Creating music in the classroom with tablet computers

An activity system analysis of two secondary school communities

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The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

Dedication

I have prioritised this research to the eternal detriment of those most kind and loyal.

Let’s make up for lost time.

Acknowledgements

This research project has emerged over many years, as a result of the music lessons I've led; the researchers and music teachers I've conversed with; the books I've read and the young people I've had the privilege of making music with.

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Abstract

Tablet computers are becoming inextricably linked with innovation and change in schools. Increasingly therefore, music teachers must consider how tablet computers might influence creative musical development in their own classroom.

This qualitative research into two secondary school communities aims to develop understandings about what really happens when students and a music teacher-researcher compose music in partnership with a tablet computer.

A sociocultural definition of creativity, theories of Activity, and the musicking argument inform a new systemic framework which guides fieldwork. This framework becomes the unit of analysis from which the research questions and a multi-case, multimodal methodology emerge.

The methodology developed here honours the situated nature of those meanings which emerge in each of the two school communities. Consequently, research findings are presented as two separate case reports. Five mixed-ability pairs are purposively sampled from each community to represent the broad range of musical experience present in that setting. A Video-enhanced, participant-observation method ensures that systemic, multimodal musicking behaviours are captured as they emerge overtime. Naturalistic group interviewing at the end of the project reveals how students' broader musical cultures, interests and experiences influence their tablet-mediated classroom behaviour.

Findings develop new understandings about how tablet-mediated creative musical action champions inclusive musicking (musical experience notwithstanding) and better connects the music classroom and its institutional requirements with students' informal music-making practices. The systems of classroom Activity which emerge also compensate for those moments when the tablet attempts to overtly determine creative behaviour or conversely, does not do enough to ensure a creative outcome. In fact, all system dimensions (e.g. student partner/teacher/student/tablet) influence tablet-mediated action by feeding the system with musical and technological knowledge, which was also pedagogically conditioned. This musical, technological and pedagogical conditioning is mashed-up, influencing action just-in-time, according to cultural, local and personal need. A new method of visual charting is developed to 'peer inside' these classroom-situated systems. Colour-coded charts evidence how classroom musicians make use of and synthesize different system dimensions to find, focus and fix their creative musical ideas over time.

There are also implications for research, policy and practice going forward. In terms of researching digitally-mediated creativity, a new social-cultural Activity framework is presented which encourages researchers to revise their definition of creativity itself. Such a definition would emphasise the role of cultural, local and personal constraint in creative musical development.
With reference to classroom practice, this research discovers that when students partner with tablet computers, their own musical interests, experiences and desires are forwarded. Even though these desires become fused with institutional requirements, students take ownership of their learning and are found rightfully proud of their creative products. This naturalistic, community-driven form of tablet-mediated creative musical development encourages policy makers and teachers to reposition the music classroom: to reconnect it with the local community it serves.

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Glossary of Abbreviations

ASF:	Activity System Framework
BERA:	British Education Research Association
CBCT:	Computer-based Cognitive Tool
CD:	Compact Disc
CMD:	Creative Musical Development
DBS:	Disclosure and Barring Service
DFE:	Department for Education
DJ:	Disc Jockey
DMT:	Digital Music Technology
DOM:	Director of Music
EBI:	Even Better If
EDM:	Electronic Dance Music
EK:	External Keyboard
GBIOS:	Garageband for iOS
GCSE:	General Certificate of Secondary Education
HOM:	Head of Music
ICT:	Information Communications Technology
ID:	Identity
INT:	Interviewer
IP:	Intellectual partnership
MAP:	Map Action Plan
MIDI:	Musical Instrument Digital Interface
PIT:	Participant Information Table
PK:	Pedagogical Knowledge
REL:	Record; Edit; Loop
RQ:	Research Question
RRL:	Rehearse; Record; Listen
SCOT:	Social construction of technology theory
SI:	Symbolic Interactionism
T:	Participating music teacher-researcher
TBMI:	Technology-based Musical Instruction
TCK:	Technological Content Knowledge
TK:	Technological Knowledge
TPACK:	Technological Pedagogical Content Knowledge
TW:	Tablet Workstation (consisting of a tablet computer, piano-keyboard, speakers and microphone)
UK:	United Kingdom
WWW:	What Went Well
ZPD:	Zone of Proximal Development

Chapter 1:
Introduction and Research Rationale

This chapter will explain how this research project, which sets out to understand tablet-mediated creative music-making in secondary school settings, emerged from the author's experience as a secondary school music teacher. In my classroom, a utopian goal became to provide creative, musical, reliable and affordable experiences which authentically connected students of all musical abilities to their musical heritage. From part 1.2 onwards, research literature is presented to argue why such a goal is worth pursuing. This literature will provide a rationale for researching tablet-mediated creative music-making in classroom settings.

1.1 Personal perspectives and starting points

The author is fortunate to have enjoyed a life-long interest in digital musical technology and this has ranged from building computers to researching philosophical considerations for a master's degree. Once the opportunity arose to train as a secondary classroom music teacher, the relationship between DMTs and the classroom became intriguing and perplexing in equal measure. Following the acceptance of a teaching post at a rural secondary academy, twelve mothballed desktop computers presented themselves, happily occupying one third of the teaching space. Their quantity was obviously insufficient for classes of 33 Key Stage Three students and classes of 28 GCSE students, where one computer per student was required. Consequently, for GCSE composition lessons, my own Apple tablet equipment was 'passed around' to those students in urgent need of a familiar platform through which to create their music. Some informal observations were made of those students who made use of these devices. Unlike the desktop computers, the tablet:

- offered reliable, high quality sound;
- was easily moved into practice rooms away from the main teaching space;
- did not require persistent maintenance from school technicians;
- was not bespoke musical equipment. It came preloaded with the 'GarageBand' music application and the unit was readily available everywhere;
- did not crash, loose students' work or become easily damaged;
- did not require students to painfully 'learn' complex software prior to engaging musically;
- somehow enabled all students, even those who did not play an instrument to interact with and experiment with sound to ultimately produce a composition;
- boasted realistic loops, virtual instruments and ways of editing sound that students seemed to intuitively relate to and understand.

These informal observations led to casual engagement with staffroom magazines, which published narrative accounts of schools introducing tablet computers. Additionally, a professional development course was attended in Cambridge and delegates explained that their own schools in the South East were purchasing tablet computers (typically those made by Apple Computers). The delegates were unsure of how to make effective use of tablets for musical learning and some even rejected the devices out-of-hand. Further, no widely accepted, easily accessible framework existed to help these teachers 'make a start' in their own classroom. From the author's perspective, some difficult pedagogical questions remained unanswered. These are reproduced below:

> •What is gained and what is lost when students create music with a tablet computer?
> •Can the tablet curate the learning process, without the need for a teacher or student partner?
> •When a tablet computer is made use of, where do creative ideas come from and how do they develop?

These questions describe a utilitarian desire to deeply understand 'what really happens' when students and their teacher use tablet computers to create music in formal settings.

Fortunately, it is found that the music education research community share many of the author's concerns. Consequently, a literature-informed rationale will now argue the technical challenges of existing classroom technologies (1.2); the complexity of initiating compositional behaviour (1.3); out-of-date classroom pedagogical practices (1.4) and a disconnect between formal and informal music-making practices (1.4.1) which necessitate new research. This rationale informs a series of research questions (1.6), which in turn guide a literature review and the design of methodological processes.

1.2 Technical problems!

To understand classroom music education, especially its desire to educate all children to create music in partnership with digital music technology, is to open Pandora's box. When Collins attempts to rationalise music education, she likens the process to 'trying to unravel a tangled extension cord' (2013, p.217).

In the interests of clarity, national curriculum requirements are a reasonable starting point for secondary school music teachers working in England. Classroom music achieved national curriculum status in 1992 (Finney, 2007b) and since then, music lessons have been expected to provide creative musical experiences and access to digital music technologies for all (see DfE, 2013; DfE, 2011). Tobias agrees that digital technology should be integral to music classroom settings, arguing that 'being musical' is to embrace the skills and processes demanded by those technologies which define contemporary musical genres:

> …music educators might acknowledge and address expanded notions of composition in popular music that include processes of recording, engineering, mixing, and producing along with the technologies, techniques, and ways of being musical that encompass these processes. (2013, p.213)

Desktop computers and digitally interfaced piano keyboards are popular classroom technologies but they remain expensive, absorb valuable rehearsal space and often require time-consuming maintenance by school technicians and the music teacher. Those trainee teachers who participated in research into 'factors that constrain the use of music technology in teaching placements' share this perspective:

> There were not enough computers – I could only fit 15 or 16 in (of a class of 28) (Male 2011/2012).

> The computers were so unreliable, I dreaded doing ICT with Key Stage 3 [music] lessons [for pupils aged 11–14], because every lesson it wouldn't be the same thing that went wrong, it would be something different (Female 2008/2009).
>
> The fact that the software was out of date or the equipment was unreliable and made it awkward to use meant that there were many things that we discussed at uni [university] that I was unable to experiment with during my teaching practice (Female 2011/2012). (Gall, 2013, p.13-14)

There remains an evident need for a cost-effective, ubiquitous and absolutely reliable digital technology that can be transferred between learning spaces to satisfy ever-changing needs. Consequently, music departments and even whole schools are choosing to purchase tablet computers, where bodily gestures replace keyboard and mouse:

> Nowadays, the use of computers in music education can no longer be classified as a new or recent development. The traditional desktop computing is increasingly complemented and possibly even gradually replaced by a new breed of computational systems in which mouse and keyboard are exchanged by body movements as controller. (Nijs and Leman, 2014, p.41)

Believing that most music teachers will soon be required to consider mobile technologies for use in their own classroom, we must better understand 'what really happens' when students create music with digital tablet technologies. After all, '...there is legitimate room for caution and concern in embracing new technologies, and not everything new deserves a place in the curriculum' (Randles, 2013, p.49). Before new technologies can be considered however, it is necessary to better understand their intended setting and therein, the current polemics arising from 'the music classroom' will now be presented.

1.3 Creating music is daunting and difficult to initiate

Since ancient times, composing music has been considered a cerebral and deeply challenging pursuit. Thorgersen writes that Aristotle considered high-level music making to be a task for slaves because it was 'far too demanding and physical for free citizens' (2012, p.134).

A creative person is required to sustain themselves and even thrive in states of 'disturbance'. Balkin (1990) defines this concept as rethinking, reconsidering, replacing, refining, redoing, reaffirming, reprocessing, rewriting and reconceptualizing existing ideas. Moreover, the personal ideas being 'disturbed' communicate something of 'the self' to the outside world. That is, in the words of Harris, 'the process of uncovering, objectifying our unique gamut of potentialities' (1934, p.188). Understandably, asking young people to 'disturb' their existing ideas, to communicate perhaps their deepest emotional thought through music, can positively ensure the challenge is rejected altogether:

> ...[creative] stages are usually accompanied by feelings of tension, irritability, anxiety, a sense of frustration, discouragement, and sometimes an abandonment of the whole problem. (Dimock, 1986, p.36)

Balkin (1990) goes further to suggest that a fear of making mistakes, looking foolish and disrupting established musical traditions haunts composers at all stages of their development.

If student-held fear and anxiety isn't enough to deter music teachers, successfully 'teaching' or 'guiding' compositional activity poses equal challenges. For instance, Deutsch argues that a music teacher's 'fear of the unknown' can make it difficult for their students to 'discover their unknown selves' (2009, p.92). He also argues that 'mastering the mystery of sound' is equally challenged by historically and politically influenced teaching goals, which can become steeped in passive theoretical study:

> The silence of theory . . . stress the word SILENCE . . . is not sound. There are still too many of us who can recall those awful days when a music class meant a teacher drawing five lines on a board and eliciting the hopefully memorized "Every Good Boy Does Fine" or "All Cows Eat Grass." (Deutsch, 2009, p.92)

Student fear, teacher anxiety and unsuitable learning goals can be compounded by the infinite range of musical abilities and cultural backgrounds of those young people attending our academies and maintained schools. Comber et. al remind us that:

> All pupils, regardless of ethnic and cultural origin, of gender, and of physical and mental ability, have the right to experience music. (1993, p.123)

'Music for all' is a guiding principle of the national curriculum for music (see DfE, 2013) and this presents further challenge for music teachers. Shatin (2009), Thorgersen (2012) and Shuler (2012) explain that classroom music students might enjoy chart pop, dance or rap music; have limited, if any ensemble performance experience; be proficient at drumming or electric guitar only; have very weak score-reading skills or conversely, have virtually no musical background whatsoever. Coercing diverse student cohorts to collaboratively create music is made ever the more difficult when in informal contexts, composers, both young and old, can freely explore and manipulate digitally-mediated sound worlds and impose their personality upon them. Meanwhile, music classrooms staunchly continue to offer woodblocks, tambourines and aging desktop computers. This formal environment can present a hostile context to initiate those creative desires harbored by today's classroom musicians. Odam summarizes the challenge of situating collaborative, creative musical experiences when training, resources and classroom layouts are limited and/or outdated:

> New generations of teachers have struggled with the reality of trying to adapt their inadequate teaching environments, equipment and training opportunities to accommodate and develop this work. At the heart of the problem is the difficult balance between co-operative learning techniques which encourage groups of children to work with minimum supervision in order to maximize limited resources in a mixed-ability environment, and individual learning needs. (Odam, 2000, p.111)

In terms of training related to the use of DMTs for learning, Wise et al. find that '…there is little evidence about what their [the students'] music teachers know about technology in regard to their practice, how they deploy, or might deploy, this knowledge in the classroom, and what they learn from doing so'. (2011, p.118). Understandably, this lack of technical competence brings with it a lack of confidence too:

> It feels as if music technology in schools has been caught up in a vicious cycle: inadequate pre and in-service training has resulted in many school music teachers lacking confidence or competence and, as a consequence, interest in ICT and music; a shortage of equipment for whole class use has then led to further hesitation in bringing technology into music lessons and a disinclination to develop new skills and awareness

> in this area of classroom work, especially with children under the age of 15… (Gall, 2017, p.99)

It is apparent that teachers may not have adequate resources; may not possess the technical and pedagogical knowledge required to make effective use of DMTs and may not have the confidence to overcome their students' and/or their own anxieties. Music education might commit itself to confronting these challenges in order to maintain the influence of the music classroom in a digital age.

1.4 The fading influence of the music classroom in the digital age

Perhaps the basic premise of the school is to socialise students in ways which ensure they become influential participators in and contributors to their own societal context. Waldron (2017) takes this view. She argues that institutionalised music education only retains relevance when it defines its students as situated in a 'newly socially sanctioned technological reality' powered by its 'space of flows' (Waldron, 2017, p.718). Waldron's 'space of flows' hints at the incomprehensible volume of information and knowledge communities are increasingly expected to manage in order to retain social currency:

> More and more students will have to learn to navigate through large amounts of information and to master calculus and other complicated subjects to participate fully in an increasingly technological society. (Roschelle et al., 2000, p.76)

This prediction is proving to be well founded. Societal demands have continued to increase and yet century-old school music classrooms continue to transmit once 'sacred' but increasingly alien musical traditions:

> Our students actually love studying music, but generally not the music we teach in schools (exceptions being music programs designed to engage students, usually through popular music cultures, rather than to impart information about music). (Humberstone, 2017, p.634)

Too often, music lessons ease back into a formalized teacher-centred experience wherein students work through a regulated curriculum which restricts choice and autonomy (Finney, 2007a). This became sharply apparent when Ofsted, who inspected music education provision in 90 secondary schools, published its findings. They found music lessons to be a largely passive, verbal experience and seldom musical:

> ...in too many instances there was insufficient emphasis on active music-making or on the use of musical sound as the dominant language of learning. Too much use was made of verbal communication and non-musical activities. Put simply, in too many cases there was not enough music in music lessons. (Ofsted, 2011, p.1)

The dominance of verbal interaction to which Ofsted refer is symbolic of a music classroom which forwards the teacher's voice as 'absolute musical authority'. Music is talked about and its 'rules' memorized in place of 'active' music making:

> …our music education system is still predominantly rooted in traditional beliefs and values, conventional musical skills connected with usual musical instruments, learning to read and write in (mainly) Western notation, composing by paying attention to the specific rules and constrains of a particular musical genre (which is usually part of Western classical traditions). (Chrysostomou, 2017b, p.195)

Any such curriculum typically supports linear thinking and 'noncreative skill building' (Webster and Williams, 2017, p.22). Shaffer et al. (2005) remind us that over a century ago, the philosopher John Dewey found schools to enjoy a 'fact fetish', to the extent that learning was perceived as a body of information that must be 'acquired'. Shaffer et al. find that classrooms have not adapted; their 'standardized curriculum are dinosaurs in this new world' (2005, p.110). Understandably, such a regulated setting can perceive digital music technology as a usurping force; a resource of unknown influence, one which could 'overturn' the old order:

> Music made by technology is seen as undesirable and not compatible with "real" music. Smartphones and tablets in the hands of learners during school hours are seen as a negative, often not for instructional goals but for administrative, security and disciplinary reasons. (Webster and Williams, 2017, p.22)

Fortunately, the case to retain such pedagogical ideals can easily be challenged. Sherman (1971) reaffirms that music is a living, ever-changing conceptual medium of expression. He defines the values of art as relative; not universal laws to be memorized and therefore, any artistic culture is permanently in a state of evolution (Sherman, 1971). If this argument is accepted, it's possible to agree with Balkin (1990) who advises a repurposing of the music teacher into someone who can reconcile formal education with the diversity and connections of real life. After all, as Lum (2017b; 2017a) argues, students have unprecedented access to mobile DMTs in out-of-school settings and in those settings, students retain the power and control over their musical discourse. This 'mobile economy' is found to be a primary catalyst for twenty-first century music consumption habits:

> If you talk to today's teenagers about music, their feelings and attitudes are quite different than that of the thirty/forty-somethings…The kids' culture is a highly mobile, networked, all-digital, and interactive culture, and digital technologies are a tacit standard that is completely and unobtrusively integrated in to their lifestyles. (Kusek et al., 2005, p.101-102)

In spite of their musical experience, young people today happily individually or collaboratively compose music and digitally share their products worldwide: without intervention from their classroom music teacher. Kusek et al. (2005) explain that digital file formats ensure computers are used to read, write, upload and download the music people want. The ubiquitous, mobile and digital nature of contemporary musical experience has given rise to increasing 'individualization'. Individualization through technology proposes a '…wave of possibilities and freedom to experiment…' (Lum, 2017a, p.546). Pignato (2017b) also finds that young people make use of DMTs in 'highly individualized' ways. He finds that secondary age students seek out the music which best represents their personal identities; join those social communities who uphold the same musical values and curate their own musical learning (Pignato, 2017b). Sadly, when Pignato (2017b) compares these behaviours to the use of DMTs in school, he finds that they can be deployed to inherently limit, restrict and even suppress young musicians:

> …young musicians use technology to socially construct idiosyncratic personal and social musical worlds, [but] educational institutions often use technology to reproduce, affirm, or advance fundamental assumptions about music; for example, what music ought to be and how it is best learned. (Pignato, 2017b, p.340)

The problem for Haning (2016) is that serving music teachers are typically ‘digital immigrants’; they have adopted technology as a useful tool over time but they were not exposed to that long-term immersion which ‘digital natives’ bring with them to the classroom. These digital natives ‘…have spent their lives surrounded by and using computers, video games, digital music players, mobile phones and all the other tools and paraphernalia of what is also called the information age’ (Wise et al., 2011, p.118). Haning (2016) concedes that teachers might be afraid to lose the respect of these ‘tech-savy’ students and consequently, they become critical to the extent that new technologies are not considered. Williams (2017) adds that music teachers are also afraid to surrender comfortable and familiar routines:

> We are a profession that resists change, and this resistance has hurt us. This resistance is fast making us irrelevant in a musical world that is ever changing. (Williams, 2017, p.161)

While there are those music teachers who accept digital technology as fundamental for societal relevance, Gonzalez-Moreno (2017) discovers that a range of other positions are commonly held. Music teachers might reject technology because of its perceived inadequacy for the curriculum; they might adopt Williams’ (2017) stance and maintain their department’s ‘status quo’ or echo Pignato (2017b) and use technology to affirm traditional pedagogical practices. Gonzalez-Mareno’s first position, one of rejection, cannot be dismissed out of hand. Music teachers are legitimately worried about the ‘deskilling’ process, that is ‘…just how much student agency can be lost if no attention is paid to mediating effects [of DMTs]…’ (Louth, 2013, p.148).

