**
25. I will use music in different ways to create a friendly and stimulating learning environment	**1**	**2**	**3**	**4**	**5**	**6**	**7**
26. I will probably only play music in the background	**1**	**2**	**3**	**4**	**5**	**6**	**7**
27. I would be happy to incorporate music into my teaching	**1**	**2**	**3**	**4**	**5**	**6**	**7**
28. I believe music is too difficult a subject for me to teach.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
29. With further training I would be happier incorporating music into my teaching	**1**	**2**	**3**	**4**	**5**	**6**	**7**
30. Generalist teachers should not be expected to teach specialist subjects like music.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Appendix B

Anonymous Pre-Service Teacher Self-Reflection Survey
Based on Harvard Graduate School of Education's See Think Wonder framework (2013)

SEE - What did I do?

THINK – INNER – How did I go?

THINK – OUTER – How did the children react?

WONDER - In Future

Appendix C

ETHICS

To: j.heyworth@ecu.edu.au
Subject: FW: Project 7939 HEYWORTH Annual ethics report request
Attachments: HREC_Ethics_Report_Form.docx

Dear John

Project Number: 7939 HEYWORTH
Project Name: The impact of music looping technologies upon pre-service generalist teachers' self-efficacy to teach music in Primary schools

Chief Investigator: John HEYWORTH
Supervisors:

- Geoff Lowe

Ethics approval for your research project was granted from 27 February 2012 to 31 December 2018.

The *National Statement on Ethical Conduct in Human Research* requires that all approved projects are subject to monitoring conditions. This includes completion of an annual report (for projects longer than one year) and completion of a final report at the end of the project.

From: Allison.Mclaren

To: John HEYWORTH

Subject: approval of your research application

Date: Friday, 27 April 2012 8:39:56 AM

Attachments: John Heyworth.pdf

Dear John

I am pleased to inform you that your application to conduct research on Department of Education sites has been given final approval by the Director. You should receive the approval letter in the mail in the next few days. A copy of this letter will need to be included with your letter to site managers.

All the best with your research.

Regards,

Allison

Allison McLaren

A/Evaluation Officer

System Performance Branch

Appendix D
Information Letter for Principals

The impact of music looping technologies upon pre-service generalist teachers' self-efficacy to teach music in primary schools

May 2013

Dear Gxxxx,

I (John Heyworth) am leading a research project at Rxxxxxx Primary school. The project aims to develop ways of enhancing the quality of music teaching and resources that best support multi-level classrooms in our schools. Two tutorial groups of 3rd year primary pre-service teachers have been asked to participate. I would also like to invite Rosemary Weldon to participate in this project and I seek your consent for your school's participation in this research study.

The project will involve research and development activities in which pre-service teachers along with an expert teacher (Rxxxx Wxxxx) will work with me to develop strategies for the use of iPads in the music classroom, in this case with a year 5 class. I believe that the project will provide a rich professional learning experience for Rxxxxy Wxxxxx and myself as well as provided useful information for future resource development.

Research data will be gathered by the video recording of up to six classroom lessons. I will facilitate the videoing of the lessons in the ECU research centre. All Pre-service teachers will have a *Working With Children* criminal records check. I have a current *Working With Children* check, as well as being a currently registered teacher with the teacher registration board.

No risks have been anticipated for the teachers or students involved in this project. No child will be disadvantaged by their willingness or otherwise to take part in the study. Should any incidents occur in the video recorded lessons that might cause embarrassment to the teacher, students or your school these will be erased from the video tapes by myself at the request of the teacher. The tapes will be analysed to evaluate the use and effectiveness of the deployment of music resources. All research data will be treated confidentially, stored under lock and key, accessed only for research and will be destroyed after five years.

Separate information letters and consent forms have been sent to teachers and to parents and children for the class participating in the study. No teacher, school or student will be identified in any research reports. Your school, the teacher and students are free to choose not to participate in this study without affecting relationships with ECU or the research team.

I am happy to discuss any questions you may have about the project and you may contact me, John Heyworth, on 9370 6839 or by email using j.heyworth@ecu.edu.au. This project has been approved by the Human Research Ethics Committee at Edith Cowan University and has met the requirements of the Department of Education and Training. If you have any concerns about the project or would like to talk to an independent person, you may contact the Research Ethics Officer at:

Human Research Ethics Office Edith Cowan University

270 Joondalup Drive

JOONDALUP 6027 WA

Phone: (08) 6304 2170

Email: research.ethics@ecu.edu.au

If you are happy for your school to participate in this study, could you please sign the consent form attached to this information letter and return it to me. Please note that your school is free to withdraw from the study at any time and any data collected will be destroyed.