The challenge to the rejection argument is that in spite of any potential deskilling, students arrive at the music classroom with expectations around what DMT-mediated interaction should look like. Leah Kardos (2017) became acutely aware of this when she attempted to develop a student’s critical and diagnostic listening skills during a music technology course. The student rebuffed Kardos’ pedagogical approach and expected to use an ‘app’ to ‘quick fix’ the issue. This quick fix was designed to circumvent precisely those critical listening skills and musical understandings Kardos expected the student to develop. Meanwhile, Kardos’ student raises a valid point. In a world increasingly defined by digital ‘work arounds’, Lepa et al. (2015) believe it is right to question traditional theoretical, formalized musical expertise as being the only expertise necessary to understand music-making. After all, traditional musical skills typically take years to acquire and therefore, they represent a consummate barrier to musical engagement:

> So much of children’s music education is impeded by a need to develop the necessary skills required to play and to compose. If the musical learning environment is such that reliance on musical technical skills is not the focus, it is possible to surmise that what occurs in a music class will change. (Reynolds, 2005, p.247)

In terms those classroom changes, Kardos (2017) believes that new technologies can actually propose newfound freedoms. She explains that never before have the materials of music been so pliable, touchable, easy to understand and accessible (Kardos, 2017). This increased accessibility also has the potential to rewrite hierarchal relationships in the music classroom. A range of researchers assert that social actors situated in the most challenging of social economic settings can access the materials of music via digital technology (e.g. Folkestad et al., 1998; Roels, 2012; Randles, 2013; Kirkman, 2011; Comber et al., 1993). The point is best summarized here:

> Computers are more evenly spread throughout the population and can bridge socio-economic boundaries, effectively giving students and teachers access to a whole range of musical ‘instruments’ and tools. (Thorgersen, 2012, p.135)

Ubiquitous access to musical experience is a happy blow for ‘musical elitism’ and consequently, the classroom music teacher must better position themselves in the music classroom. Historically, music teachers have developed a role as stalwart gatekeeper to the musical realm. Ironically then, music teachers themselves became a barrier to musical experience. Of course, in the contemporary age, music teachers may not influence young peoples’ ability to actively create, perform or passively listen to music. If music teachers are to retain their influence, they must commit to better understanding young peoples’ informal music-making practices. A review of these practices will now be presented.

1.4.1 An emergent disconnect between young peoples’ formal and informal musical experience

When new technologies emerge, Berry and Dahlstedt (2003) believe that those technologies cause societies to change and that it is the job of artists to produce artworks – such as compositions – which respond to, or make use of those mechanisms of change. Berry and Dahlstedt’s argument defines artistic expression as transient; it is situated in time and space. By the late twentieth century, Brooks (2001) discovers that the average adolescent can afford, access and make creative use of professional grade music technologies. When those same adolescents reach the music classroom, quite a different scenario is presented to them:

> [As students]…matriculate through the education system, they are often exposed to materials and manipulatives used for the past 40 years, and not to the digital media to which they are accustomed. (Annetta, 2008, p.229)

The growing challenge for such institutions is that ubiquitous access to ‘digital media’ can lead young people to question why schools ‘retain ownership’ of their learning trajectory:

> Today's technologies make the world's libraries accessible…As a result, people have unprecedented freedom to bring resources together to create their own learning trajectories. (Shaffer et al., 2005, p.110)

Personalized learning trajectories can emerge from informal settings (such as the home) without assistance or ‘permission’ from formal institutions. Informal music learning practices are defined here:

> Informal music learning exists in any community in which there is music. At their most basic level, informal music practices are natural and spontaneous responses to music. There is no evaluation, formal or otherwise, and no teacher direction or guidance. (Jaffurs, 2004, p.192-193)

Lucy Green’s research into the informal practices of learning popular music finds that ‘…young musicians largely teach themselves or ‘pick up’ skills and knowledge from family and friends’ (Green, 2002, p.5). When teaching themselves, Green explains that young people learn that music they choose for themselves; carefully listen to and copy recordings; learn from their friends without adult guidance and develop learning processes which are holistic, haphazard and bear no obvious structured progression (2008, p.25). Fast forward to the present and young people are increasingly making use of digital technology to mediate their informal learning trajectories:

> In the informal realm, individuals make active choices about what, when, and how they want to learn. The technological tools at hand enable them to develop new skills through imitation and playful, engaged participation, and to explore, create, and share their own work with fellow members of supportive communities of interest. (Howell, 2017, p.19)

Like Howell (2017), Lum (2017b) finds that it is new technologies which have broadened both the personal and collaborative spaces for musical learning. Referring to collaborative spaces, Webster and Williams (2017) forward the argument that informal learning networks are 'where the real action is' for musical learning. They find these participatory cultures encourage '…more democratic opportunities for self-expression across varied musical styles and practices' (Webster and Williams, 2017, p.22). The Clubhouse Network is an international community consisting of 100 clubhouses situated in 18 countries (Khurana, 2018). The clubhouses are hubs for 25,000 young people from underserved communities. Young members work with adult mentors to explore, invent and self-discover through the arts, including music. At clubhouse, young people are empowered to collaborate with digital technologies in an inclusive environment, which celebrates diversity in musical taste and background (Khurana, 2018). Informal learning networks can center around the individual too. Savage (2012) introduces his brother's son, Tom. Tom is a keen young guitarist who develops his own informal music curriculum using online social tools because formal instruction methods failed him:

> I heard music coming from Tom's room…I wondered who it was…I found Tom plugged into his laptop, moving his eyes between a YouTube video and his guitar fretboard. He had set up a system where he could slow down guitar parts to learn them more easily, he had accompanying drum and bass patterns to help him keep time, and he uploaded his practice sessions so that a group of his friends, having similar musical adventures, could hear what he was doing and leave comments. (Savage, 2012, p.218)

Tom creates his learning trajectory around his need to learn the guitar so that he can authentically participate in a musical community. Savage (2012) adds that two months later, an online peer introduced Tom to the ccMixter web-based software. Tom began to upload musical sketches and even complete compositions for other members of the online community to download, overdub and remix. Savage makes the point that the way technology is used within formal music education settings is a '…stark contrast to the free-flowing, improvisatory nature of learning in the informal context of Tom's learning of the guitar' (2012, p.219)

Fortunately, there are ways in which Tom's approach can be validated and developed in formal classroom settings and these potentials for change will now be explored.

1.4.2 Bridging informal and formal music-making practices

Regardless of what schools do, or don't do, young people have long composed music out-of-school. Odam (2000) visited 26 state secondary schools and found that 35% of key stage three students composed for pleasure in informal settings. 'Pupils spoke of composing as a relaxation, a relief from depression and from boredom' (Odam, 2000, p.122). Accepting that DMTs might further catalyze such compositional practices, Burnard (2012a) suggests that existing curriculum specifications are inappropriate, if young people are to enjoy an invigorated creative music education in school. The development of new classroom curriculum specifications presents an opportunity for music education '…to align itself more closely with the ways many young people choose to interact with music beyond the classroom: in participatory ways that involve digital technologies and media' (Bolden and Nahachewsky, 2015, p.19). It is proposed that now might be 'the right time to bring formal and informal music settings closer' and in doing this, there is an opportunity to '…take music education to another level, one that would be impossible without digital technology' (Chrysostomou, 2017a, p.348-349). How this is to be achieved should preoccupy music teachers as they ponder their curriculum and pedagogical approaches:

> Closing the gap between technology use at home and school preoccupies teacher thinking about what should be included in the [music] curriculum and how it should be delivered and where it should be positioned. (Burnard, 2007a, p.197)

A starting point is to reject the polarization of formal and informal learning practices and also to refrain from overwriting one approach with the other. When Paisley and Cassidy (2016) investigated the intrinsic musical value of the console game 'Rock Band 3', they discovered that game-based, simulated rock-band experiences can integrate with existing classroom practice. Their sole participant soon developed the confidence and desire to engage with more traditional forms of music-making. Paisley and Cassidy conclude that, 'In sum, the synergistic context of music games appears to present a vehicle to bring the informal and formal musical worlds to the learner' (2016, p.135). Buckingham adds that to bridge a digital divide between home and school, teachers require '…a new and less superficial attention to people's cultures' (Buckingham, 2007, p.2). For music teachers, this amounts to a desire to better understand the nature of their students' peculiar relationships with music. Aligning with school teacher and creativity researcher John Paynter, musical interpretation is something unique to the person and therefore, our students' perceptions of music must become a priority:

> Music can mean whatever anyone wants it to mean. If, while you listen, you imagine landscapes, seascapes, inter-planetary travel or anything else, no one can say that is wrong; but, then, another person's entirely different literal interpretations would not be wrong either! What about the composer's intention for the music: surely that takes priority? (Paynter, 2000, p.22)

The point here is that whatever musical interpretations or informal experiences young people bring with them, teachers might more deeply understand and prioritize them. Cain explains that when teachers use electronic keyboards and computers for instance, students access '…a range of sounds that are often very similar to the ones heard in popular music, making it possible to relate more closely school music and the world outside' (2004, p.216). Clennon (2013) used electronic composition tools with a group of young offenders participating in a community music pilot study. The Macintosh Logic software, selected for older age groups, encouraged participants to accompany their own lyrics with musical loops. The loops and lyrics became a vehicle to explore and reflect upon street life and its impact upon participants' anti-social behaviour (Clennon, 2013). Returning to a school setting, Gall and Breeze (2008) worked with students 10-11 years old to develop compositional behaviour in partnership with Dance eJay software. Their findings revealed that the software enables students to become culturally invested in the music they create because the loop-based genres were familiar to them. One participant summarized their experience:

> . . . like if you hear instruments playing on those classical tunes but, like, we're into hip-hop and rock and stuff like that . . . so it's quite . . . strange for us, to hear the music we're into. . .it's new. . .it's good. It has a better beat! (Gall and Breeze, 2008, p.36)

The Macintosh software Garageband also has the potential to connect students to their informal musical worlds. Bolden (2009) used case study methodology to chronicle how Jesse, an experienced secondary school composition teacher, worked with students in Ontario, Canada. Jesse was found to be committed to ensuring that student music-making remained personally meaningful and had relevance beyond the classroom (Bolden, 2009). Jesse chose Garageband, in part, for its culturally relevant sound-world:

> [Jesse] These sounds in GarageBand are the sounds they're hearing in their music – what they listen to on the radio. They're familiar with them; they know how to build with them. (Bolden, 2009, p.147)

As well as accommodating his students' own digital music-making practices, Jesse also celebrates and made use of students' broader musical cultures during lesson time:

> [Jesse] I have students working here that are from the Middle East. They're doing an assignment that incorporates rhythms from the Middle East. For the most part I let them do what they're comfortable doing, because they have an interest in it. And they'll do better work. (Bolden, 2009, p.146-147)

Jesse's approach makes it possible to capitalize upon students' informally constructed digital and musical practices during lesson time. As part of Dorfman's (2016) research into the perceptions of music teachers who run one-to-one iPad programmes, music teacher Katherine was observed. Katherine explained that while it takes time for students to master the tablet's functionality, they developed new-found confidence when culturally-popular technology was embedded in the music classroom:

> [Katherine] I think it's put a positive spin on music for them because maybe they feel like they have a little bit of extra knowledge that they can share—it empowers them. (Dorfman, 2016, p.169)

In this case, the students' 'ways of doing things' are given currency when Katherine decides to make use of tablets for creative musical activity.

Hitherto, this rationale has identified concerns around the current provision of digital technologies in music classrooms; described some of the difficulties students and teachers can face when initiating compositional behaviour; reviewed young peoples' informal learning music practices to highlight a divide in technology use between home and school and suggested ways which teachers can bridge that divide if they are willing to authentically work with the musical cultures students bring with them to the classroom.

Of course, the mere inclusion of tablet computers or any digital device in formal learning experience is not necessarily a beneficial step. Part 1.4.3 will now forward the belief that deeper pedagogical understandings about how to manage DMTs in music classrooms are required. The absence of a popular framework, insufficient micro-level research into digitally-mediated composing and scant pedagogical understanding of tablet computers compounds the problem.

1.4.3 In search of deeper understanding

As for Huang (2014), it is argued here that software-based alternatives for conventional paper-and-pencil composing practices must be sought. Simultaneously, Savage (2012) heeds caution, explaining that teachers and researchers quickly identify the potential benefits of new technologies but often fail to identify or analyze any physical, cognitive and musicological downsides. Perhaps teachers and researchers are not to blame. Understanding the influence of digital technology when '…research on musicians empowered by and educated through digital and virtual technologies is scarce', remains challenging (Partti, 2014, p.3). In particular, how composing practices are both transformed and constrained by technological processes is insufficiently understood. Bresson agrees, calling upon researchers to explore those '…musical concerns underlying the use of the computer and calculus in composition' (2013, p.273).

Bauer (2013) argues that a starting point for music teachers is to develop a technical knowledge alongside their musical content knowledge and attempt to figure out how these knowledge systems interact. Rightly, Dillon (2004) finds this 'easier said than done' because educational multimedia is a problematic field that has emerged rapidly with little time to establish any robust intellectual tradition. A number of commentators note the uptake of digital technology in learning demands an appropriate language and form of conceptualization to better understand the nature and properties of technologies, their pedagogical benefits and the broader organizational changes required (Martin, 2013; Derry, 2007; Conole, 2004; Kirkman, 2011). In response, a suitable framework might help to '…conceptualize and actualize the knowledge, skills, and dispositions educators need to be able to effectively integrate technology into teaching and learning' (Bauer, 2013, p.54). For music education researchers seeking to contribute towards such an aim, Derry (2007) proposes that conceptual frameworks help to carry out further analysis; establish clear understandings around how particular technologies achieve particular goals; identify potential limitations and inappropriate usage and critically, provide a shared discussion point to achieve further refinement.

Deeper conceptual understandings are acutely timely given that 'technologies, such as the iPad, are becoming more and more prevalent in music classrooms' (Reese et al., 2016, p.107). Katzan (2015) finds that the introduction of tablet computers into schools has 'drastically changed' how learning experiences transpire. For him, this presents a 'vexing problem' because 'many educators have neither the time nor the inclination to look into this new subject' (Katzan, 2015, p.15). This is a precarious scenario for both pre-service and experienced music teachers. Well-known manufacturers of digital audio software (e.g. Steinberg and Apple Computers) have developed apps for Android and Apple mobile phones and tablets. Méndez believes that this '…innovation progression is helping to create a whole new dimension both in the music creation process and in the development of possible applications of these new technologies in the education field' (2015, p.68). Meanwhile, there is an acute absence of research into how tablet apps influence music-making:

> Due to the scant number of studies regarding young children's use of music technology and engagement with musical apps, research needs to be conducted to determine the qualities of apps that are musically educational and developmentally appropriate. (Burton and Pearsall, 2016, p.88)

Responding to Burton and Pearsall's plea for fresh research, this study will review existing literature to ultimately propose a conceptual framework designed to guide a philosophical and methodological approach (see chapter five). Meanwhile, part 1.5 will now review those research designs which diverse research communities believe have the potentiality to unlock new understandings about development through and around digital technology.

1.5 The type of study required

Studying technology raises questions about what should be included when we actually study it (see Means and Haertel, 2004). Bauer (2013) begins to consider this issue concluding that there is a requirement to consider the influence of the new technology itself (e.g. enabling and constraining factors) and secondly, how that technology interacts with pedagogy and the classroom environment. Kress (2010) broadly agrees. He encourages researchers to investigate what communicational or pedagogical implications arise from any new technology (Kress, 2010). Communicational and/or pedagogical dimensions imply a requirement to observe human behaviour around the technology as a means to better understand how the tablet influences classroom music-making. In the words of Vygotsky, it is the task of the researcher '…to uncover the real relationship…that exists between behaviour and its auxiliary means' (1978, p.53). Perhaps then, to understand how tablets are used by students to create music, it is their behaviour which must be observed, which will in turn account for the tablet computer's influence:

> Behavioural research, which attempts through direct observation and quantification of behaviour, is useful in detecting how individuals engage in composing, but does not tell us why or what they are thinking. (Hewitt, 2009, p.22)

Observing behaviour around a tablet computer is a simple starting point to develop understanding but as Hewitt (2009) suggests, the 'how' and 'why' remain unknown. To overcome this issue, Konstantinou suggests that '…students' perspective should be examined in more detail in regard to change when introducing technology' (2016, p.186). Indeed it is the students themselves who are best placed to explain how and why they behaved in a particular musical, or non-musical fashion, for example. Given this preliminary discussion on the proposed design of the study and the rationale presented hither-to, a number of research questions emerge. These will now be introduced and briefly discussed.

1.6 Research Questions

At rationale part 1.3, composing music was found to be challenging to the extent that mere engagement with the process can trigger low confidence and anxiety in people of all ages and experience levels. It was also found that teachers can battle a lack of appropriate, reliable and sufficient digital resources alongside a necessity to accommodate students with diverse musical abilities. Fortunately, digital technologies '…have allowed people who previously would not have considered themselves musicians to handle, create and communicate music via their computers and this is a most tantalizing prospect for teachers' (Wise et al., 2011, p.119). Savage disagrees with Wise et al. (2011) and paints a 'grim reality' of digitally-mediated creative musical activity in the secondary school. Based on visits to schools in the north of England he observes:

> • Unskillful uses of music notation technologies to produce scores where considerations of instrumentation have been given cursory attention
>
> • Insensitive and over-enthusiastic approaches to cutting and pasting in music sequencing software leading to compositions that have weak structures, lack of contrast and little, if any, melodic, harmonic or rhythmic variation and development
>
> • Creative 'borrowings' or 'samplings' of others' work through the opening of access to digital media being done with little thought to style, context, reinterpretation or ownership
>
> • An over-reliance on auto-accompaniments, auto-tuning or other support (Savage, 2012, p.219)

In response to these contradictory accounts of digitally-mediated creative musical activity in the secondary school, this research project will investigate how a tablet computer influences students' compositional processes. The tablet might manifest itself as a constraining influence upon students' creative freedom or conversely, enable students to become part of a creative musical experience otherwise out-of-reach, for example. The following research question therefore emerges:

> *RQ1: How, if at all, can tablet computers enhance or constrain musical creativity?*

Of course, digital technology might not be the only constraining feature of formalized creative musical experiences. Rationale part 1.4 evidenced that politically and historically influenced teaching goals can seek to impart musical information and restrict students' contact with active creative music-making. Consequently, classroom composing can be ritualistic, heavily regulated, curriculum determined and teacher-centered. Some teachers even perceive technological music as undesirable, not classroom compatible and subsequently, change is resisted and comfortable routines upheld. Admittedly, accessible guidance for the design of tablet-mediated creative music experiences has yet to exist and consequently, professional development in this area is self-taught, haphazard or non-existent. Rather obviously therefore, this research must better understand how, if at all, classroom music teachers pedagogically 'manage' those compositional activities mediated by a tablet computer. The following research question therefore emerges:

> *RQ 2: How, if at all, do classroom music teachers influence tablet-mediated creative musical activity?*

Returning to rationale part 1.5, Kress (2010) and Bauer (2013) encourage researchers to investigate the communicational consequences of situating a new technology in the classroom. While the teacher's influence has been discussed, what of our student's classmates? Early stage secondary school students typically create music collaboratively in the classroom:

> …[We must] move away from the child as an isolated individual and see the interplay of personality upon personality. In such settings children mature emotionally and socially. Music is an activity which lends itself to sharing, between children and the teacher. (Cox, 1999, p.33-34)

This view is upheld by Ginocchio who argues that collaborative creativity provides ‘creative safety’ for those ‘…who are more critical or less confident about their own work’ (2003, p.53). He also explains that peers contribute musical knowledge; discussion; leadership and even develop formalized teaching roles (Ginocchio, 2003). These roles are emergent and transient between student participants:

> As valuable products emerge, leadership shifts from one person to another in recognition of the value of the product or talent...Sharing and cooperation are integral to the activity. (Dimock, 1986, p.133)

The pedagogical benefits of student partners appears substantial but their necessity for tablet-mediated composing remains in question. Therefore, a further research question emerges:

> *RQ3: How, if at all, can student partners influence tablet-mediated creative musical activity?*

Referring again to Konstantinou (2016), the mere observation of social actors will not explain why they behave in such a way. Means and Haertel (2004) explain that behaviour is not only influenced by the technology or human actors but a much wider range of contextual factors. These include a student’s prior achievements inside and outside the classroom and their pre-existing technology skills, for example. Rationale part 1.4.2 has suggested that such an approach, that is, the prioritization of those musical interpretations and/or informal musical experiences young people bring with them to the classroom, is a necessary starting point. This is unsurprising given the divide that can exist between young people’s informal, digitally-mediated musical practices and any formal provision offered by secondary schools. Once a narrative for a student’s musical identity is constructed, a logical research question arises:

> *RQ4: To what extent, if at all, can students’ broader musical cultures, current musical interests and experience influence their tablet-mediated creative behaviour?*

Research questions have thus far considered how the tablet, teacher, student and peer might influence creative musical activity. Each question intends to account for some part of classroom-based, tablet-mediated composing. In broad terms, the research questions respond to Swanwick’s (1979) four variables of musical experience, three of which are the available skills and technology; personality dispositions and broader social/cultural influences. Swanwick (1979) also cites a currency of musical ideas. How these supposedly ‘new’ ideas are initiated and developed in partnership with a tablet computer remains mysterious. In search of clarity, we might begin by ascertaining that musical composition is a longitudinal process, one which traverses time and space. For example, Tjora’s (2009) primary observation of young composers who used a Groovebox (a self-contained, loop-based electronic instrument) was that student needs become more advanced as their user trajectory develops. She concluded that a single technological artefact can be adapted to assume various usage modes over time (Tjora, 2009). Unsurprisingly therefore, Lagerlöf et al. (2014) explain that in their study, which investigates ‘play’ with and around a new music technology, a video-enhanced, detailed analysis of events as they unfolded was necessary. Chronicling events over time could therefore be essential for investigating how tablet, teacher, student and peer come together at moments in time to construct creative situations (Lagerlöf et al., 2014). To find out what musical ideas are found and how those ideas develop overtime therefore, an additional research question is proposed:

RQ5: How, if at all, are creative musical ideas initiated and developed during tablet-mediated creative musical activity?

It is hoped that the rationale presented hitherto has ensured that the research questions introduced here are unsurprising. The research questions are presented at this early stage for two reasons; those originally outlined by Tracy (2013). Firstly, the research questions presented here provide an orientation and launching pad for the forthcoming literature review and secondly, they sensitise readers to the goals of this project at an early stage (Tracy, 2013).

The presented research questions respond to three broad literature paradigms: musical creativity, digital technology and classroom pedagogy. Chapters two, three and four will review these paradigms. Moving forward through the thesis, chapter five will bring the aforementioned paradigms together to present a theoretical framework developed to define a unit of analysis (a case) necessary for answering the research questions. Chapter six will present a methodology developed to observe and construct situated meanings about tablet-mediated creative musical development in two different settings. Chapters seven and eight will each present a case report chronicling how a specific school community initiated and developed creative musical ideas through and around the tablet computer. Chapter nine will undertake a cross-case analysis of the case reports to examine their emergent themes. This analysis will be organised by research question. Chapter ten will discuss the cross-case themes alongside relevant literature. Using this newfound understanding, a new systems-based framework will be presented, which might have transferable value going forward. Chapter eleven will conclude this thesis by presenting ten seminal contributions to music education research and teaching practice. Research limitations and recommendations will also be considered.

Now, chapter two will reference literature to better understand creativity, which is ultimately defined as a form of social cultural behaviour.

Chapter 2:
A revised vision for musical creativity

A research rationale has been presented. Chapters two, three and four will now review literature on creativity, digital technology and pedagogy respectively. These research paradigms will provide the understanding necessary to ground those research questions presented in chapter one. From these research paradigms, a new conceptual framework will emerge, one designed to understand the fundamentally distributed nature of tablet-mediated creative music action. Additionally, methodological strategy (i.e. guiding philosophy) and design (e.g. methods and sampling) will also be determined by the literature-based, theoretical augments presented in these forthcoming chapters.

Returning to this chapter, it will now propose a definition of creativity which emphasizes the influence of social setting and its broader, culturally-conditioned conventions as definitive for explaining a composer's creative behaviour. This perspective will therefore ultimately reject individualistic, romanticized arguments which forward composers as 'divine geniuses'. Rather, it will be proposed that a composer's desire for musical self-expression emerges in response to their social cultural setting: one situated in time and space.

The act of musical creation, it is argued, is a behaviour inseparable from human discourse. For millennia, 'people of every culture have found a need to express and share feelings, thoughts and ideas by ordering sounds into forms which symbolize and interpret their experience' (Stephens, 1996, p.2). This is perhaps best illustrated by Frank. Frank was one of nine participants in a study undertaken by Bolden and Nahachewsky (2015), which examined undergraduate students' experience of creating podcasts to communicate their relationship with music. During the study, Frank identified the extent to which music had emotionally impacted his life:

> Frank: Music for me has always kind of been, I don't want to say crutch, but it's helped me get through some hard times. So, to revisit those challenges that I've faced and then kind of see it through the lens of music ...wow, did that ever help me. I was so engaged. (Bolden and Nahachewsky, 2015, p.23)

Perhaps then, the role of the school is to help more students better understand themselves and communicate their place in the world through music. After all, Harris (1934) suggests creativity is that human desire to capture and communicate feeling and Ginocchio (2003) accepts the ability to communicate is probably the most important skill we ever learn. Sadly, back in the classroom, music lessons can give credence to ancient musical myths which can impede authentic creative communication. Music teacher Janet Mills summarizes the primary issues:

> People think that they are 'not musical'. Or that to play an instrument you first have to learn to read music. Or that if they have tried to learn an instrument, but did not make too much progress, this was necessarily their fault. Or that you have to be Mozart to compose. (Mills, 2005, p.5)

Understandably, Mills (2005) pleads with music teachers to 'put all of this right' before things go wrong. She asks us to build upon every child's natural affinity for 'making-up' music, so that their full musical potential can be realised (Mills, 2005). Mills' vision is tantalizing but in reality, many researchers find 'creativity' to be a slippery concept: one overused, misused, confused and misunderstood to the extent that there is little common consent about its meaning (Balkin, 1990; Philpott, 2007a; Webster, 1996; Paynter, 2006; Burnard, 2006).

In an attempt to dispel confusion, this chapter will construct a theoretical understanding for musical creativity, one which acknowledges 'individual' (cognitive) perspectives but primarily forwards 'multiple' (social-cultural) perspectives.

2.1 Demystifying the romanticised genius: cognitive perspectives

It is no surprise that young people can be daunted by the creative process. Hargreaves (1986) retells the tale of the muse who works frantically without food or sleep until a composition is produced. Through this lens, Hargreaves (1986) finds creativity to be mysterious, irrational and far from ordinary. It is easy to conjure the '…image of a lone heroic genius or some historical character in a powdered wig' (Hugill, 2012, p.118). These narratives describe well what is now termed a 'romanticised' view of creativity that '…remains deeply linked to the ideal of individual heroism, of the Great Composers' individual genius' (Burnard, 2012b, p.26). Burnard (2012b) reveals that romantic conceptions forward a singular creativity which is embedded in historical cultural hierarchies (Burnard and Haddon, 2015). These hierarchies separate the seemly divine nature of 'the great musician' from ordinary mortals (Burnard and Haddon, 2015). This is creativity perceived as '…some sort of mental activity, an insight that occurs inside the heads of some special people' (Csikszentmihalyi, 1997, p.23).

Humphreys (2006) discovers that in the Western world, the ability to create music has long been seen as dependent upon some inherent, superior level of 'talent', which is not especially amenable to change, even with formal training. This talent describes people 'whose minds secrete music' (Gardner, 1993, p.103). Composers experience a 'lightening flash', that moment '…when these ideas begin to crystallize and to assume a significant shape' (Gardner, 1993, p.101) . This event can signpost the composer toward a range of musical ideas:

> The pregnant musical image can be anything from the simplest melodic, rhythmic, or harmonic fragment to something considerably more elaborate; but in any event, the idea seizes the composer's attention, and his musical imagination begins to work upon it. (Gardner, 1993, p.101)

Of course, the 'music image' – the inspiration – is no accidental process. Inspiration is more likely induced by a composer's ability to exercise divergent thought. Four useful characteristics of divergent thought are reproduced below:

1. Fluency - the ability to generate a number of ideas in a given situation.
2. Flexibility - the ability to generate a number of different ideas in a given situation.
3. Elaboration - the ability to extend or embellish one idea.
4. Originality - the ability to generate unique ideas. (Webster, 1979, p.228)

A composer's cognitive fluency, flexibility, elaboration and originality can ensure that inspiring new ideas present themselves but what about the obvious necessity to produce the work? Here, the composer might fall back on their own range of factual knowledge, skills and well-tried procedures. Chen (2012) defines these practices as examples of convergent thinking:

> …the composer must employ convergent thinking to search for the most suitable musical examples and composition techniques. This involves consciousness to test ideas and find solutions. (Chen, 2012, p.161)

Wallas (1926) describes the creative process as four stages of creative thought. The stages, which he terms preparation, incubation, illumination and verification, seemingly describe a sequential application of both divergent and convergent thought processes which supposedly unfold in a composer's head (Burnard and Younker, 2004; Webster, 1979). Preparation is that moment when a problem space is divergently conceived and researched. Incubation processes strengthen internal connections and illumination is that 'lightbulb' moment where a goal (a problem to be solved) is fully formed. Things change when the verification stage is reached. The composer must think convergently to transform their new idea into reality (Burnard and Younker, 2004; Philpott, 2007a; Wallas, 1926). Essentially, Wallas is proposing a cognitive theory for how creative artists organise their experience (Paynter, 2006).

2.2 Composition pathways

Some composers surely identify well with Wallas' (1926) linear, sequential description of the creative process. Meanwhile, important research undertaken by Burnard and Younker (2004) finds that while Wallas' (1926) theory is not 'incorrect', it requires enlargement, refinement and more research evidence to retain contemporary relevance. Consequently, Burnard and Younker (2004) undertake a cross-case comparison of six student composers aged between 11 and 20 years. Their analysis of students' verbal and written reports, collected during and following composing sessions, reveals that composition pathways shifted between instances of problem-finding (divergent thinking) and problem-solving (convergent thinking). These findings broadly align with Wallas' (1926) theory. However, at the micro level, each participant develops a different composition pathway over time, age notwithstanding.

Rob (11 years) is described as a 'Floater' because he spends nearly all of his time exploring ideas (preparation/find) but he does not progress to 'incubate' or 'verify' (fix) his creative intentions (Burnard and Younker, 2004). Guitarist Lia (12 years) explores a great deal but prematurely skips to verification (fixing her ideas) and this ensures that the creative product is 'weak'. Singer and multi-instrumentalist Katyia (16 years) develops a 'staged' pathway because she progresses forward and across phases, much like Wallas (1926) originally describes. Singer, cellist and pianist Angie (16 years) develops a 'regulated' pathway because she is able to self-regulate her movement between any phase in order to ensure her goal is achieved. These findings evidence '…varying levels of problem-finding and problem-solving strategies…' (Burnard and Younker, 2004, p.64). For instance, Burnard and Younker (2004) learnt that Angie self-regulated her pathway by persistently listening, exploring, researching, testing, constructing solutions, drafting, editing and refining in a deeply iterative way. The authors summarise the observed variations in composition pathway as follows:

> These pathways could be defined in terms of spending most of the time exploring ideas (preparation); moving directly from illumination (when solutions appear suddenly and with certainty) to verification (or working out) phases; interplay between some of the phases to a cyclical, regulated path which included continuous feedback loops through all phases. (Burnard and Younker, 2004, p. 64)

As a consequence of these findings, Burnard and Younker (2004) reconceptualize Wallas' (1926) theory to better explain the full range of staged and non-staged pathways their participants describe. As 2-1 indicates, Wallas' 1920s terminology is also updated to better suit contemporary usage:

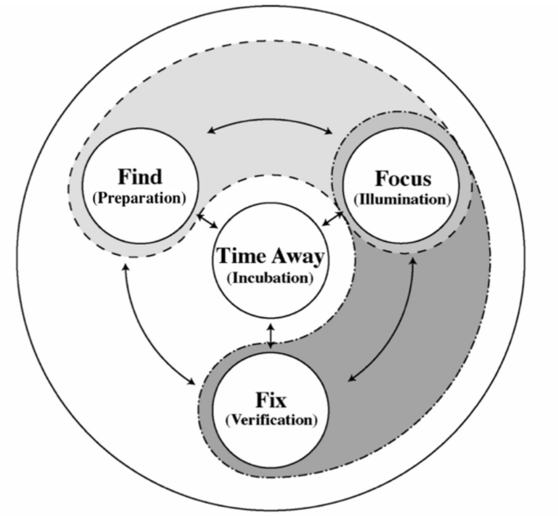


Figure 2-1 Model of composition pathways. (Burnard and Younker, 2004, p.65)

Burnard and Younker's model of composition pathways (Figure 2-1) sensitizes us to the diverse pathways student composers might devise to find, focus and/or fix their creative ideas. The bi-directional arrows suggest that composers devise a composition pathway in a way which suits their cognitive style. Furthermore, if the model is used to analyse creative behaviour, moments of creative weakness might be revealed. For example, if a composer were to progress very quickly through the stages, or 'float' in one area only, their pathway would likely require further development (Burnard and Younker, 2004). In essence, the model provides a cognitive perspective from which creative musical development can be tracked over time.

2.2.1 Constructivism

The model of composition pathways (Figure 2-1) can be celebrated for its rejection of a singular creative process, such as that most overtly proposed by Wallas (1926). The bi-directional arrows in Figure 2-1 infer that creative behaviour remains at the behest of a composer's cognitive strategy: that is, something uniquely 'constructed', by them, over time:

> [Cognitive strategies]…describe a broader family of intellectual capabilities that enables individuals to exercise executive control over how they think in problem-solving situations. When the problem is how to learn something, the individual accesses previously acquired attitudes, ideas, and skills that underlie study behavior, and uses these to construct a learning strategy. (Derry and Murphy, 1986, p.2)

As Derry and Murphy identify, cognitive strategies describe '…individual differences and preferences in modes of perceiving, remembering, thinking, and problem solving' (Schmidt and Sinor, 1986, p.161) Such differences ensure that '…some individuals select and report solutions quickly, with minimal consideration for their probable accuracy, while others take more time to decide about the validity of solutions' (Schmidt and Sinor, 1986, p.161-162). Like Burnard and Younker (2004), Schmidt and Sinor's (1986) research suggests that impulsive cognitive styles (e.g. fixing musical ideas too quickly) can be correlated to low academic achievement and an increasingly reflective style is more likely to yield superior performance.

Both Derry and Murphy (1986) and Schmidt and Sinor (1986) explain that a composer's cognitive style is influenced by their previously acquired attitudes, ideas and skills. This is a tenet of constructivism. Holland (2015) asserts that constructivism rejects standardised, linear models of learning, such as the belief that students must progress in predefined sequential stages, for instance. Holland (2015) prefers to understand learning as inherently non-linear and recursive (a retracement of steps). The perpetual construction and reconstruction of ideas through active experience ensures that 'learning is cumulative; that is, nothing is learned in isolation but previous learning experiences influence and relate to new learning' (Akhras and Self, 2000, p.13). Piaget is well-known for his view that knowledge is transitory; it continually shifts in shape and form and consequently, a composer's cognitive schemas are applied, modified or dispensed with accordingly (Rieber, 1996; Piaget, 1964). Long (2000) defines a schema as a cognitively-held, structured cluster of information which is used to represent events, concepts, actions or processes. The seminal point here is that the way in which composers apply, modify or reject their schemas [see Piaget's (1964) processes of assimilation and accommodation] is influenced both by their historical (previously constructed schemas) and present experience. Therein, this theoretical perspective suggests that a young person's informal musical practices (see chapter one) will directly influence their cognitive approach to musical creativity. This is why ignoring student practices, interests and believes out-of-hand in the music classroom is an outmoded cultural convention which music teachers honour at their peril.

2.2.2 The deficiencies of cognitive models for creative thinking and development

By their very nature, cognitive development models seek to generalise humanistic behavioural patterns and unsurprisingly therefore, Mills (1996) concludes that they cannot be expected to answer all of our questions about children's music-making. Burnard also questions the ability to label milestones in a child's creative development:

> The extent to which it is possible, however, to outline developmental milestones in creativity, which applies different criteria for labelling something as a developmental change in artistic, aesthetic, and musical modalities, remains in question. (Burnard, 2006, p.361)

Additionally, Green (2008) accepts that musical skills are haphazardly constructed in the informal realm and therefore, creative development can be fundamentally non-linear:

> Performers do not make progress only by playing pieces that are more difficult technically, or faster, or longer. They show they are getting better also by playing

> relatively easy pieces better than they did previously, or even just by revisiting pieces that they learnt previously, in order to consolidate them. (Mills, 2005, p.158)

‘Musical prodigies’ present yet another problem for creative development. Gardner (1993) sets up a hypothetical musical audition scenario wherein preschoolers perform music. One child plays a Bach suite for solo violin and another plays a simple minuet on piano. Gardner (1993) explains that these children have not arrived at such ‘heights of youthful talent’ via the same route. The first child has participated in the Suzuki programme, a popular initiative which originates from Japan. This programme educates thousands of young children to master a string instrument before they enter school. The other child began to pick out tunes on the family piano, as a consequence of being raised in a musical family (Gardner, 1993). While Gardner (1993) concedes cognitive ability may well be a factor, he insists that there are other forces at work. Gardner’s examples describe children who have membership to various social and cultural units (Burnard, 2006). In this case, families and additional out-of-school musical cultures prove influential for those children’s musical development. Consequently, it is suggested that the model of composition pathways (Figure 2-1) awards the composer too much of the credit. It focusses ‘…on creativity as the product of a single individual and focus on development as a process within the individual’ (Hargreaves, 1999, p.356). Critically, it is proposed here then that ‘…creativity does not happen inside people’s heads, but in the interaction between a person’s thoughts and a socialcultural context’ (Csikszentmihalyi, 1997, p.23). Consequentially, part 2.2 will now propose a ‘multiple’, ‘systemic’ view of creativity, one which begins by accounting for local social influences. Ultimately, this systemic perspective will be expanded to consider the influential nature of cultural situatedness (from part 2.4). Only then, might we more deeply understand the truly multidimensional nature of creative musical development.

2.3 Creativity as a fundamentally social process

The way we think about musical creativity ‘…falls far short of grasping the potential multiplicity of musical creativity today’ (Burnard, 2012b, p.36). Burnard has a point. Pepper (2017) cites online communities for digital composition (e.g. SoundCloud) and mobile apps (e.g. BeatWave, PatternMusic and Looptastic) as emergent opportunities for aspiring composers to share their music, receive critique and collaborate with human partners. These practices ‘…represent a major shift in how music is consumed and created – from a solitary act of composing…to a worldwide collaborative and creative enterprise’ (Pepper, 2017, p.318-319). This worldwide enterprise takes place in what Burnard (2012b) terms virtual fields, which influence newly emergent communal creative practices:

> …the Internet is allowing new musical creativities to emerge. This emergent communal music-making process, involving the appropriation and mixing of existing musical material, can be found in new or derived techno-communal innovations in digital media space. (Burnard, 2012b, p.39)

Consequently, we have to agree with Hargreaves (1999), who proposes tool-based digital technologies as fundamentally collaborative and therefore socially influential in nature. Hillier et al. (2016) undertook a review of research studies which explore the pedagogical value of the tablet computer. They discovered that iPad devices encouraged young people to share their work, take turns and collaborate with one another more easily (Hillier et al., 2016). This finding is supported by research undertaken by Charissi and Rinta (2014), which investigated the way in which preschool children develop their musical and social skills when they make music with a tablet computer. The researchers explain that:

> In this [music-making] process, which seems to be non-linear in nature, children were observed to develop negotiation skills, empathy and a tendency to verbalize their thoughts whilst exchanging their musical ideas. The initial findings, therefore, provide evidence that using appropriate music technology in a classroom can be of benefit for children to develop musical and social skills. (Charissi and Rinta, 2014, p.39-40)

Hillier et al.'s (2016) review also adds that the tablet's multiple viewing angles and its ability to handle multiple users simultaneously makes it especially advantageous for supporting collaborative creativity. The iPad's emphasis on visual stimuli was also found to support those students with communication challenges (e.g. English as a second language), or with disabilities, to collaborate more effectively and build confidence (Hillier et al., 2016).