Regards,

John Heyworth Lecturer

Primary and Early Childhood Education. Edith Cowan University

Email: j.heyworth@ecu.edu.au Phone: 9370 6839

Principal Consent Form

The impact of music looping technologies upon pre-service generalist teachers' self-efficacy to teach music in primary schools

- I have read this document and understand the aims, procedures, and risks of this project, as described within it.
- For any questions I may have had, I have taken up the invitation to ask those questions, and I am satisfied with the answers I received.
- I am willing for my school to become involved in the research project, as described.
- I understand that participation in the project is entirely voluntarily.
- I understand that my school is free to withdraw its participation at any time, without affecting the relationship with the research team or Edith Cowan University .
- I understand that should my school choose to withdraw from this project after lessons have been videotaped, all video footage recorded at my school will be erased.
- I understand that research findings will be reported to DET and at academic conferences and in journal articles, provided that the participants or the school are not named.
- I understand that my school will be provided with a copy of the findings from this research upon its completion.

Name of Principal (printed):

Name of School
Signature:

Appendix E

Faculty of Education and Arts

School of Education

The impact of music looping technologies upon pre-service generalist teachers' self-efficacy study

Researcher: John Heyworth

ECU AED3106 Students 2012

Dear students,

During this semester I will be conducting a study into the effectiveness of digital technology in Primary Education. I am particularly interested in whether looping technology can assist and enhance learning in the classroom. Some aspects of our work in this unit will be looking at ways to integrate technology with learning in a meaningful and relevant manner.

To gather information I would like to conduct a pre and post student survey/questionnaire during this semester for analysis. All surveys are to be kept strictly anonymous.

Participation is voluntary. Apart from a simple survey, no extra work is required of any participant. There is no academic penalty for not participating and also any student can withdraw from the study at any time without academic penalty. Participants will be asked to complete an informed consent form within the first weeks of semester.

Please feel free to ask me any questions at any time about the research project (contact details above).

If you have any concerns or complaints about the research project and wish to talk to an independent person, you may contact:

Research Ethics Officer

Edith Cowan University

100 Joondalup Drive

JOONDALUP WA 6027

Phone: (08) 6304 2170

Email: research.ethics@ecu.edu.au

Results of the research will be available to any participating student on request late in December 2012

Yours Faithfully

John Heyworth

February 2012

Faculty of Education and Arts

School of Education

The impact of music looping technologies upon pre-service generalist teachers' self-efficacy study

John Heyworth

Research Permission ECU AED3106 Students 2012

Dear students,

I am seeking your approval to conduct a study into the effectiveness of digital technology in primary education. I am particularly interested in whether portable digital technology can assist and enhance learning in the classroom. To gather information I would like to conduct a pre and post student questionnaire survey. All surveys are to be kept strictly anonymous. Participation is voluntary. Apart from a simple survey, no extra work is required of any participant. Please indicate below if you are willing to participate.

Many Thanks

John Heyworth

Name ....

Student ID ....

☐ I am willing to participate in the ***The impact of music looping technologies upon pre-service generalist teachers' self-*****efficacy** as indicated above.

☐ I am **not** willing to participate in the ***The impact of music looping technologies upon pre-service generalist teachers' self-efficacy*** as indicated above.

Signed: ....

Date:

Appendix F
Information Letter for Pre-Service Teachers

The impact of music looping technologies upon pre-service generalist teachers' self-efficacy to teach music in primary schools

April 2012

Dear Students,

I (John Heyworth) am leading a research project at Roseworth Primary school. The project aims to develop ways of enhancing the quality of music teaching that best support multi-level general classrooms in our schools. I would like to invite you to participate in this project.

The project will involve research and development activities in which you, the pre-service teachers will work with me to develop strategies for the use of music technologies in the classroom, in this case with a year 5 class. I believe that the project will provide a rich professional learning experience for all of us as well as provided useful information for future resource development.

Research data will be gathered by video recording of the lessons. I will facilitate the videoing of the lessons. One video camera will be placed at the back of the classroom to capture the interactions during classroom work. This camera will also monitor the effectiveness of the strategies used with available resources in the classroom. A short survey will be conducted at school with you to gather your reflections on your practice. You will be required to have a current *Working With Children* criminal records check. I have a current Working With Children check, as well as being a currently registered teacher with WACOT, membership number 32008630.

No risks have been anticipated for you or your students involved in this project. Should any incidents occur in the video recorded lessons that might cause embarrassment to you, students or your school these will be erased from the video tapes by myself at the request of the yourself. The tapes will be analysed to evaluate the use and effectiveness of the deployment of music resources. All research data will be treated confidentially, stored under lock and key, accessed only for research and will be destroyed after five years.