Consequently, it is proposed that digital devices can catalyse those collaborative practices which define an inherently distributed view of contemporary creative activity (Dobson, 2015). Live coding practices are a case in point. A '…live coder [the composer] will write and edit the code that produces digital music in real time in front of an audience' (Hugill, 2012, pg.171). Critically, the coder's cognitive schemas have not created all of the ideas: creativity here can be found between the computer software and human (Burnard, 2012b). Burnard (2012b) suggests that while human creativity is a peculiar quality of the live act, the software, for its part, provides the platform for action and therein, a range of choices for action. Digital creativity, therefore, '…can be understood as a uniquely specific combination of human and computer creativity' (Burnard, 2012b, p.299).

Here then, we might accept that humans can creatively collaborate with technology to jointly achieve new musical products. This is a view of collaborative creativity applied irrespective of whether the collaborative creative partner is a computer, or another human, for example:

> Collaborative (or partnership) creativity grounded in shared responsibility, which comprehends the actual practise as resulting in joint creative endeavours. Ideas are generated from joint thinking, experimentation and from sustained, collective struggles to achieved shared musical outcomes and ownership. (Burnard and Haddon, 2015, p.14)

The potentially assistive nature of digital technologies also has implications for creative practice. For instance, Pepper (2017) acknowledges that those young people who have never learned a musical instrument can experience the creation of entire compositions by dragging and dropping looped audio segments on-screen. The humble computer is seemingly extending the individual's mind. In addition to its socially collaborative nature therefore, contemporary creative practices are increasingly inclusive too:

> As digital technology has brought the mixing practices to everybody's reach and offered a global distribution and exchange network for new mixes, we can truly speak of musical works as emergent communal processes. (Väkevä, 2010, p.61)

The types of computer partnerships referenced here will be reviewed in the forthcoming chapter. Meanwhile, part 2.3.1 will now consider how collaborating student partners might influence a young composer's creative discourse.

2.3.1 Student collaborators

To suitably extend those individualistic perspectives for understanding the creative process, a specific account must be given of those student partners who influence creative behaviour in social settings. Krueger begins by defining 'music' as a fundamentally social practice:

> Using music to construct and regulate emotional experiences and coordinate action is often a joint venture, a social practice fundamentally shaped by the shared presence of multiple perceivers. (2011, p.15)

From this perspective, Krueger takes the view that music facilitates interpersonal coordination and emotional convergence, that is, music is tool for shared action and feeling (2011, p.15). This shared action is found to be a '…collision of ideas, experiences, and skills' (Slater, 2016, p.21). The point where '…encultured histories come into contact' (Slater, 2016, p.21). Enculturation in this context is '…a process played out through demonstrative exchanges that mutually affect collaborators' (Slater, 2016, p.22). For secondary school students, these demonstrative exchanges can be trust-based and tricky to get right. Ashton, a student from a multi-ethnic comprehensive middle school in West London, explains how 'demonstrative exchanges' worked for him:

> I didn't go into my own world. I thought it was unfair on the others. You have to be there together. I took a bit of a chance, but it paid off, as there were no serious collisions...You have to listen to what they are playing and listen harder to what you're playing so it goes together. (Burnard, 2000, p.240)

Student Aston is describing well an instance of 'collaborative agency'. This is where individuals '…do not live in isolation but rather are interdependent in a variety of social contexts' (Kim and Baylor, 2006, p.580). Here, any product is jointly achieved; knowledge is to be found "in between" or distributed between individuals rather than "inside" any one person (see Salomon, 1998; Lave and Wenger, 1991). This joint achievement is found to be a fundamentally emergent process. Ward's (2009) study, which observed how secondary school students undertook music exploration with digital technology, revealed that any collaborative agency might begin as a chaotic enterprise:

> Pupils acknowledged that arguments and 'messing around' wasted time, leading to rushed work as the deadline neared…[Later] the technical hurdles had been overcome, and more focused work led to better results. (Ward, 2009, p.161)

Agreeing with Ward (2009), Biasutti (2015) carried out research which also found that collaborative agency became increasingly focused over time. She analysed the communication modes employed by adult musicians as they progressed through collaborative, online music compositional experiences. The study found that the composers' dialogues were based around a range of key themes. These were '…musical suggestions (introduction of new musical ideas), musical extensions (development of previous suggestions) and positive support (agreement and support for interaction)' (Biasutti, 2015, p.119). The collaborative sourcing and development of ideas over time is a finding which Rebecca and Jamie would agree with. Both students participated in a study which explored the music practices and learning strategies of nine popular electronic musicians (Thompson, 2012). Participant Rebecca discusses how she learnt to DJ by swapping ideas with her friends:

> [Rebecca] When I was learning to DJ me and my mates used to get together all the time because we only had one pair of decks between us. It also helped because we'd swap records and ideas...I suppose that's how I learnt to DJ really...we'd help each other out or swap ideas which, looking back, really helped... (Thompson, 2012, p.50)

Jamie, another participant in Thompson's study, recalls how his brother became an effective peer teacher:

> [Jamie] My brother would set me a Deejaying challenge but first he'd show me what I needed to do and then I'd try. He was also very good at telling me when I wasn't doing it right (laughs) which really helped... (Thompson, 2012, p.50)

The discovery and extension of creative ideas and peer teaching are evidently valuable opportunities for collaborative creative action. There are a wealth of research studies reporting yet more virtues of collaborate agency for creative purposes. A review of the research findings from those research studies is presented below:

- Student peers are often more effective motivation and learning partners than their adult counterparts (Kim and Baylor, 2006).
- Students who are struggling with their ideas benefit from hearing their fellow classmates' musical motives and these can trigger original musical thoughts (Robinson et al., 2011).
- Working in small groups provides creative safely for students who are critical or less confident about their own work (Ginocchio, 2003).
- Students can direct each other's learning. For example, one group member can demonstrate a rhythm or chord for the benefit of another (Green, 2008; Roschelle et al., 2000; Thompson, 2012).
- Students can retain individual agency (cooperative) even in collaborative groupwork settings. For instance, individuals can take turns inserting notes or rhythms into a melody (Ginocchio, 2003).
- Through social conversation and gesture, students can correct mistakes, resolve misunderstandings and provide advice (Roschelle et al., 2000).
- Group participants negotiate their own rules for how to achieve a jointly agreed creative goal (Clennon, 2013; Ward, 2009).
- Shared knowledge ensures that progress can be made at a rate faster than an individual composer working alone (Ward, 2009).
- Collaborative work can lead to students ultimately developing individual agency to the extent that they increasingly forward their points of view (Robinson et al., 2011).
- The acquirement of knowledge from students with diverse backgrounds and perspectives ensures that creative goals persistently develop. New shared meanings are created when students share their understandings about what they know (Dobson and Littleton, 2016).

In amongst this wealth of socially-situated creative opportunity, Roschelle et al (2000) make the point that students use gesture, as well as verbal language to mediate their communication around digital technology. This point is also forwarded by the Charissi and Rinta (2014) study.

The researchers discovered non-verbal behaviours around the technology, the dominant varieties of which they identify below:

> …eye contact was the most dominant non-verbal way of interaction (39%), while laughing as a reaction of joy or surprise generated either by the musical patterns provided by the software or by their musical creations was the second dominant non-verbal behaviour (13%). Children were, also, interacting with each other by singing (12%). (Charissi and Rinta, 2014, p.49-50)

Charissi and Rinta (2014) add that participants began their music-making by exploring the sounds of the software and interacting with each other in mainly non-verbal ways. Contrastingly, during the last session, participants interacted mainly verbally, either in order to discuss their musical choices and next steps, or to scaffold each other (Charissi and Rinta, 2014).

Promises of gestural and verbal support aside, there are negative implications for collaborative creative practice. For instance, Windsor and de Bézenac (2012) assert that enculturation processes might lead to threatening experiences for young people. Peer pressure, compliance and indoctrination describe the potentially comprising nature of collaborative creativity (Windsor and de Bézenac, 2012). Additionally, King (2009) case studied how undergraduate music technologists worked collaboratively to complete a drum kit recording. While benefits were identified, King (2009) found that his participants didn't get experience of 'doing all the bits'; were required to manage conflict; compromised on their goal; felt left out and other students hindered the execution of the task.

The collaborative potential of socially-situated digital technology and gestural/verbal human actors has been forwarded to the extent that uniquely cognitive constructivist visions for the creative process are found to be very much incomplete. Consequently, part 2.3.2 will now introduce social constructivism as a useful philosophical perspective through which musical creativity can be more completely understood.

2.3.2 Social constructivism

An account has been presented which necessitates that creativity is conceptualized as a fundamentally social process. This perspective can be summarized thus:

> …musical creativity arises in and as social practices. The field of music involves individuals, institutions, and social groupings…all of which exist in structural relations to each other. These relations determine and reproduce musical practices in their multifarious forms. (Burnard and Haddon, 2015, p.24)

This account describes a kind of communal creativity; one grounded in a socially distributed, relationship-oriented view of creativity (Burnard and Haddon, 2015). Communal creativity may be found:

> …in the interaction between a person's thoughts and a social cultural context. It is a systemic rather than an individual phenomenon'. (Csikszentmihalyi, 1997, p.23).

Given this systemic perspective, is it the creative person, or their social setting and its opportunities for action, which primarily determine creative behaviour? Social constructivists would have it that an individual '…learns in a social setting through communication, mirroring and by struggling for social acceptance and power' (Thorgersen, 2012, p.136). In this view, learning is socially determined, it '…emphasizes interaction between the learner and other' (Pritchard, 2007, p.5). This is to accept the Vygotskian view that '…the social dimension of consciousness is primary…The individual dimension of consciousness is derivative and secondary' (Vygotsky, 1978, p.30). This is the concept of internalization, '…which defines learning as proceeding from the social, intermental plane to the individual's intramental plane of understanding' (Kumpulainen, 2002, p.18).

Vygotsky's zone of proximal development (ZPD) is an idea which has long been influential for justifying the importance of social developmental perspectives. To begin with, students present an '…actual development level, that is, the level of development of a child's mental functions that has been established as a result of certain already completed developmental cycles' (Vygotsky, 1978, p.85). Their ZPD is subsequently defined as:

> …the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers. (Vygotsky, 1978, p.86)

It can be concluded then, that the ZPD represents '…how far learners can push their understanding with the help of a teacher or more able peers beyond what they could achieve on their own' (Holland, 2015, p.26). The ZPD is useful because it can help music teachers and researchers identify those maturing psychological functions and the associated social interactions necessary to transit a composer through their ZPD to achieve their creative potential (Chaiklin, 2003). In the classroom, such an approach is made reality by scaffolding learning (see Bruner, 1960). Scaffolding is defined as '…a structure, guided in specific form by tacit assessment of a child's independent capabilities and needs, and mounted temporarily on the learner's behalf until the child can self-sufficiently produce the behaviour on his or her own' (Pea, 2004, p.423). Undoubtedly, the business of scaffolding learning is a transient, fluid process, requiring flexible responses to the conduct of (creative) performance over time (Pea, 2004). In the music classroom, scaffolding might emerge in complex tacit and explicit combinations. For instance, one student might explicitly teach another how to play a chord. Meanwhile, a tablet computer might also tacitly guide creative action by displaying a range of virtual instruments from which the student can make a selection.

Considering the aforementioned socio-constructivist description of scaffolded development, surely it must also be accepted that 'in order to complete the task, some cognitive effort on the part of the students will be required if learning is to occur' (Kennewell et al., 2008, p.66). This admission leads us not to overly polarize either of the cognitive or social descriptions of creative development presented here. In reality, musicians bring with them '…'the rules of game' in which they are involved (whether it be composing, improvising, listening, performing, reflecting or appraising music)…' (Burnard, 2007b, p.47). These rules (held in a composer's schemas) provide clues as to the nature of action and also inform creative behaviour in social settings (Burnard, 2007b). Consequently, creative development might be more realistically understood in ways familiar to Pea (2004). That is, as a symbiotic relationship between the interpsychological (social) and the intrapsychological (cognitive) plane (Pea, 2004). This relationship will now be better understood by introducing the concept of human and symbolic mediational means. Secondly, social cognitive perspectives will be expanded to better account for the way in which creative musical activities are situated in culturally influenced communities of practice.

2.4 A social-cultural approach to mediated action

Mediated action '…involves an irreducible tension between an individual or individuals (i.e., intramental or intermental functioning) on the one hand and mediational means on the other' (Wertsch and Rupert, 1993, p.230). For Engeström (1999) therefore, mediation is an idea which breaks down those barriers isolating the composer's mind from culture and society. This is useful because Vygotsky (1978) and thereafter Wertsch (1991) find it difficult, misleading and even meaningless to isolate individual mental processes. The concept of mediated action is an extension of Vygotskian theory which '…stipulates that the development of the child's mental processes depends on the presence of mediating agents in the child's interaction with the environment' (Kozulin, 2003, p.17). Student collaborators or computers, as described at 2.3 and 2.3.1, are examples of mediational means which can fundamentally shape and constrain human action (Wertsch and Rupert, 1993). While Kozulin (2003) identifies these means as examples of human and symbolic mediators respectively, a starting point is to consider all mediational means as tools. A tool's function according to Vygotsky, '…is to serve as the conductor of human influence on the object of activity' (1978, p.55). Tools may take many forms. Relevant here are those tools which are physical (e.g. a computer), human (e.g. student partner) or invisible, cognitively-held psychological structures. Like Kozulin (2003), Werstch (1991) differentiates human tools from other forms of mediational means. This division appears to acknowledge a specifically human, transformational ability; that is, the ability to incorporate speech into action (Vygotsky, 1978). This emphasis upon uniquely human mediational means reflects a desire to understand 'What kind of involvement by the adult is effective in enhancing the child's performance?' (Kozulin, 2003, p.18-19). At 2.3.1, this chapter discussed the mediating influence of student collaborators. Chapter four will also explore the mediational influence of classroom music teachers. Perhaps only then can those types and techniques of human mediation useful for classroom-based creative musical activity become more systematically understood.

Symbolic mediators (e.g. tools) are also thought fundamental for the construction of a community's meanings. Salomon's extended definition of a tool makes for a necessary starting point:

> Tools do not have intrinsic value as their main justification. They have certain (external) purposes they are to serve, they have particular qualities or structures that allow them to serve their designated purposes, and they are based on particular rationales that explain and justify their goal-serving utility. (Salomon, 1993, p.179)

Solomon explains that tools (e.g. physical artifacts, human partners, mental strategies) are based upon particular rationales and serve designated purposes so that intended goals are reached. We must therefore align with Cole (1999) who suggests that when creative musicians come to adopt artifacts provided by their culture, the symbolic resources those artifacts embody are simultaneously adopted. These symbolic systems ultimately become the composer's constructed reality; they determine those psychological (cognitively-held) tools which influence their situated behaviour (Kozulin et al., 2003). Essentially, symbolic mediators signify different meanings to different cultures. This describes well the concept of the 'sign' where '…meaning (the signified) and form (the signifier) are brought together into a single unit' (Stein, 2008, p.21). The 'signified' is the particular meaning or 'message' indicated to their perceiver and it is internal to them (e.g. red means stop). The signifier is, for example, the image, word or gesture. Of itself, the signifier 'means' nothing. Only when it is interpreted does it acquire meaning and significance (see Kress and Van Leeuwen, 2001; Kress, 2010; Kress and Van Leeuwen, 2004; Chandler, 2004; Van Leeuwen, 2005). As stated, when taken as one, the signified and the signifier describe a 'sign', something which emerges during social interaction:

> …signs are socially produced and socially read. What signs stand for and how they are read is not static, pre-given or pre-determined, but affected by how people regulate…resources in their social context of use. (Stein, 2008, p.21)

What remains interesting about signs is Van Leeuwen's (2005) point that they 'bundle together' human behaviour and artefact into a singular resource. These resources describe both the actions and artefacts we use to communicate, whether they are produced physiologically (e.g. voice or gesture) or technologically (e.g. pen, scissors, computer hardware/software) (Van Leeuwen, 2005). Applying the concept of the socially constructed sign, it can now be appreciated that symbolic mediators:

> …derive their meaning only from the cultural conventions that engendered them. Symbolic tools (e.g, letters, codes, mathematical signs) have no meaning whatsoever outside the cultural convention that infuses them with meaning and purpose. (Kozulin, 2003, p.26)

Kozulin's account of symbolic mediators aligns with Wertsch's (1991) desire to develop a social cultural approach to mediated action and this will now be described and contextualized with an introduction to Lave and Wenger's (1991) communities of practice concept.

2.4.1 Communities of practice

To better understand how tools mediate action, Wertsch suggests that social (inter) and cognitive (intra) perspectives of creative development should be expanded yet further to respond to the culturally situated nature of human action:

> …the goal of a sociocultural approach to mind is to explicate how human action is situated in cultural, historical, and institutional settings. As I have argued, the key to such an explanation is the use of the notion of mediated action as a unit of analysis and the person(s)-acting-with-mediational-means as the relevant description of the agent of this action. (Wertsch, 1991, p.119)

The unit of analysis Wertsch proposes, that is, situated person(s) acting-with-mediational-means, describes a community of practice, a unit decidedly broader than individual action (Engeström and Miettinen, 1999; Wertsch, 1991). When composers act with mediational means, they '…inevitably participate in communities of practitioners…the mastery of knowledge and skill requires newcomers to move toward full participation in the sociocultural practices of a community' (Lave and Wenger, 1991, p.29). The essence here is that those meanings which composers 'come to know' are not 'universal truths' but socially and locally negotiated during community participation:

> … a theory of social practice emphasizes the relational interdependency of agent and world, activity, meaning, cognition, learning, and knowing. It emphasizes the inherently socially negotiated character of meaning and the interested, concerned character of the thought and action of persons-in-activity. (Lave and Wenger, 1991, p.50-51)

Mediated action and therein its signs and communities of practice explain well the complex ways creative products are negotiated and the seminal role of relational interdependency in that process. This perspective also explains how newcomers become part of a community of practice. For instance, when new composers engage with human and symbolic mediators, their meanings are '…configured through the process of becoming a full participant in a sociocultural practice' (Lave and Wenger, 1991, p.29)

It is this social cultural approach to mediated action that provides a theoretical grounding for part 2.4.2, which will now propose 'creativity' as a social, culturally-situated activity.

2.4.2 Creativity as social cultural Activity

A social cultural approach to mediated action aligns with Thorgersen's (2012) view that experience is both individual and social; both happen within and between human beings and in a setting constrained by social premises, historically imposed limitations and experiential constraints. Meanwhile, the individual retains personal agency: those possibilities and responsibilities to act according to their emergent community (Thorgersen, 2012). De Lima et al. (2012) make the point that any situated, socially informed approach to creative musical experience makes for a stark contrast to previous proposals, which forward individualistic perspectives. Remaining steadfast, situated approaches are found especially 'fitting' given the transient nature of musical values

> All the values of art are relative, and the artistic culture of any people at any time is in a state of evolution. Music is a living, vital, ever-changing, many-faceted conceptual medium of expression. (Sherman, 1971, p.22)

Aligning accordingly, music arises '…not simply from individual minds but in constructions that reflect the tastes and fashions of social groups, social relations and communities sharing common perspectives' (Burnard and Haddon, 2015, p.13-14). It is this argument which proposes the expansion of musical creativity '…from its outmoded singular form to its manifestation as multiple 'creativities'…' (Burnard and Haddon, 2015, p.6).

Csikszentmihalyi must be acknowledged for raising awareness of creativity as a multiple, systemic practice. His systems approach aligns with Lave and Wenger's (1991) community of practice concept because, for him, a creative idea '…must be couched in terms that are understandable to others, it must pass muster with the experts in the field, and finally it must be included in the cultural domain to which it belongs' (Csikszentmihalyi, 1997, p.27). Here, Csikszentmihalyi is primarily describing 'the domain', the first part of his three-part interrelational system, which is reproduced here as Figure 2-2:

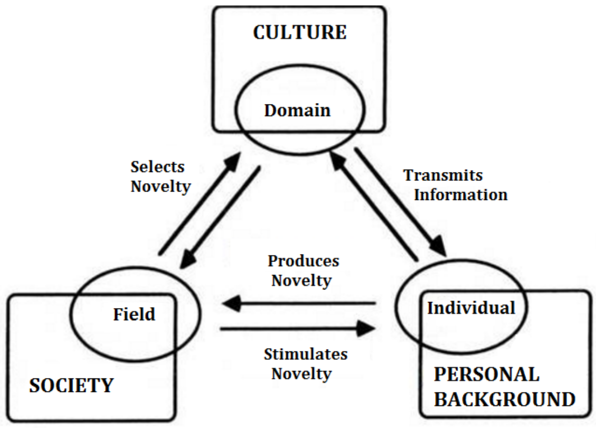


Figure 2-2 A Systems View of Creativity. (Csikszentmihalyi, 1999, p.315)

To unpack the system's model at Figure 2-2, the domain, field and individual system components will now be summarised in more detail. The *domain* is '…nested in what we usually call culture, or the symbolic knowledge shared by a particular society, or by humanity as a whole' (Csikszentmihalyi, 1997, p.28). But what of those human mediators such as the music teacher or student collaborator? Csikszentmihalyi describes their role as the *field* component of creativity, '…which includes all the individuals who act as gatekeeps to the domain' (1997, p.28). The gatekeepers '…decide whether a new idea or product should be included in the domain...It is this field that selects what new works...deserve to be recognized, preserved, and remembered' (Csikszentmihalyi, 1997, p.28). The third component of this systems model is the *individual* 'person'. This component best aligns with those cognitive and developmental process outlined at 2.1 and 2.2. Csikszentmihalyi takes the view that creative individuals have the potentiality to contribute something new to their community domain (Burnard and Haddon, 2015; Csikszentmihalyi, 1997). This individual component describes the moment when '…a person, using the symbols of a given domain such as music...has a new idea or sees a new pattern, and when this novelty is selected by the appropriate field for inclusion into the relevant domain' (Csikszentmihalyi, 1997, p.28). In essence, this statement describes those interrelations between the domain, field and person which are influential for the nature of creative products. Helpfully, through the use of arrows and textual cues at Figure 2-2, Csikszentmihalyi visualises how situated symbolic mediators are managed by the 'field' to be repurposed by the 'individual' for new authorization by the field for ultimate inclusion in the 'domain'.

Figure 2-2 is helpful to raise awareness of the culturally-situated nature of symbolic rules and how those rules can be assimilated and then modified by a creative individual: thereby propelling cultural development. Meanwhile, Burnard and Haddon (2015) find that the systems view (Figure 2-2) suffers from a little over-simplification. To make their case, the researchers quote Born (2005) to state that in reality, there is no singular, privileged cultural or social system of musical creativity but rather, creative domains are boundless. They are all but '…fluid quasiobject[s], in which subjects and objects collide and intermingle…' (Born, 2005, p.7). Consequently, a pluralistic definition of 'the domain' is sought:

> [Domains]…produce deeply entrenched forms of cultural practices, which are not only tied to authorized domains, but are also linked to the way in which music creativities are represented by different cultures and cultural systems. (Burnard and Haddon, 2015, p.12)

This view accepts that music does not, in fact, exist in boxes but it takes 'myriad social forms' (Born, 2005). Consequently, Burnard and Haddon's (2015) own conceptualization, aptly titled 'diverse musical creativities' pluralizes Csikszentmihalyi's system components as domain(s), field(s) and person(s). This appears to indicate that cultures (domains) and their mediating components (fields and persons) are themselves simultaneously interrelated to other systems.

This multiple, social cultural view of creativity is important because it encourages us to develop understandings about those domains or communities of practice that our secondary school music students informally participate in. Such an understanding might help classroom music teachers and researchers to better appreciate the kinds of musical experiences young people expect to participate in during classroom music-making. Sherman's advice on this matter remains as relevant today as it was in the 1970s:

> ...music education must abandon its obsession with the past and address itself to the problems and needs of the young of today's world. Music education must assist in the task of restoring the student's faith in today, his hope in tomorrow...(Sherman, 1971, p.22)

To restore students' faith, a better understanding of their informal communities of practice and their defining symbolic mediators is required. Pritchard (2007) suggests that when children work with new ideas in a context they recognize and can relate to, they are far more likely to take an interest. This signposts a requirement for music teachers to consider Crawford's (2009) view that musical learning should occur in authentic ways. That is naturally, as it does in everyday life. Woody (2007) concurs explaining that students will be pushed away unless music classrooms engage with the 'proper tools' necessary to actively experience students' native music:

> In a very real way, respecting the music is respecting our students. If we ignore musical authenticity with popular styles, our students will know it. (Woody, 2007, p,33)

A social cultural conceptualization of creative practice is consequently proposed. This chapter has suggested that a composer's individual creativity, namely their cognitive ability to find, focus and fix creative ideas is fundamentally mediated in social cultural ways.

From this perspective, creativity is defined as not only as individualistic (cognitive) phenomenon but as a human behaviour influenced by socially situated, mediational means (e.g. people/artifacts/rules). In turn, these mediational means signify meanings which pass muster with situated communities of practice (cultures). It is these culturally conditioned, mediational means which are thought to explain the nature an individual's creative (in this case musical) behaviour.

This chapter has also suggested that composers can develop close collaborative partnerships with digital technology: a complex symbolic mediator. Consequently, chapter three will now investigate those distributed, intellectual partnerships which digital technological tools and composers develop to mediate creative action.

Chapter 3:
Digital technology and its influence upon creative music-making

The construct for creativity proposed by chapter two has defined meaning as forged in the actions of situated communities of practice. It was found that during creative action, human and symbolic mediators come together to signify meanings which describe a community's creative practices. Meaning is therefore found to be emergent; situated in time and space and by virtue of this definition, fundamentally subjective. In consequence of this understanding, music educators should be concerned about any potential distillation of 'humanity' when classroom musicians partner with digital technologies. Mantle (2017) shares this concern, explaining that over the course of the last two centuries, the widening impact of technology poses a threat to "humanness". He advises music teachers become aware of this issue and that they move towards a changed understanding of human beings as mediated by technology:

Concerns about human subjectivity are relevant to music educators because music, historically at least, has been considered so central to what it means to be human. If this is so, then any "technology" that alters what music means also alters how we understand ourselves as human beings. (Mantle, 2017, p.67)

Given Mantle's warning, part 3.1 will argue that any creative musical interaction with digital technology should be conceptualised according to humanistic, rather than deterministic philosophical assumptions. In light of this, part 3.2 will introduce computer-based cognitive tools and their promise to amplify *human* (creative) intentions via pedagogical and performance-based intellectual partnerships. These partnerships are further scrutinized at part 3.2.3 and 3.2.4 to ascertain the extent to which they constrain and propose creative musical opportunity. Part 3.3 will then propose that the constraining nature of multimodal interfaces and the semiotic resources they promise are seminal to the nature of creative musical partnerships with a computer.

Once a humanistic theoretical approach to digital technology is established, part 3.4 will specifically consider the tablet computer's musical potential. The influence of its touch screen and gestural digital instruments will be considered (see 3.4.1) and the tablet-based studio application GarageBand for iOS, will be evaluated (see 3.4.2). In sum, this chapter will present a theoretically-informed understanding for how tablet computers might form intellectual partnerships with young composers to multimodally mediate their creative behaviour.

3.1 The necessity for human agency

For the purposes of this research, technology is defined as existing science and knowledge (defined as intelligence at 3.2.2) which has been purposed into human invented devices or methods to achieve specific goals. This definition will be expanded during a discussion of computer-based tools at 3.2. Music teachers might consider what kind of relationship they want young composers to develop with the technologies in their classroom. Any such relationship should be initially concerned with the question of agency. That is, the balance of power between technology and human:

> To what extent do we have control over the tools we use—and hence also our systems of production, social relations, and worldview? To what extent are our technologies thrust upon us—by controlling elites, by path-dependent decisions from the past, or by some internal technological logic? (Dafoe, 2015, p.1048)

Having technology 'thrust upon us' describes a dystopian relationship with technology: one where students are in some way enslaved by it (Vermaas et al., 2011). This deterministic stance advocates that '...technology is taken for granted and society carries its imprint' (Jones and Bissell, 2011, p.286). When students enter into such a relationship with technology, technology is perceived as an isolating, autonomous force which determines social development.

Determinism aside, technology can also be defined quite differently. That is, as an emergent product of a community's goals: '... an expression of our endeavours to adapt the world in which we live to meet our needs and desires' (Vermaas et al., 2011, p.1). This perspective introduces well Pinch and Bijker's (1987) social construction of technology (SCOT) theory, which argues that technology does not in fact develop autonomously and determine human behaviour. It is *people*, attached to particular social groups, who play a crucial part in its development (Bijker and Pinch, 1987; Bijker, 1993; Pinch, 1996; Bijker, 1987; Russell, 1986; Pinch and Bijker, 1986; Bijker et al., 2002).

Adopting Pinch and Bijker's SCOT perspective and an emergent definition of meaning, it must be argued that classroom composers should be given opportunities to exercise agency during active music-making. Pignato asserts that students must be able to 'work upon' products in ways which '…sometimes affirm market intent and in other instances subvert it' (2017a, p.239). By subverting societal intentions, classroom composers necessarily create music in unforeseen ways, by forging and collaboratively attributing new meanings to their technology:

> Developers make products, but people use them and give them their ultimate meaning. Users act. They perform…In so doing, they change technological products, or at least change the conception of what they could or ought to be in their lives. (Pignato, 2017a, p.239)

In this view, music students and technology are co-evolving and impacting each other (Tobias, 2017). During co-evolutions, students forge new, situated meanings with technology in the music classroom which align with the beliefs and needs of their relevant social group. This perspective is summarized below:

> …changes that occur in music education can be attributed to the discourses, possibilities, challenges, sociocultural or musical contexts, and ways that people conceptualize, interact with, and integrate technology in their lives rather than to technology itself. (Tobias, 2017, p.451)

Tobias is making the point that it should be the student (person), with their myriad of situated influences, who should determine how technology is conceptualized and interacted with.

When it is classroom students who determine how technology is used, their musical identity can be reflected through their technology-mediated behaviour. To acknowledge musical identity is to award students '…some autonomy to select curriculum content for themselves: that is, to choose the music they work on in class' (Green, 2008, p.13).

Part 3.2 will now propose that computer-based cognitive tools and their intellectual partnerships have the potential to support students as they create personally meaningful musical products; musical ability notwithstanding.

3.2 Computer-based cognitive tools

Chapter two came to align with Hammond et al. who found that creativity is often bound up with the idea of ‘creating original products with personal meaning’ (2009, p.54). Computer-based tools submit to this humanistic belief because they necessitate composers exert their peculiar cognitive (creative) influence in order for the computer tool to enjoy any meaningful function and/or realise a goal. Tools have been defined at part 2.4 as situated amplifiers of human action. Tools are henceforth considered as a specific type of technology (see 3.1 for an operational definition of technology). Namely, they are found not to propose any intrinsic value in themselves but they do promise particular built-in structures which allow them to serve and influence community goals and rationales. This point is revised and expanded here:

> …tools literally carry intelligence *in* them, in that they represent some individual's or some community's decision…In terms of cultural history, these tools and the practices of the user community that accompany them are major carriers of patterns of previous reasoning… (Pea, 2001, p.53)

Tikhomirov (1999) transfers the ‘tool as cultural construct’ to computers at which point he agrees with Pea (2001). He believes that ‘the specific character of such influence is defined, first of all, not by a computer, but by the organizational and social conditions of its use and by the characteristics of the activity’ (Tikhomirov, 1999, p.353). In term of music composition activity, Hamman argues that composition has been greatly advanced by the computer-as-tool:

> The computer provided the kinds of tools that allowed the composer to explore, more deeply, the very conceptual frames in which musical ideas might be imagined and realized. It enabled the composer to critically examine and assess the musical result, the means by which that result came about, and how the two are conceptually and generatively related. (Hamman, 2002, p.93)

Hamman enlightens us as to how composers might use computer-based tools to realise their creative ambitions. The promise to ‘visually’ explore musical content in conceptual ways ensures that composers can metacognitively reflect upon their work. Computers also provide a ‘conceptual frame’ for translating compositional ideas into sonorities. This ‘frame’ is a cultural frame because it ‘...contextualizes the activity by which humans - as for instance composers - come to understand, design, and model the materials and forms that frame their view of the world in which those activities occur and in which things are produced’ (Hamman, 2002, p.111). When a digitally situated, conceptual frame aligns itself with a composer’s intentions, personally meaningful music-making will likely commence.

It is now evident that despite human intentions, computer-based tools also influence creative products. This transpires to ensure that both composer and computer collaborate as partners, to some greater or lesser extent:

> All computer music constitutes a collaboration between composer and computer system designer, with the computer tool bringing its design capabilities and limitations to bear

> on the composer's intents. This collaboration can be friendly or antagonistic, apparent or hidden; in any case, the tool actively affects the artifact. (Belet, 1992, p.7)

Belet et al. sensitize us to the very different types of collaboration which can emerge between a human and computer. Collaboration in this sense (i.e. human – computer interaction) is an important unit of analysis. Bertelsen et al. (2009) explain the analytical unit as 'domain object' (creative product); 'user(s)' (composer[s]) and 'tool' (computer). The aim is surely to find out how the '..user applies the computer tool to mold the domain object in foreseeable ways according to a well-defined goal' (Bertelsen et al., 2009, p.197). Part 3.2.1 will now propose that to understand human partnerships with digital technology is to accept that the total cognitions required to achieve a creative goal are distributed between human and computer in ways which help the composer to move beyond the limitations of their mind.

3.2.1 Extending composers' minds

For the computer's part, Danielson et al. (2007) explain that it promises to remember, organize and provide an environment through which explanations of phenomena can be constructed. The combined intention of these characteristics is to reduce a composer's extraneous cognitive load. In this role, the computer becomes 'an extension of the mind' – it can take over mundane organizational duties (e.g. the provision and organization of musical resources for manipulation) thereby freeing up the composer's cognitive faculties to make creative decisions (e.g. about the general direction the work should take) (see Blanchard and Rottenberg, 1990; Pea, 2001; Perkins, 2001). The computer is a cognitive technology because it '…helps transcend the limitations of the mind, such as memory, in activities of thinking, learning, and problem solving' (Pea, 1985, p.168). What cognitive tools 'do' therefore is support '…social problem-solving processes by providing physical representations of abstract strategies and concepts, making them tangible for inspection, manipulation, and discussion, thereby encouraging generalized metacognitive awareness and self-regulatory ability' (Derry and Lajoie, 1993, p.6).

Unsurprisingly, computer-based cognitive tools (CBCTs) are thought to subscribe to social constructivist, Vygotskian beliefs (see 2.3.2) because 'they potentially allow a learner to function at a level that transcends the limitation of his or her cognitive system' (Salomon et al., 1991, p.4). For young composers who find composing a daunting prospect (see 1.3 and 2.1), the promise of conquering the total cognitions which stand between them and their goal is a tantalizing prospect. Despite the promise, this proposition is precarious because '…software tools carry huge ideological and epistemological payloads that the human user must accept, silently or otherwise' (Hamman, 2002, p.96). Once the composer accepts these 'payloads', they in turn become part of their constructed reality:

> …digital musicians' musical identities and professional expertise are partly constructed through digital technologies as they provide musicians with the cultural landscape for creative expeditions and progression. (Partti, 2014, p.12)

Perhaps then, music teachers would be right to remain wary of digital technology. In the first instance therefore, a better understanding of how CBCTs co-construct identity and expertise is required. Consequently, the proposed opportunities CBCTs present for intellectual partnership will now be investigated.

3.2.2 Distributed intelligence

According to Salomon et al. (1991), what makes a computer tool a 'cognitive' tool is its ability to offer a human actor an intellectual partnership (IP). IPs respond to a specific definition of intelligence, such as that provided by Roy Pea. Pea defines intelligence as '…a product of the relation between mental structures and the tools of the intellect provided by the culture' (1985, p.168). Salomon (1993) adds that such relations share the cognitive burden of carrying out an intellectual task, such as the composition of music, for example. IPs can therefore represent 'a complementary division of labor that becomes more interdependent and that develops over time' (Salomon, 1993, p.3). Successful human-computer partnerships of this nature are dependent on joint effort and in return, they promise to 'amplify' human thinking (Jonassen and Carr, 2000; Salomon et al., 1991).

Importantly, because Salomon and Gardener (1986) insist that IPs require mindful control from human actors, the nature of any cognitive partnership is characterized by its situatedness. That is, the cognitions 'draw on the immediate physical and social context' meaning that they are, in fact, situated' (Hargreaves, 1999, p.30). This is thought essential for creative practice because composers must necessarily draw upon their personal and community interests when partnering with CBCTs. Music technologies which propose IPs might therefore provide opportunity for young composers to apply their own informal creative practices (as referenced by chapter one).

When a CBCT and composer form an intellectual partnership, an important presumption about cognition is dispelled: namely that cognition '…exists inside an individual's mind and that the cognitive process occurs internally' (Kim and Baylor, 2006, p. 574). Rather, 'intelligence should not be seen as a property of the mind alone but rather as a quality that is distributed among the components of learning systems and the social-cognitive environments in which they are embedded' (Reusser, 1993, p.156). Kim and Baylor (2006) widen the scope for distributed cognition by forwarding Lave and Wenger's (1991) view that cognition is distributed in-between' minds, social processes, physical artifacts and cultural influences ensuring that an interdependent, inseparable and dynamic social cultural system of cognitions mediate that community's discourse.

Pea takes issue with term 'cognitions' as applied to symbolic mediators (see 2.4) for he believes that '…only humans "do" cognition' (Pea, 2001, p.50). Consequently, Pea's notion of 'distributed intelligence' is forwarded:

> When I say that intelligence is distributed, I mean that the resources that shape and enable activity are distributed in configuration across people, environments, and situations. In other words, intelligence is accomplished rather than possessed. (Pea, 2001, p.50)

Pea later explains that these '…tools literally carry intelligence in them, in that they represent some individual's or some community's decision' (2001, p.53). This is irrespective of a tool's physical (e.g. a computer), intellectual (e.g. schemata) or human (e.g. a music teacher) form, for example. Such built-in intelligence can influence human action in ways either intentioned, or unforeseen by a community. This potential to creatively subvert, musically or otherwise, a community's cultural conventions infers the suitable potential of IPs for creative practice.

Returning to the composer, the view is taken that ‘human cognitive capacity is limited and that we can only attend to a certain amount of information at any one time’ (Lajoie, 1993, p.263). Consequently, a ‘…cognitive tool might be used to assist our attentional capacity by reducing the burden of attending to every aspect of the task’ (Lajoie, 1993, p.263). Computer-based tools typically reduce cognitive burden by distributing intelligence through pedagogically-oriented or performance-based intellectual partnerships. Salomon et al. explain that pedagogical partnerships emphasize the need to leave student composers with ‘educationally valued cognitive residue’; that is, to enjoy some ‘effect from’ using the CBCT (1991, p.2). Conversely, performance-based partnerships emphasize ‘…mainly the updated performance in a person-machine system of partnership’ (Salomon et al., 1991). Those intellectual partnerships which propose pedagogical value will now be discussed at 3.2.3 and performance-orientated intellectual partnerships will subsequently be reviewed at 3.2.4.