Separate information letters and consent forms will be sent to parents and children for the class participating in the study. No teacher, school or student will be indentified in any research reports. Your school, yourself and students are free to choose not to participate in this study without affecting relationships with ECU or the research team.

I am happy to discuss any questions you may have about the project and you may contact me, John Heyworth, on 9370 6839 or by email using j.heyworth@ecu.edu.au. This project has been approved by the Human Research Ethics Committee at Edith Cowan University and has met the requirements of the Department of Education and Training. If you have any concerns about the project or would like to talk to an independent person, you may contact the Research Ethics Officer at:

Human Research Ethics Office
Edith Cowan University
270 Joondalup Drive
JOONDALUP 6027 WA
Phone: (08) 6304 2170
Email: research.ethics@ecu.edu.au

If you are happy to participate in this study, could you please sign the consent form attached to this information letter and return it to me. Please note that you are free to withdraw from the study at any time and any data collected will be destroyed.

Regards

[redacted]

John Heyworth
Lecturer
Primary and Early Childhood Education.
Edith Cowan University
Email: j.heyworth@ecu.edu.au
Phone: 9370 6839

Pre-Service Teacher Consent Form

The impact of music looping technologies upon pre-service generalist teachers' self-efficacy to teach music in primary schools

☐ I have read this information letter and I understand the aims, procedures, and any identified risks of this project, as described within it.

☐ I have taken up the invitation to ask any questions I may have had, and am satisfied with the answers I received.

☐ I understand that participation in the project is entirely voluntarily.

☐ I am willing to become involved in the project, as described.

☐ I understand I am free to withdraw that participation at any time without affecting my relationship with my school, Edith Cowan University or the research team.

☐ I understand that after the music lessons have been videoed I am free to withdraw from participation and have any video footage of me erased.

☐ I give permission for the research findings to be reported to DET, at academic conferences and in journal articles.

☐ I understand that I can request a summary of findings once the research has been completed.

Name of Participant (printed):

Signature of Participant: Date: / /

Information Letter for Colleagues

School of Education
Edith Cowan University
2 Bradford Street,
MT LAWLEY
WA 6050

The Impact of music looping technologies upon pre-service teachers' self-efficacy skills

April 2012

Dear Rxxxxxxxx,

I (John Heyworth) am leading a research project at Rxxxxxxx Primary school. The project aims to develop ways of enhancing the quality of music teaching and resources that best support general multi-level classrooms in our schools. I would like to invite you, Rxxxxxx Weldon to participate in this project.

The project will involve research and development activities in which pre-service teachers will work and use music technologies in the classroom, in this case with a year 5 class. I believe that the project will provide a rich professional learning experience for all of us as well as provided useful information for future resource development.

I have a current Working With Children check, as well as being a currently registered teacher with WACOT, membership number 32008630.

No risks have been anticipated for you or your students involved in this project. Should any incidents occur in the video recorded lessons that might cause embarrassment to you, students or your school these will be erased from the video tapes by myself at the request of the yourself. The tapes will be analysed to evaluate the use and effectiveness of the deployment of music resources. All research data will be treated confidentially, stored under lock and key, accessed only for research and will be destroyed after five years.

Separate information letters and consent forms will be sent to parents and children for the class participating in the study. No teacher, school or student will be identified in any research reports. Your school, yourself and students are free to choose not to participate in this study without affecting relationships with ECU or the research team.

I am happy to discuss any questions you may have about the project and you may contact me, John Heyworth, on 9370 6839 or by email using j.heyworth@ecu.edu.au. This project has been approved by the Human Research Ethics Committee at Edith Cowan University and has met the requirements of the Department of Education and Training. If you have any concerns about the project or would like to talk to an independent person, you may contact the Research Ethics Officer at:

Human Research Ethics Office
Edith Cowan University
270 Joondalup Drive
JOONDALUP 6027 WA
Phone: (08) 6304 2170
Email: research.ethics@ecu.edu.au

If you are happy for your school to participate in this study, could you please sign the consent form attached to this information letter and return it to me. Please note that your school is free to withdraw from the study at any time and any data collected will be destroyed.

Regards

[redacted]

John Heyworth
Lecturer
Primary and Early Childhood Education.
Edith Cowan University
Email: j.heyworth@ecu.edu.au
Phone: 9370 6839

Teacher Consent Form

Project title: The Impact of music looping technologies upon pre-service teachers' self-efficacy skills

□ I have read this information letter and I understand the aims, procedures, and any identified risks of this project, as described within it.