3.2.3 Pedagogical partnerships with computer-based cognitive tools

Pedagogically-oriented partnerships describe a cooperative division of labour whereby ‘the computer tool carries out tedious lower level operations, leaving the user to hypothesize’ (Salomon, 1993, p.182). When students hypothesize about their compositional approach for example, they might learn how to better find, focus and fix their creative ideas (see 2.2). For instance, If students were required to completely master the conventions of hand writing musical notation, they might never embark upon the business of composing at all:

> A student who has a gift for composition but who lacks skills in music notation can play a piece on a synthesizer, and if the synthesizer is connected to a computer with the appropriate music printing software, the student can print the piece out quickly. (Small, 1991, p.53)

Software which automates the creation of notation reduces a student’s cognitive burden. Consequently, student thought can remain dedicated to the business of composing. They need not worry about assembling those constituent parts (e.g. notation tools, loop banks, virtual instruments) necessary for working in the compositional domain:

> Computer software whose interface is designed in this manner frees the user's attention for domain-related [composing] activities. Rather than having to think in terms of the system s/he is using, the user can remain focused on domain-related [compositional] concepts, thus freeing attention for domain-centered activities... (Hamman, 2002, p.98)

The nature of this composing software might encourage students ‘…to sonify and visualize their ideas, providing the opportunity to perform, edit and hone the sounds in order to create, iteratively, their sonic product’ (Moir and Medboe, 2015, p.153). For the CBCT’s part then, it enables composers ‘…to find out essentials in new areas, and use those new concepts to construct more complex ideas’ (Kommers, 1995, p.126).

The challenge for young composers who develop pedagogically-oriented IPs is that they are cooperative in nature. That is, the composer and computer retain ownership of their individual roles (e.g. computer – provides resources; composer – understands these resources and then assembles them in unforeseen ways). This division of labour is favoured because the cognitive burden to realise a compositional goal remains firmly with the composer. Suppose however, that our student composer is not ready, for whatever reason, to apply higher-order cognitions to the business of finding, focusing and fixing creative ideas. Fortunately, CBCTs can offer students a different kind of intellectual partnership. This is one which ensures they become a collaborative and not cooperative partner to the extent that any creative musical product emerges as a truly joint effort. These performance-enhancing partnerships will be now discussed.

3.2.4 Performance-enhancing partnerships with computer-based cognitive tools

A young person's access to musical experience '…is impeded by a need to develop the necessary skills required to play and compose' (Reynolds, 2005, p.247). Consequently, Reynolds (2005) predicts that if musical and technical skills were not the focus in music classrooms, what happens there would fundamentally change. Roschelle et al. add that a computer's ability to simulate reality, dynamically link notational representations and be interactive ensures that '…ordinary students can achieve extraordinary command of sophisticated concepts' (2000, p.86). A theoretical understanding of such phenomena is surely necessary for music teachers and it is proposed that performance-enhancing intellectual partnerships offer the conceptual insight required.

All musicians have physical and cognitive limitations and Overholt (2009) identifies they are mitigated either by practice or via the integration of digital technology, which partially circumvents any natural restrictions placed on performance ability. In terms of digital technology:

> Novices might become liberated to engage in cognitive activities normally out of their reach without the technological partnership. (Salomon et al., 1991, p.3)

During such a Vygotskian-natured, performance-enhancing partnership, Hamman (2002) explains that 'work done' is accredited to both the technological tools and also, to the way in which the user takes up and applies those technological tools to realise their goal. Therefore, the creative product is produced collaboratively and for that reason, jointly owned. The consequence is that 'work done' promises 'intellectually superior performance':

> It becomes observable…that the collaboration of individuals and computers is often characterized by intellectually superior performance that cannot easily be accounted for by individuals' cognitions alone. (Salomon, 2001a, p.xiv)

The great promise of this type of intellectual partnership is its ability to democratize music education by widening access to creative musical experience. Young people '...with little or no music training could compose without restriction, without reliance on technical instrumental skills, knowledge of notation, understanding of structure, or dependence on other musicians' (Reynolds, 2005, p.242).

Despite the promise of performance-enhancing IPs, 'reliance on a computer's processor/memory to enhance a human performer's brain/memory is a double-edged sword' (Overholt, 2009, p.220). For instance, when composers are bereft of ideas, they can merely conform to their community's established digital conventions:

> A...problem is that the person becomes a servant of the system, no longer able to control or influence what is happening…it depersonalizes the job, it takes away control, it provides, at best, a passive or third-person experience. (Norman, 1998, p.197)

This ‘faded influence’ of the composer upon creative musical activity can result in a ‘loss of ownership’. A female participant in Shibazaki and Marshall’s (2013) study had this to say about composing with computer:

> Sometimes, when you do it on the computer...it doesn’t sound like your music – it’s better but you know I couldn’t have done that. [Female] (Shibazaki and Marshall, 2013, p.353)

Gower and McDowall (2012) undertook research to understand how readily available, interactive music video games might be educationally useful tools for the music classroom. Of particular interest was the game ‘Guitar Hero’: a game played via buttons embedded into a plastic guitar body which interacts with a musical soundtrack (Gower and McDowall, 2012). Findings highlight a participating music teacher’s belief that any musical skills acquired by the student during from their Guitar Hero partnership are minimal and their transferability questionable:

> . . . I really don’t think that there’s enough musical literacy, musical things that are built up within the programs to make it authentic musically but it certainly enhances aspects of it. (Music Teacher One) (Gower and McDowall, 2012, p.97)

This finding suggests that skills acquired from Guitar Hero are ‘worlds away’ from the complete assemblage of abilities a professional guitarist requires, for example. In the words of Louth, while ‘…technology is often advertised as a means by which “ordinary people” can access knowledge previously in the domain of experts, ironically, it often removes people from the domain of expert knowledge’ (2013, p.149).

The research studies forwarded here evidence well the challenges to ‘extending’ classroom musical experience through performance-enhancing, intellectual partnerships with CBCTs. When evaluating new digital technologies for the music classroom, it is now clear that teachers must be broadly aware of how cognitive load is distributed between their student(s) and computer(s). Consequently, 3.3 will now examine in more depth how intellectual partnerships with computer tools constrain creative action.

3.3 Creating ‘new’ music from a world of multimodal constraint

In terms of creating music with computers, Desain and Honing argue that any supportive system, ‘..should enable a composer to express ideas in a direct way’ (1988, p.30). Of course, they themselves concede that this ideal is almost impossible, given that all systems use known aesthetics typically linked to accepted musical conventions. The composer too is constrained, by their cultural musical dispositions:

> We are all, I believe, musically handicapped (as well as advantaged) by our musical culture, particularly (in my culture) by common-practice Western music notation and its associated performance practices, abilities, and traditions. (Pope et al., 1995, p.13)

The composer and computer are proposed as products of socially authorised conventions and consequently, forging new meanings in such situations poses acute challenges. Meanwhile, Pope et al. (1995) have noted that constraints, such as cultural conventions, can be advantageous in equal measure. Digital systems and their potential to manipulate sound might subscribe to communally authorised practices in relation to electro-acoustic, neo-classical or DJ compositional practices, for example. These ‘constraints’ might offer expansive creative freedoms:

> First, they explore the world of sounds. Shaping, molding, and personalizing synthesized, recorded, or sampled sounds and then storing them. MIDI sequencing opens the door to the fundamental processes of counterpoint, form, and orchestration. (Deutsch, 2009, p.95)

Comparatively, during Moir and Medboe’s (2015) qualitative investigation, four undergraduate popular music composers explained that an ability to sequence music and use virtual instruments in music production software gave them freedom. A freedom ‘…to improvise, experiment and capture performed ideas that may or may not become elements of a completed work’ (Moir and Medboe, 2015, p.153). Agreeing with Magnusson (2010), the material constraints of computer software can simultaneously propose its expressive scope. By way of an additional example, students can view the way software might guide and/or instruct them as musically beneficial. A research study undertaken by Shibazaki and Marshall (2013) investigated gender differences in computer and instrumental based composition. Their findings evidenced that the visual notational representations imposed by the computer helped students to better consider how to apply the musical element ‘pitch’ in their composition. One student expressed this point of view:

> Well, computers can let us know...[and] see notes and this is better, for example, we had to do high and low pitch and when we heard it...it seemed easy but then when you play it on a instrument it is not easy to know high pitch and low pitch but when you can see it then you know which it is and you know you have got it right or not. (Shibazaki and Marshall, 2013, p.353)

Here, the computer’s insistence to visualize student notation probably resulted in a higher-quality creative endeavour. Evidently, young composers’ partnerships with culturally constrained digital technologies can promise constraint and creative opportunity in equal measure. Consequently, when student compose with digital technology they ‘…may create in response to it, in spite of it, or in defiance of its limiting forces’ (Howell, 2017, p.388).

Those intellectual partnerships which award composers ‘too much freedom’ can be equally detrimental to creative musical experience (Simon, 1987; van Loon et al., 2012). A research study undertaken by Nevels (2013) case studied the experiences of a composer, aged 15 years, who partnered with music software in a classroom setting. The software became a hindrance to the young composer because its software library presented too many options and consequently, their decision processes became increasingly complex and inconclusive (Nevels, 2013). This finding is substantiated by Moir and Medboe’s (2015) study which describe the experiences of Luke. Luke is a composer who prefers to sketch out ideas on paper during early stage creative activity because the possibilities offered by the music software are found too distracting:

> [Luke] I don't trust myself to concentrate on what I'm doing if I've every option under the sun on the technology. It's almost like, when you can do anything, it's hard to do one thing that you want to do. (Moir and Medboe, 2015, p.154)

Music teacher Holland (2015) also found that as for Luke, his own students were taking too long to select sounds. So, he constrained the musical materials accordingly:

> It was decided that reducing the number of sounds would shorten this process, allowing the children to have more time to experiment, have a narrower focus and therefore make more progress (Holland, 2015, p.35)

It is fascinating that Holland perceives 'constraints' as enablers for creative musical development. This is not always the case. Human or technological constraints could equally be perceived as agents '…of repression, forcing the user to succumb to a normalizing view of his/her task environment' (Hamman, 2002, p.96). A study which focused upon adult perceptions of the musical directedness of the Roland MC303 Groovebox found that this self-contained instrument induced deliberate compositional change or strategy. Respondent seven describes how their music became more repetitive and dance-like during their partnership with the Groovebox:

> Before I had the Groovebox, I used more chords that lasted for several measures, whereas now I use the Groovebox more for short synthesizer loops and bass loops. I have been trying to continue to use these long chords on the Groovebox itself, but the structure of the sequencer and the way in which this instrument is made just doesn't allow this so easily (student seven). (Tjora, 2009, p.169)

Consequently, the Groovebox' 'kind of will' was unearthed during the study. Another instance of constraint was reported in a research study undertaken by Shibazaki and Marshall (2013). It recorded that several boys found their music software 'too simple'. The boys found their software's timbral range and ability to offer sufficient musical customisation insufficient to realise a digital expression which befitted their musical desires:

> ...it's good but it needs more instruments...and too simple...I like more complicated software. [Male]
>
> ...well, you can get some good sounds but it will go faster but if you want to make sounds...you know not notes like in a tune but like a scream...you can't do it so you should be able to add sounds as well because they can be important as well. [Male] (Shibazaki and Marshall, 2013, p.353)

The second male cannot get the computer to realise his musical intentions. Echoing Savage (2017), there appears a real danger that students could lose their sense of humanity: something which has been found seminal for creative music-making. A number of the teachers who participated in Wise et al.'s (2011) investigation share Savage's (2017) concerns about the digital systemization of classroom-based creative practices. Wise et al.'s (2011) study reports the perceptions and practices of nine music teachers, all of whom worked with digital technology in four New Zealand secondary schools. Referencing Macintosh-based GarageBand software, Teacher Two was concerned about the use of pre-recorded loops, and described the practice as 'just cutting and pasting, and to me that is not composing' (Wise et al., 2011, p.126). Two further teachers expressed similar concerns, labelling GarageBand as a set of 'drag and drop' features for making music (Wise et al., 2011).

These are legitimate concerns which necessitate further understandings about how computer-based constraints work. Part 3.3.1 will now argue that despite the aforementioned anxiety, the reality is that constraints are the 'fuel' which drive communities of practice and therefore, any attempt to completely reject the role of representational systems in human action is found to be misplaced.

3.3.1 Musical constraint frameworks

It has been argued that '…music software never presents itself as a "lump of clay"' (Bertelsen et al., 2009, p.199). A myriad of socially constructed, historical connections '…are metaphorically re-mediated in the interface' (Bertelsen et al., 2009, p.199). This is because all cultures are founded upon constraints '…they are the rule-sets that maintain dynamic unity' (Magnusson, 2010, p.63). Subsequently, it is argued that there '…is no musical process without representational systems at work' (Vaggione, 2001, p.60). These representational systems ensure that '…the compositional process proceeds in a kind of personal and social tension' (Lapidaki, 2007, p.106). The social tension (in this case a computer) remains dependent on its potential and structures for appropriate action together with the student's (personal) abilities and predispositions (Lapidaki, 2007). A computer's structures for musical action are best conceptualized here as a musical framework, that is an '…entity, construct, system or paradigm – conceptual or physical – that contributes in some way to the composition or performance of music' (Mooney, 2011, p.144). Although frameworks influence musical results, they are not unique to a computer. Mooney (2011) explains that if a composer chooses to write for a violin, they 'buy into' a constraint framework, which ensures any musical outcome is infused with 'violin-ness'. The same can be said for when composers accept stave notation, or those virtual instruments and associated digital musical representations promised by music production software. Hugill (2012) suggests that such musical constraints are largely self-imposed, even those which are tacitly held and/or underdeveloped. A composer's imposed constraints can be of a material, compositional and/or process-based nature. These three types of compositional constraints are summarised below:

> • material constraints, where restrictions are placed upon the quantity or nature of the sonic materials
>
> • process-based constraints, where the musical process itself unfolds according to rules (e.g. algorithmic music)
>
> • compositional constraints, placing constraints on the act of composition itself (e.g. making music in a particular style or using a particular technique for a particular purpose). (Hugill, 2012, p.126)

Hugill's compositional constraints build upon Norman's research into natural and cultural constraints. Natural constraints include the 'material constraints' of human tools. 'Each object has physical features...that limit its relationships to other objects, operations that can be performed to it, what can be attached to it, and so on' (Norman, 1998, p.55). Magnusson (2010) cites the inability of a double-bass to play very high-pitched notes as a natural/material constraint. Meanwhile, a student's compositional constraints are thought the product of 'cultural constraints', which are societally '…evolved, numerous artificial conventions that govern acceptable social behavior` (Norman, 1998, p.55).

It has been suggested that when composers intellectually partner with computer software, that partnership is mediated by a combination of natural and cultural constraints. Part 3.3.2 will now explore the multimodal, situated and emergent nature of these constraints by defining them as semiotic resources for meaning-making.

3.3.2 Meaning-making with multimodal, semiotic resources

Music production software has been described as a computer-based cognitive tool, capable of offering composers pedagogical and performance-enhancing partnerships. This software typically presents composers with a musical framework, which composers might accept or subvert. Within this framework, a range of community conventions are digitally symbolized in the form of material, process-based and compositional constraints and these pose influence for a composer's creative behaviour. The way in which composers attribute meaning to these digital, multimodal frameworks will now be considered, in order to better conceptualise how computer tools mediate creative musical action.

At part 2.4, a social-cultural approach to mediated action defined computer-based tools as symbolic mediators which acquire meaning from those cultural conventions which engendered them. The meanings composers 'arrive at' are determined by those signs which emerge during their social interaction with a computer. Part 2.4 introduced 'the sign' and found it to be '…a fusion of form and meaning' and their genesis 'lies in social action' and this defines signs as 'made' and not 'used' (Kress, 2010, p.54). Such a definition builds upon a social-semiotic approach. In short, semiotics is concerned with 'the study of signs' (Chandler, 2004, p.1). A social-semiotic perspective acknowledges that meaning is forged *between* individuals and their partnerships with those cultural resources found in social situations:

> In a social-semiotic account of meaning, individuals, with their social histories, socially shaped, located in social environments, using socially made, culturally available resources, are agentive and generative in sign-*making* and communication. (Kress, 2010, p.54)

In terms of 'culturally available resources' these might be thought of as semiotic resources, which are defined as '…the actions and artefacts we use to communicate' (Van Leeuwen, 2005, p.3). Van Leeuwen (2005) believes semiotic resources emerge both physiologically (e.g. through the voice, facial expression and/or gesture) and through the development of technology (e.g. the emergence of the pen and paper or computer hardware and software). This conceptualization suggests that to observe emergent semiotic resources, the whole assemblage of modes should be captured for analysis because they simultaneously shape the nature of emergent signs. Jewitt adopts a similar approach in order to develop her understanding of new digital technologies:

> My analysis of new technologies focuses on a number of *modes* including image, colour, speech and sound-effect, movement and gesture, and gaze. For me, *mode* means an organized set of resources for making meaning with: *semiotic resources.* (Jewitt, 2006, p.17)

Jewitt (2006) proposes that digital technologies have the potential to ensure that human-computer interaction is inherently multimodal. She goes on to explain that students multimodally engage with computer software by pointing, gesturing and gazing at the screen (Jewitt, 2006). Students might also move a mouse or tap a screen while talking to others about what they are doing (Jewitt, 2006). Her seminal point is that students learn through the total consort of modes (e.g. visual/sound) on screen and also those around the screen (e.g. gesture) and certainly not from just what is said (i.e. language) (Jewitt, 2006).

Tomlinson (2014) reminds us of the transient nature of mode-based, semiotic resources. He explains that modes are not ‘fixed’ but fluid and subject to change (Tomlinson, 2014). After all, it is the emergent nature of social discourse which produces and organizes meaning in ways that constitute a particular domain (or community) (Kress and Van Leeuwen, 2001; Kress, 2010). Consequently, ‘discourses’ might unlock ‘what really happens’ when a composer and computer partner create music. Kress and Van Leeuwen (2001) list the rich variety of knowledge discourses ‘carry with them’ to include who is involved; what takes place where and when and also a corresponding set of evaluations, purposes and interpretations. Kress and Van Leeuwen (2001) also find that discourses are represented ‘in very many modes’ and ‘capturing mode’ is therefore seen as essential for the construction of meaning about the role of a digital technology in a music classroom, for example.

Gall and Breeze (2005) investigated how ‘Dance eJay’ and ‘Cubasis’ software provide multimodal opportunities for classroom-based composing. They found that the spatial arrangement of musical parts and samples on-screen encouraged teacher and student discussion around the computer. Consequently, students and teacher developed shared meanings in relation to the emerging compositional structure. The teacher also simultaneously used visual and audio modes to discuss the texture and structure of student C’s music:

> Teacher: Can you tell me about the theme A. Can someone describe to me the “catchy” bit?
>
> C: It’s the orange bit at the top
>
> Teacher: Can you tell me...listen (lots of quiet chatter)...shh.- tell me what sound you hear that’s the tune?
>
> (A pupil then sings the melody and the teacher indicates that the first pupil was right: the part he had seen was the “melody”). (Gall and Breeze, 2005, p.8)

Additionally, a different student sang along with their composition as it progressed on-screen and latterly began to chant in time and conduct the music (Gall and Breeze, 2005). This student then successfully anticipated their ‘B’ section by listening and following the on-screen musical representations:

> One, two, three, four. Enter (three bars rest) B,e,e,e, NOW! (Gall and Breeze, 2005, p.9)

Gall and Breeze’s findings forward the potentially influential nature of digital, multimodal representations. This said, it is the extent of interrelated multimodality that a computer and human jointly promise which poses special interest here. After all, in ‘…multimodal interaction, several modal resources are mobilized to build an action’ (Deppermann, 2013, p.3)

In terms of their capacity for multimodality, mobile phone, tablet and human partnerships promise new opportunity:

> This proliferation of multimodal interfaces on cell phones has gradually expanded user options for input…Newer input modalities on smart phones now also include multi-touch, gestures, images and eye movements, stylus, and a multitude of sensors…content of users' intended input involving speech, gestures, stylus, images, gaze, and sensors can be processed using recognition technologies. (Oviatt and Cohen, 2015, p.13)

How this newfound multimodal potential influences creative musical action is a matter for this research and therefore, part 3.4 will now consider the multimodal potential of the tablet computer for creative musical activity.

3.4 The musical potential of tablet computers

A tablet computer '…is a flat-panel computer device with a touch-screen on the upper layer and the electronics below' (Katzan, 2015, p.8). Unlike desktop computers, no keyboard or mouse is provided '…so most actions are taps and swipes on a sensitive glass surface' (Knight and Lagasse, 2012, p.189). Consequently, it is possible that 'a single musician can perform and create multilayered music with one [tablet] device with much more ease than with the cumbersome keyboard workstations of the past' (Medvinsky, 2017, p.701). The differentiating feature of tablet computers is that 'touch' is the basic operational mode which underlies their use.

The tablet computer also promises consummate potential as a multimodal signifier. Nijs and Leman (2014) state that a tablet's computational power permits the real-time, visual representation of sound through time. This has led to the emergence of interactive musical systems which can be used for '…displaying different aspects of music playing, such as the playing technique, the sound quality and the expressiveness' (Nijs and Leman, 2014, p.40). When composers partner with tablets therefore, they use their body (gestures) to manipulate visual and sonic resources to experience multimodal compositional practices (Nijs and Leman, 2014). Bodily gesture is encouraged by the tablet's touchscreen, which Vanderlinde (2017) identifies as seminal for arguably the tablet's most controversial compositional opportunity; its performance-enhancing, musical partnerships:

> The intuitive nature of the touchscreen and ease of flow of functions creates a setting where musical processes become highly accessible for all learners but is of particular value for learners who struggle with decoding notation, who have cognitive or processing delays, who struggle physically with playing acoustic instruments, or for whom collaborative music making is a challenge. (Vanderlinde, 2017, p.665-666)

The touch-screen and its software-driven 'flow of functions' appears to democratise (i.e. flatten) the access hierarchy to creative musical experience. For instance, Kardos (2012) found that a student who had taken piano lessons since the age of 8 has much less of advantage when composing via tablet than another student who had never read, or written music before. Trainee music teacher John also forwards the egalitarian nature of tablet devices. He explains how the iPad (a popular brand of tablet computer) and its music application 'GarageBand' ensured his students could creatively improvise music in a blues style, without having to 'know' how to play a blues scale:

> The iPad [is] pretty entry-level in the sense that you can pick from a huge variety of sounds and then just play. What's great is that Garage-Band has mode/scale settings that can be applied. For instance, students can select "minor blues" and improvise in a blues style without having to actually know their blues scales. (Riley, 2013, p.84)

Given the potentially transformative nature (for good or bad) of a tablet's multimodal partnerships, it is no surprise that Scharber finds the iPad is being thrust into the world of teaching and learning even when '…the verdict is still out about the ways in which using iPads can positively impact teaching and learning' (2014, p.69).

In music education settings, another controversial way tablets can be deployed is as a 'musical instrument'. To better appreciate what happens when students use tablets as a digital musical instrument, part 3.4.1 will now emphasise the importance of gesture in 'playing' musical instruments in order to better assess the role, musical or otherwise, of the tablet computer.

3.4.1 Gestural digital musical instruments

It has been established at 3.4 that keyboards and mice are increasingly complemented and even replaced by bodily gestures as primary device controllers (Nijs and Leman, 2014). Abrahams (2015) believes that when humanistic, creative gestural intention partners with an iPad to make music, the iPad becomes a musical instrument. This argument is founded upon the belief that tablets demand a range of creative musical behaviours from their human composers:

> …the iPad is a musical instrument. It can be performed well or poorly. It takes practice to build performance technique on it. It will do nothing without musicianship, creativity, and imagination supplied by a person. It has musical limitations just like any instrument, but in the right circumstances, it can be used to make amazing music. (Abrahams, 2015, p.97)

Given this creative musical potential, it is no surprise that Randles (2013) imagines that if Bach or Mozart were alive today, they would explore what an iPad could do. This is because, like the clarinet or pipe organ, for example, the iPad is a technology '…invented to do a particular musical thing, at a particular point in time' (Randles, 2013, p.49). Tablet technology allows for '…the manipulation of melodic and rhythmic materials in musical performance, just like the keys on a saxophone and the slide on a trombone' (Randles, 2013, p.50). Those 'for' the use of tablets in music education consequently cast the device in this mold, believing that like a musical instrument, a tablet '…causes the transfer of spatial (pitch) and temporal (duration/rhythm) information from the conscious and subconscious systems of the body to the apparatus that physically produces the sound' (Paine, 2009, p.142). The point is that 'playing' an instrument necessitates some physical act on behalf of the human composer.

In terms of making sound with tablet computers, Paine (2009) introduces a 'model of digital instrumental control' best considered as two stages. Stage one requires a composer to develop gestures to physically control the dynamics, pitch, vibrato, articulation and attack/release of the digital instrument (Paine, 2009). Stage two is linked to stage one because it describes those physical (gestural) components necessary to control the instrument; which are pressure, speed, angle and position (Paine, 2009). It must be concluded that that a tablet computer does necessitate a reasonable, albeit different, level of physical, creative and musical gestural control.

Despite the arguments presented here, ones which define gestural digital instruments as musical instruments, there are those who remark that '…the iPad is not a real musical instrument…not worthy of study by serious musicians' (Abrahams, 2015, p.94). Conscious of this concern, when the gestural digital instrument and music production platform GarageBand for iOS (GBIOS) is now proposed at 3.4.2, its selection for use in secondary school music classroom settings will be carefully justified.

3.4.2 GarageBand for iOS

GarageBand for iOS (GBIOS) is a free software application developed by Apple Computers for use with their iPhone and iPad touch-screen devices. It was primarily selected for this research study because GBIOS promises students both performance and pedagogical intellectual partnerships (see 3.2) which promise a wealth of multimodal interaction (see 3.3.2). In particular, the application's 'smart' touch instruments and automated drum interfaces promise to enhance the musical performance of those less competent or confident musicians:

> The smart instruments and drum machine features of GarageBand also provide support for musicians with varied prior experiences to perform and create together. This enables learner-musicians to create with the understanding that the organization of sound remains the central focus. Self-expression continues to be core of the experience supported by technology. (Medvinsky, 2017, p.702)

Medvinsky is suggesting that GBIOS 'frees up' students' cognitive faculties so that they can experience acts of self-expression which directly engage with their musical interests:

> In school-age classrooms, children's musical interests might be stimulated with access to music-listening equipment, music sequencing or notation software, or iPads loaded with the GarageBand application. (Bond, 2013, p.27)

If a student is able to experience personally meaningful, creative musical expression through the stimulation of their musical interests in formal settings, then a key tenet of the research rationale, that is the need to better connect formal and informal music-making practices, might be accommodated (see chapter one).

When students tap open the GBIOS application, they choose between a 'Tracks' or 'Live Loops' interface. By selecting 'Tracks', students subsequently make a choice between 'smart' or 'non-smart' gesture-based virtual instruments. These instruments include a Smart Keyboard, Smart Drums, Smart Strings, Smart Guitar, Keyboard, Drums and Electric Guitar. An Audio Recorder interface is also available for the recording of acoustic sound via an external microphone (e.g. voice or violin). The smart instruments share a number of common features. Agreeing with Riley (2015), the 'Smart Piano' instrument area invites students to tap on pre-made chords to create chord progressions. Students can also choose to arpeggiate the chords or 'auto-play' them in four different ways. There are a number of keyboard timbres available, which include classic rock organ and electric piano. Figure 3-1 (Apple, 2019) details this interface which promises interactive interrelated visual, audio and gestural modes:

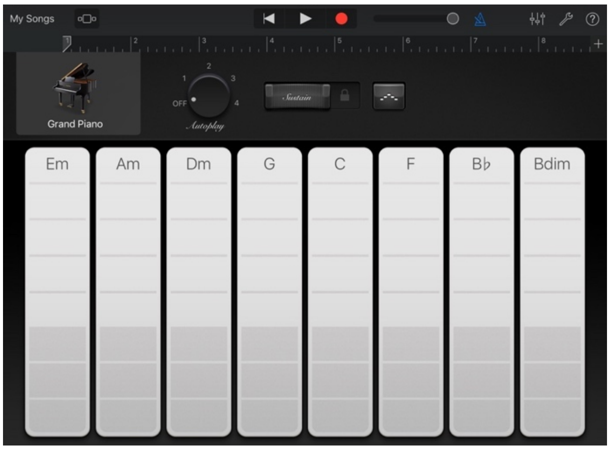


Figure 3-1 The Smart Piano interface set to Grand Piano timbre complete with tap chords and auto-play dial. (Apple, 2019)

Figure 3-1 details the smart piano interface. Students are invited to tap the chords provided on-screen – all of which promise a strong harmonic relationship with each other. Different inversions of each chord are triggered when students traverse each vertical chord bar with their finger.

Once the student(s) is satisfied with their keyboard part, they can record it via the 'Transport Toolbar' (see top centre of 3-1). The red button signifies a record command, whereas the blue triangle button toggles the metronome on/off.

Evidently, students do not need to know how to perform chords, or which chords share strong harmonic relationships, or to search for a range of keyboard timbres. The auto-play feature will even take care of timing issues and the development of simple rhythmic and melodic patterns *for* the composer. Consequently, it is proposed that this smart instrument distributes intelligence between tablet and composer in a collaborative way to achieve a joint, performance-enhanced musical outcome. The 'Smart Guitar' (Apple, 2019) is based upon a similar musical frame. In addition to strumming chords with vertical gestures, it promises students melodic development because a range of scales are provided which can be 'played' by tapping blocks on-screen.

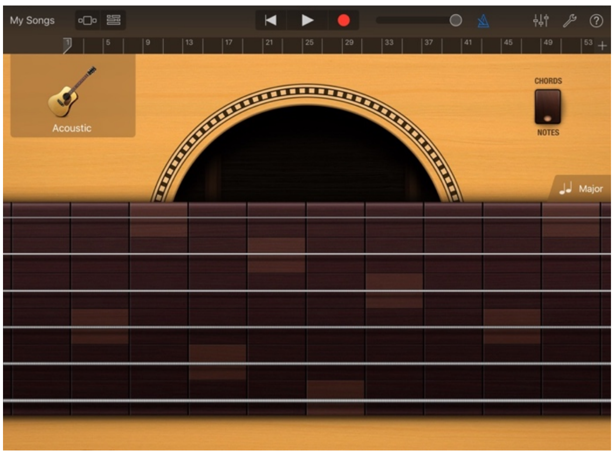


Figure 3-2 The Smart Guitar interface set to Acoustic Guitar timbre, complete with guitar neck blocks. Each block represents a scalic note in relation to a particular octave. (Apple, 2019)

Figure 3-2 details the smart guitar interface. Resembling a real guitar, the strings on the virtual neck are ‘flexible’ which ensures that students can influence volume, vibrato and pitch slide with their finger in real-time. The scale button is set to Major. If this scale button is tapped, students can reconfigure the guitar neck to produce notes from minor, pentatonic, blues, mixolydian, klezmer and Japanese scalic traditions also. Once the student has gesturally rehearsed their melody, it can be recorded as an additional compositional layer using the transport bar. Comparatively, the Smart Strings interface invites students to use gestures to initiate different playing techniques such as pizzicato (plucking) and sustained, cinematic vibratos.

GBIOS promises a copious range of smart drumming options for composers, which include a Drum Matrix and Drum Simulator. The Drum Matrix interface together with a typical matrix drum pattern is presented as Figure 3-3:

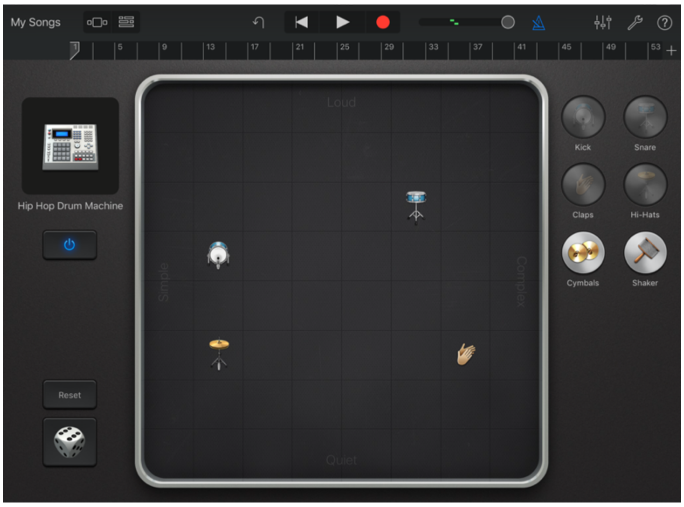


Figure 3-3 The Drum Matrix interface complete with drum beat and configured to the Hip Hop Drum Machine sound set. (Apple, 2019)

The Drum matrix (Figure 3-3) is increasingly assistive/performance-enhancing because students drag and drop parts of a drum kit onto the matrix grid to create a beat. Choice of placement defines the volume and rhythmic complexity of that individual layer. Once students are satisfied with each drum part’s dynamics, rhythmic complexity and timbral nature, the drum track can be recorded into their composition.

The Drum Simulator, a secondary Smart Drums interface, awards the composer much more of the cognitive burden necessary to create and perform a drum track. Figure 3-4 presents the ‘Drum Simulator’ interface:

Figure 3-4 The Drum Simulator interface configured to the SoCal Drum Kit. (Apple, 2019)

When students select the drum simulator (Figure 3-4), they use their fingers to play three or more parts simultaneously, in real-time; much like real-world drumming requirements. Here then, it is the student who assumes responsibility for inventing the rhythm and coordinating its polyrhythmic performance.

The student can vary the strength of their tap gesture to adjust the dynamic of each drum strike. They can also position their gesture to different parts of the drum and/or cymbals to introduce different timbres.

Those who take vocal or instrumental lessons, for example, might not require such constraining musical and creative support from smart instruments. In addition to a microphone, which can be used to record verbal raps, sound effects, singing and any acoustic musical instrument, an external music keyboard controller can also be connected (the EK). This feature could address the needs of those more experienced musicians who perceive the tablet as simply somewhere to store their creative products. Students are seemingly able to choose how much creative musical support they require from GBIOS, which arguably differentiates the application as the most '…versatile of the apps designed for music creation' (Riley, 2015, p.8).

Once students have recorded their tracks, they can view their work by selecting the Track-View interface. An example of how Track-View typically visualises students' musical ideas is presented at Figure 3-5:

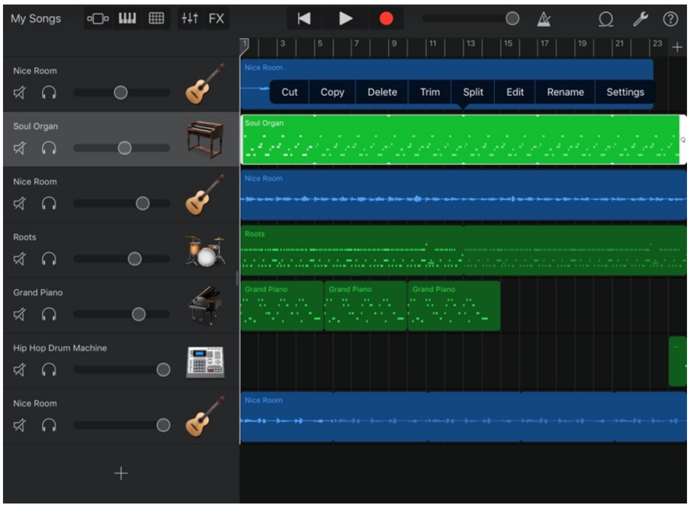


Figure 3-5 The Track-View interface detailing seven tracks. One track is highlighted and its potential to be edited is revealed. (Apple, 2019)

The track-view at 3-5 includes both blue and green tracks. Blue tracks represent real audio, likely recorded in via a microphone and green tracks represent those musically editable products of the virtual instruments. All tracks can be cut, copied, deleted, trimmed and split.

The musical value of virtual instrument tracks (green tracks at Figure 3-5) is that they can be edited in some micro detail. Figure 3-6 presents the Piano Roll view which spatially arranges student work by pitch and duration:

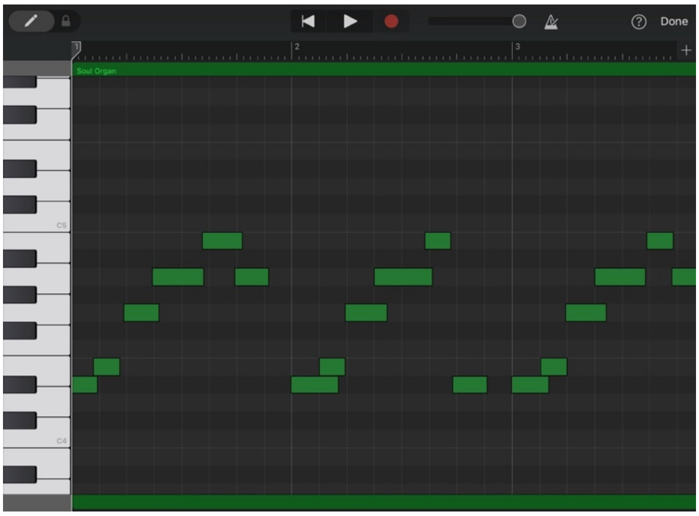


Figure 3-6 The Piano-Roll interface, which ensures that students can edit their digital musical content. (Apple, 2019)

The piano-roll at Figure 3-6 scrolls in real-time, as the part is played. Any notes which are out-of-time or sounding at an undesired pitch can be moved, cropped or dragged accordingly.

GBIOS also simulates sonic-based, contemporary compositional practices too. For instance, students who listen to Dubstep, Hip-hop or Drum and Bass, for example, might choose to create a composition which builds its structures and textures from samples and loops. That is, they can adopt the compositional practices which define their preferred musical stylistic conventions. To achieve this aim, students might select the Live Loops interface. Original loops can be created or pre-loaded loop-sets selected. The pre-loaded loop-sets promise Electronic Dance Music, Hip-hop, Dubstep, RnB, House, Rock, Electro Funk, Beat Masher, Chinese traditional and Chinese modern. Figure 3-7 illustrates the Live Loops interface (Apple, 2019), complete with an Electronic Dance Music (EDM) loop-set:

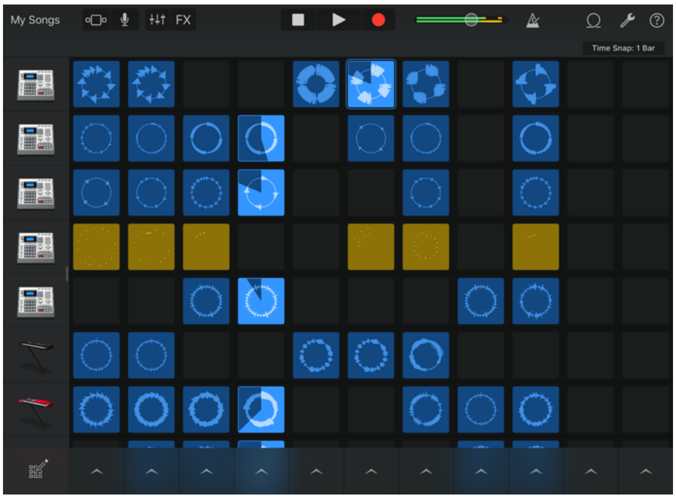


Figure 3-7 The Live Loops interface configured for an EDM loop-set. (Apple, 2019)

At Figure 3-7, a student has triggered the fourth vertical stack of EDM loops and just one loop from the sixth vertical stack. The loops begin and end in real-time. When the student taps record, they layer up textures and organise structure by triggering loops to suit their creative intentions. Importantly, this work is recorded into track-view as a single track (see Figure 3-5). This ensures that additional acoustic tracks (e.g. a rap) or virtual instrument tracks (e.g. a keyboard synth) can be added to the loops and this helps to customise what is a heavily automated starting point.