□ I have taken up the invitation to ask any questions I may have had, and am satisfied with the answers I received.

□ I understand that participation in the project is entirely voluntarily.

□ I am willing to become involved in the project, as described.

□ I understand I am free to withdraw that participation at any time without affecting my relationship with my school, Edith Cowan University or the research team.

□ I understand that after the music lessons have been videoed I am free to withdraw from participation and have any video footage of me erased.
□ I give permission for the research findings to be reported to DET, at academic conferences and in journal articles.

Name of Participant (printed): □ I
Name of School:
Signature of Participant: Date: / /

understand that I can request a summary of findings once the research has been completed.

Please return the signed consent form to:
John Heyworth
School of Education, Edith Cowan University
2 Bradford Street, MT LAWLEY WA 6050

Information Letter for Parents

School of Education
Edith Cowan University
2 Bradford Street,
MT LAWLEY
WA 6050

Project: The Impact of music looping technologies upon pre-service teachers' self-efficacy skills

April 2012

Dear Parent/Carer,

I (John Heyworth) am leading a research project at Roseworth Primary school. The project aims to develop ways of enhancing the quality of music teaching and resources that best support general multi-level classrooms in our schools. I have invited your child's music teacher Rosemary Weldon to participate in this study along with pre-service teachers from Edith Cowan University.

The project will involve research and development activities in which the pre-service teachers will work and use music technologies in the classroom, in this case with a year 5 class. I believe that the project will provide a rich professional learning experience for all of us as well as provided useful information for future resource development.

It is expected that the lessons will be quite routine and that students will only be fleetingly captured on the video. There are no anticipated risks for students' participating in this study. However, should any incidents occur that might cause embarrassment to the teacher, school or students these will be erased from the video tapes by the researchers at the request of the teacher. The tapes will be stored under lock and key and will only be accessed by members of the research team. The tapes will be analysed to identify characteristics of the teacher's management of classroom music.

Participation in this research study is entirely voluntary. If you do not wish your child to participate in this study, he/she will not be excluded from their class, but will be seated in an area of the classroom that the video cameras will not film. After the lessons have been video recorded, should you or your child wish to withdraw from the study, video footage of your child will be edited out of the video. I will be facilitating the videoing and will film the lessons. I have a *Working With Children* criminal records check and this has been shown to your school principal. I am also a registered teacher with WACOT (The Western Australian College of Teaching).

I am happy to discuss any questions you may have about the project and you may contact me, John Heyworth on 9370 6839 or by email using j.heyworth@ecu.edu.au. This project has been approved by the Human Research Ethics Committee at Edith Cowan University and has met the policy requirements of the Department of Education and Training. If you have any concerns about the project or would like to talk to an independent person, you may contact the Research Ethics Officer at:

Human Research Ethics Office
Edith Cowan University
270 Joondalup Drive
JOONDALUP 6027 WA
Phone: (08) 6304 2170
Email: research.ethics@ecu.edu.au

Would you please discuss this letter with your son/daughter. If you are happy for your child to participate in this study, could you please sign the consent form attached to this information letter and return it to your child's teacher. You will find a separate letter and consent form for your child attached to this letter.

Regards

[redacted]

John Heyworth
Lecturer
Primary and Early Childhood Education.
Edith Cowan University
Email: j.heyworth@ecu.edu.au
Phone: 9370 6839

Parent/Carer Consent Form

□ I have read this document, or have had this document explained to me in a language I understand. I understand the aims, procedures, and any identified risks of this project, as described within it.
□ I have taken up the invitation to ask any questions I may have had and am satisfied with the answers I received.
□ I understand that participation in the project is entirely voluntarily.
□ I am willing for my child to become involved in the project, as described.
□ I have discussed with my child what it means to participate in this project. He/she has explicitly indicated a willingness to take part, as indicated by his/her completion of the child consent form.
□ I understand that both my child and I are free to withdraw that participation at any time without affecting the family's relationship with my child's teacher or my child's school.
□ I understand that any video footage of my child can be erased should I or my child decide to withdraw from the study after the lessons have been recorded.
□ I give permission for the research findings from this study to be reported at academic conferences, published in reports and journal articles provided that my child or the school is not identified in any way.
□ I understand that I can request a summary of findings after the research has been completed.

Please TICK one of the options below, sign and return to your child's teacher

□ I GIVE CONSENT for my child to be video recorded in this research study. I have read the information above and understand that my child's class will be video-taped during two music lessons. I have discussed this research study with my child and I give consent for my child to participate in this research study realising that s/he may withdraw at any time.

OR

□ I DO NOT GIVE CONSENT for my child to be video recorded in this research study and request that my child be seated in the classroom in a position where he/she will not be video recorded.

Name of Child (printed):

Name of Parent/Carer (printed):

Signature of Parent: Date: / /

Name of my child's teacher:

Information Letter for School Students

Please return the signed consent form to your child's teacher.

Project: The Impact of music looping technologies upon pre-service teachers' self-efficacy skills

Dear Student,

My name is John Heyworth from Edith Cowan University. I would like to invite you to take part in a research project that I am doing. It is about helping teachers teach with the use of resources in music lessons.

I am asking for your help with the project because we will be video recording your class in two music lessons. WA.

What would I be asked to do?
If you agree to take part, there will be a video camera placed at the back of the class and if you participate in the class discussions you will be recorded on the video.

Do I have to take part?
No. You are completely free to say yes or no. I will respect your decision whichever choice you make.

What if I wanted to change my mind?
If you say no, but then change your mind and want to take part, please let your teacher know.

After the lessons have been video recorded, if you decide that you don't want to be in the video we can edit any pictures of you out of the video. Just let your teacher or mum (or dad, or the person who looks after you) know, and they will tell me.

What will you do with the video?
The video will be used to help us learn about the way we discuss ideas in music lessons.

How do I get involved?
You have already talked with your mum or dad, or the person who looks after you, about what it means to take part in the project. Now you get to say for yourself.

If you **do** want to be a part of the project, please read the next page and write your name in the space provided.

This letter is for you to keep.

[redacted]

John Heyworth
Lecturer, Primary and Early Childhood Education
Edith Cowan University
Email: j.heyworth@ecu.edu.au; Phone: 9370 6839

Student Consent Form

Project: The Impact of music looping technologies upon pre-service teachers' self-efficacy skills

□ I know that I don't have to be involved in this project, but I would like to.

□ I know that I will be video recorded during two lessons as part of the project and some of the video may be used to train other teachers.

□ I know that I can stop when I want to

□ I know that if I change my mind about being on the video I can be edited out of the video at a later date.

□ I understand that I need to write my name in the space below, before I can be a part of the project.

Your name: Today's Date: / /

Your teacher's name:

Appendix G

Australian Curriculum, the Arts, Music Overview

Rationale

This rationale complements and extends the rationale for The Arts Learning Area.

Music is uniquely an aural art form. The essential nature of music is abstract. Music encompasses existing sounds that are selected and shaped, new sounds created by composers and performers, and the placement of sounds in time and space. Composers, performers and listeners perceive and define these sounds as music.

Knowledge and Skills of music

In Music, students' exploration and understanding of the elements of music, musical conventions, styles and forms expands with their continued active engagement with music. In listening to, performing and composing music from a broad range of styles, practices, traditions and contexts, students learn to recognise their subjective preferences and consider diverse perspectives of music. This, in turn, informs the way in which they interpret music as performers and how they respond to the music they listen to. Additionally, students develop their own musical voice as composers and their own style as musicians.

<table>
<tr><th>Aims of Music</th><th colspan="2">Structure</th></tr>
<tr><td>Students develop the confidence to be creative, innovative, thoughtful, skilful and informed musicians</td><td rowspan="2">Making:
Making in Music involves active listening, imitating, improvising, composing, arranging, conducting, singing, playing, comparing and contrasting, refining, interpreting, recording and notating, practising, rehearsing, presenting and performing.</td><td rowspan="4">Both Making and Responding:
Both making and responding involve developing aural understanding of the elements of music through experiences in listening, performing and composing. The elements of music work together and underpin all musical activity. Students learn to make music using the voice, body, instruments, found sound sources, and information and communication technology. Music is recorded and communicated as notation by a unique system of symbols and terminology, and as audio recordings using technology. With increasing experience of the elements of music, students develop analytical skills and aesthetic understanding.</td></tr>
<tr><td>Students develop skills to compose, perform, improvise, respond and listen with intent and purpose</td></tr>
<tr><td>Students develop aesthetic knowledge and respect for music and music practices across global communities, cultures and musical traditions</td><td rowspan="2">Responding:
Responding in Music involves students being audience members listening to, enjoying, reflecting on, analysing, appreciating and evaluating their own and others' musical works.</td></tr>
<tr><td>Students develop an understanding of music as an aural art form as they acquire skills to become independent music learners.</td></tr>
</table>

Information taken from The Australian Curriculum, the Arts, Music at
https://www.australiancurriculum.edu.au/f-10-curriculum/the-arts/music/