It has been suggested that students might develop a range of performance-enhancing, or pedagogically-oriented creative strategies in partnership with GBIOS. Music teacher Mr. Davis reported for a case study undertaken by Nielsen (2013) that those students with a music performance background adopted a more structured approach to composing with a Macintosh version of Garageband. These students tended to develop music which exhibited tonality and form (Nielsen, 2013). Student Laura epitomises this approach:

> Laura: At first I kept to the guidelines, I did not mess around very much. I simply got it done right. He [Mr. Davis] told me I was doing it right, but I did not go outside the box much. (Nielsen, 2013, p.58)

By way of contrast, Mr. Davis found that '…the nonperformers are very random' (Nielsen, 2013, p.58). The nonperformers' musical ideas:

> …were streamed together with very little musical connection. This approach was quite typical in the early stages of the students' compositions. (Nielsen, 2013, p.58)

In response to this study, it is proposed that to truly understand the influential nature of GBIOS, any research project should purposively represent the broad range of musical, technological and stylistic expertise evident in that school's student community.

This chapter has provided a theoretical construct to describe what might happen when student composers, situated in a school community create music with a tablet computer and its GBIOS application. It has been conceptualised that during social discourse, multimodal, semiotic resources will emerge from an intellectual partnership between tablet and student. The materials of these semiotic resources are found to be combinations of gestural, visual and audio modes (for example), which signify meanings to the student(s). These signified meanings ultimately constrain creative musical activity in peculiar ways. Alongside this chapter's primary focus on the tablet computer and digital technology, chapter two theorised how a student composer might cognitively, socially and culturally constrain their creative behaviour during intellectual partnerships with a tablet computer. To fulfil Nielsen's (2013) finding that teachers also influence creative behaviour through their provision of learning activities, chapter four will now assess how classroom music teachers might influence tablet-mediated creative musical activity.

Chapter 4:
The classroom music teacher and their musical, technological and pedagogical knowledge

A research rationale has described the kinds of digitally-mediated composing practices today's classroom music students can choose to engage with in informal settings (see chapter one). Thinking about these practices, Chrysostomou laments that '…it is unfortunate that music teachers do not incorporate the types (or uses) of technology that are relevant to students' interests and manners of thinking' (2017b, p.195). Kirkman (2011) has researched how social cultural context shapes computer-mediated composing processes inside the music classroom. He introduces Samuel, who performs music with friends and family. He plays saxophone, bass, drums and piano. These musical practices enshrine Samuel with the confidence to perceive music-making as a self-expressive and exploratory activity (Kirkman, 2011). This is what Samuel had to say about his classroom music lessons:

> Samuel: Music inside school is based around how the teacher does a lot of classical stuff and is classically trained and we seem to constantly do it around classical stuff which I find kind of irritating. But outside school we're free to do whatever we want. (Kirkman, 2011, p.116-117)

Samuel's perspective helps us to recognise that '…it may be the right time to bring formal and informal music settings closer, so that each can benefit from the other and at the same time take music education to another level…' (Chrysostomou, 2017a, p.348-349). How a classroom music teacher might achieve this utopia, that is bring together formal and informal musical experience during classroom action, will now be considered.

This chapter will argue that music classrooms should make available three conceptual spaces of development. Within each space, the music teacher must administer situated combinations of pedagogical, musical and technological knowledge to ensure that students move through the conceptual spaces to build a dialogic community of creative musical action. This dialogic community and its situated, emergent rules and desires is the 'engine house' which will ultimately produce a meaningful creative musical product. This chapter will argue that the music teacher is highly influential for empowering their dialogic community of music makers.

To describe this teacher influence, part 4.1 explains that music teachers might operationalise both musical *and* technological knowledge during musical activity. Part 4.2 introduces the pedagogical payloads that are inherent in these musical-technological knowledge spectrums. Consequently, music teachers are invited to carefully consider how their identities and classroom strategies impose or overcome barriers between formal and informal music-making experiences. Ultimately, a music teacher's identity is found to be bound up with the extent they monologically instruct students (4.2.1); facilitate the realisation of students' own goals (4.2.2) and/or become students' dialogical partner in order to achieve joint creative outcomes (4.2.3).

4.1 Musical and technological knowledge

A substantial proportion of my teaching practice was absorbed supporting GCSE music students as they strove to realise their creative musical ambitions through desktop computers. Students were obviously furnished musical guidance but they also responded to my knowledge of the software. 'Sir, how do I delete this?' and 'Sir, what should I add in next?' ranked among some of the most ubiquitous student questioning. Of course, these questions require the music teacher to operationalise some technological knowledge (question one) alongside musical knowledge (question two). The musical knowledge in this case would have been embodied in some harmonic, melodic, rhythmic or structural suggestion or demonstration, for example. In reality, both types of knowledge are always required. Making a musical change on-screen simultaneously necessitates technological knowledge in order for that musical change to happen. That is, both teacher and student '…need to be musical and technical at the sametime…' (Kardos, 2017, p.491). Of course, when students engage in digital compositional practices, the line between music and technology becomes evermore blurred (Kardos, 2017). In response, Lum argues that teachers must engage their young composers musically, aesthetically (e.g. exploring the source and perception of the creative idea) whilst also '…recognizing their growing hunger for ever-alluring technological music commodities' (2017b, p.114-115). Dorfman (2013) agrees and proposes that music teachers should perceive technology-based musical instruction (TBMI) as falling somewhere on a musical and technological spectrum. Dorfman illustrates this idea visually and it is presented as Figure 4-1:

Figure 4-1 Spectrum of TBMI Lesson Content.
(Dorfman, 2013, p.99)

Dorfman (2013) explains that the left-hand extremity of his spectrum as depicted at 4-1 describes those activities which are purely musical. The right-hand extremity describes those activities as purely technological. Using Dorfman's definitions of musical and technological as a starting point, these terms will now be unpacked. Let us begin with Dorfman's account of musical behaviour:

> …when we ask our students to rehearse or perform a piece of music (although it may eventually be recorded, edited, mixed, etc.), we are addressing musical goals through musical activities without integrating technology. (Dorfman, 2013, p.99)

This is a relatable anecdote because when students compose with digital technology, they might choose to rehearse, perfect and ultimately 'perform' their composed part in a conventional musical way (at the piano, for example). Unfortunately, Dorfman does not undertake a critical investigation of what 'musical knowledge' is, or what it is not. Swanwick (1994) does set out to settle this matter in his book *Musical Knowledge: Intuition, Analysis and Music Education*. In it, he defines musical knowledge two-fold: knowing *about* music and knowing *how to* music.

Knowing about music is factual, propositional knowledge, whereas knowing how to music is '…a type of knowledge that we display in action every day' (Swanwick, 1994, p.28). Swanwick (1994) explains that 'knowing about' music is routinely learnt verbally and abstractly in school and consequently this knowledge becomes detached from a genuine music context. He argues that music teachers should resist this temptation and support learning in action. Swanwick outlines this two-part conception of musical knowledge below:

> This is an important distinction…the difference between indirect propositional knowledge by description and that which is acquired and associated directly through musical experience. (Swanwick, 1994, p.27)

The belief that knowledge emerges *during* experience is a seminal guiding principle for this research. The principle aligns with Christopher Small's (1988) definition of 'music'. Music is defined not as a 'thing' but a 'process'. Musicking is about 'taking part in a musical performance' be that listening, or providing material for performance (composing) (Small, 1988). To emphasise the process-based, emergent and situated nature of this definition, Small coins the term 'musicking', which he defines as follows:

> The act of musicking establishes in the place where it is happening a set of relationships, and it is in those relationships that the meaning of the act lies. They are to be found not only between those organized sounds which are conventionally thought of as being the stuff of musical meaning but also between the people who are taking part, in whatever capacity…[that is] relationships between person and person, between individual and society… (1988, p.13)

Swanwick's (1994) concept of 'knowing how' epitomises well Small's perspective. It forwards the emergent nature of knowledge to make a case for designing and studying active, digitally-mediated music-making systems.

Having now discussed musical knowledge, we return to the right-hand extremity of Dorfman's spectrum (Figure 4-1). Here, it is claimed, '…fall activities that are purely technological' (Dorfman, 2013, p.99). These activities include '…procedure for digital file management, techniques within software, or hardware connectivity and maintenance' (Dorfman, 2013, p.99). In summation, technological knowledge…

> …refers to the special knowledge of the operating of technology and its applications. In addition, technological knowledge is related to proper and informed selection of technological tools that can help students learn effectively. (Dorfman, 2013, p.45)

As a music teacher, I can relate to a necessity for these behaviours. 'Click on that'; 'turn that dial'; 'save your work'; 'drag it there' are just some of the phrases I have tirelessly directed around digital technologies. This said, Dorfman's explanation of technological knowledge remains incomplete once again. To amplify confusion, Swanwick (1994) amalgamates what might be called 'technological knowledge' into 'how to' music knowledge. Talking about the necessity for 'manipulative control', Swanwick identifies the necessity for students '…to manage the instrument, to coordinate muscles and articulate keys in dependable controlled ways' (1994, p.28). Given the integral necessity for acoustic or digital manipulative control, it is possible to rebuke Dorfman (2013) and propose music and technology as symbiotic; wholly inseparable:

> All types of musician have always worked with technology, and all musical instruments are an example of technological innovation and development. (Hugill, 2012, p.5)

Knowing how to use hands and embouchure to tease sonority from a trumpet is surely comparable to *knowing how* to make a computer emit sound. This counter argument proposes that music *is* a technological discourse so neither extremity of the musical technological spectrum should exist in a vacuum:

> The very soul of what it is to be human seeks expression through whatever technology is on hand for music making. (Webster and Williams, 2017, p.15)

Given this argument it remains surprising that Hugill (2012) delineates aural awareness and musical ability from technical skill. For Hugill (2012), technical skills are discussed in context with the digital realm. Technical skill is '…skill in recording, producing, processing, manipulating and disseminating music and sound using digital technologies' (Hugill, 2012, p.6). Despite the apparent similarity between Hugill's (2012) and Dorfman's (2013) descriptions of technological knowledge, Dorfman's (2013) initial polarisation of 'musical' and 'technological' remains overtly controversial.

Perhaps a more realistic account of the spectrum could be proposed, one which defines it simply as a *symbiotic tension wherein one extremity constrains and therefore, defines the other*. Of course, the fluid nature of spectrums somewhat absolves clinical polarisations in any case. A spectrum might therefore define technology-mediated musical learning as a situated but transient *blend* of musical and technological influence. Dorfman (2013) himself concedes that purity of musical or technological content is rare; he accepts that most classroom music-making falls in the middle of the spectrum. The music teacher masterfully blends musical and technological aspects together '…so that students recognize the application of technology to music, and of music to technology' (Dorfman, 2013, p.99).

For teachers and/or students, tension can arise when a classroom lesson might only focus upon a primarily musical or technological aspect. The student might attempt to engage in more musical or technological activity, whilst their music teacher desires or even statutorily requires the opposite. For example, a student could become obsessed with exploring digital, pre-loaded loops to produce their composition (a process requiring copious technological knowledge). Meanwhile, their music teacher might require those same students to perform a chord progression (a series of chords) at the piano to meet a curriculum objective (a process designed to ultimately develop musical knowledge). Consequently, Dorfman (2013) widens his argument to accommodate the merger of these teacher–student and musical–technological tensions. A second visual representation is provided by Dorfman and it is reproduced here:

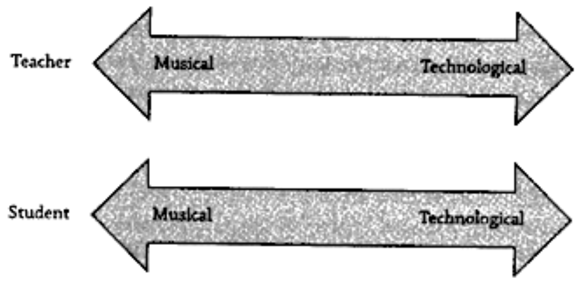


Figure 4-2 Spectrum of TBMI Lesson Content – Student and Teacher Perspectives. (Dorfman, 2013, p.100)

The pair of teacher and student bi-directional arrows presented at Figure 4-2 are explainable under the aegis that music teachers typically plan to locate their lessons somewhere on the spectrum, even when their students' perspectives are often very different (Dorfman, 2013). Any disparity between teacher and student in relation to the spectrum requires the teacher to operationalize their pedagogical knowledge (reviewed in more detail at 4.2) to reconcile the tension between teacher and student, so that the goal of completing a musical work can be realised.

Dorfman's musical and technological spectrum is not alone in advocating that distinctive bodies of knowledge influence creative musical activity. The Technological, Pedagogical and Content Knowledge (TPACK) framework argues that effective creative musical development with digital technology necessitates music teachers to mobilise three bodies of knowledge (Koehler and Mishra, 2009; Mishra and Koehler, 2006). This teacher knowledge is described as an interaction *between* content (in this case musical), technological and pedagogical knowledge (Koehler and Mishra, 2009). Koehler and Mishra believe that content knowledge is '…teachers' knowledge about the subject matter to be learned or taught' (2009, p.63). Their framework acknowledges integration *between* knowledge areas. For instance, TPACK concedes that 'Technology and content knowledge have a deep historical relationship' (Koehler and Mishra, 2009, p.65). TPACK emphases the relationship *between* content [musical] and technological knowledge, in ways comparable with the Dorfman (2013) and Swanwick (1994) perspectives. Termed Technological Content Knowledge (TCK), Koehler and Mishra explain that TCK highlights '…the manner in which technology and content influence and constrain one another' (Koehler and Mishra, 2009, p.65).

Alongside TCK, music teachers must also apply pedagogical knowledge (PK) during action. That is, '…deep knowledge about the processes and practices or methods of teaching and learning…[the] overall educational purposes, values, and aims' (Koehler and Mishra, 2009, p.64). This account of PK is expanded below:

> A teacher with deep pedagogical knowledge understands how students construct knowledge and acquire skills and how they develop habits of mind and positive dispositions toward learning. As such, pedagogical knowledge requires an understanding of cognitive, social, and developmental theories of learning and how they apply to students in the classroom. (Koehler and Mishra, 2009, p.64)

The pedagogical, musical and technological knowledge this chapter has hither-to identified make for convenient, ready-made analytical themes, capable of informing field data codes but problems abound. Perhaps the most acute, is the view that knowledge can be presented as some objective set of principles, principles which remain consistent across different settings. My epistemological beliefs (enlarged upon during chapters five and six) are interpretivist and they accept that '…all 'meaning', all 'knowledge' is a personal, individual interpretation of life experience: there is no such thing experientially as neutral data…Life gains significance and shape in musical event, where…meaning is both celebrated and created' (Swanwick, 1994, p.240). Again, Small's (1988) concept of musicking defines musical knowing as a series of relationships which become established in a place where music is performed and it is in those relationships where the meaning of the act lies. By comparison, TPACK can be criticised for purveying meaning as some transferable objective reality. Archambault and Barnett (2010) praise the way in which TPACK has influenced research: they welcome a unifying conceptual framework for the study of technology-mediated teaching and learning. So, while TPACK is thought potentially useful to conceptualise how technology might improve teaching and learning, '…it requires additional examination to understand if technology, content and pedagogy meld together to form the unique domains described by the framework' (Archambault and Barnett, 2010, p.1656).

Even if conceptions of TPACK are 'blindly imposed' upon educational settings, researchers immediately encounter the confounding problem of identification and/or measurement. To investigate this problem Archambault and Barnett (2010) measured survey responses submitted by 596 teachers working across the United States. The survey included 24 items designed to measure each TPACK knowledge area. Findings suggested that it remains difficult to objectively separate out each of the knowledge domains and the authors believe this discovery calls into question the legitimacy of their existence. Archambault and Barnett (2010) explain that while teachers were better at identifying the technological domain, there existed 'fuzzy boundaries' accredited to 'confusing definitions', when teachers were asked to differentiate between the pedagogical and content domains (Archambault and Barnett, 2010). Conclusions remark that '…there is room to continue to build on TPACK or even conceptualise other models that provide a less complex, more precise way of representing the effective integration of technology to improve student learning' (Archambault and Barnett, 2010, p.1661).

The epistemological and empirical challenges TPACK raises inform its application henceforth. Adopting Lincoln and Guba's (1985) idea of transferability, TPACK will only be 'transferred' to a community and its data if some cordial compatibility between theory and research is discovered. This strategic approach is suggestive of a broader, fundamentally pragmatic approach to theory and research relationships. This will be enlarged upon in chapter six.

Enacting a pragmatic approach, TPACK's epistemological limitations are now acknowledged but the framework remains a useful sensitising but not absolutist instrument to inform understandings of technology-mediated classroom settings. Consequently, this chapter will continue to make tentative reference to TPACK in order to construct an understanding of situated, digitally-mediated secondary music classrooms.

Part 4.1.1 will now describe the content (musical) and pedagogical content knowledge a music teacher might operationalise around digital technology to encourage musical creativity in their role as teacher-as-musician. 4.1.2 will then consider what technological and technological pedagogical knowledge a music teacher might operationalise around a digital technology to develop creative music-making. In this way, a teacher's behaviour across the musical and technological spectrum might then be properly discussed. The second part of this chapter (from 4.2) will focus upon how a music teacher's pedagogical knowledge can influence the creation of digitally-mediated music in formal settings.

4.1.1 Teacher-as-musician

Music teachers influence their students' musical ideas to some greater, or lesser extent. Those keen to recognise O'Kane's (2000) view that children are active participants in the construction of their experiences, might be cautious about providing too much musical structure, for example. Whatever volume of content knowledge provided *for* students, it is typical that teachers offer and/or even impose compositional stimuli. Stimuli are concepted here as socially imposed, semiotic resources which are communicated via one or multiple modes (see 3.3.2). They also assume physical and non-physical (conceptual) forms (see 3.3.2). Cain (1985) proposes the use of stimuli in the classroom for their potential to suggest musical moods (e.g. sombre, celestial, celebratory, sinister) via poetry, pictures or stories, for instance. Compositional stimuli can also take the form of musical fragments. Wilson (2001) provides teachers with musical suggestions designed to stimulate community creativity and some of these are presented below:

> •Provide a melody and ask students to write a counterline.
> •Provide a harmonic progression and ask students to write a melody using only four given pitches.
> •Provide an "A" theme and ask students to write a contrasting section…
> •Provide one repeated pattern and ask students to layer complementary material "on top" of it. (Wilson, 2001, p.29)

Wilson's stimuli might apply best to those students who exhibit some greater musical experience but the point stands that teachers can choose existing musical concepts and make them starting points for new music. Additionally, Hugill (2012) proposes experimentation with timbre and working within specific musical traditions.

Malcolm Ross (1978) argues that creative arts teachers should help students focus their expressive 'impulse' by presenting them with a suitable 'medium' through which that impulse can be expressed. By providing the medium (e.g a musical tradition or scale), the student or class are '…given a sense of direction, certainly during their first few [compositional] attempts, and probably later on as well' (Cain, 1985, p.11).

Perhaps one of the great joys of music teaching is that one can be musical: that is, exhibit musicality in every fibre of one's being. Thereon, the music teacher retains the privilege to create and present emergent, personalised/targeted musical stimuli live before their students' eyes (and ears). Sadly, this does not always happen:

> Too few teachers at present show themselves as composers by working with the pupils in a creative way. There is too much `do as I say and not as I do'. Where the teachers are perceived as working composers the pupils will follow. (Odam, 2000, p.118)

Philpott (2007a) suggests that if teachers become real live composers by 'jamming' with students or composing for their class, they emerge as a role model for their students to imitate. Teachers can model musical stimuli, which they have purposefully composed to meet the needs of specific students. That student can learn this music by imitating the teacher and once learnt, that musical content might provide a starting point for original creative ideas:

> Learning by imitation has an important place. The child observes, then imitates; success produces curiosity and pushes the child towards new musical experiments. The child's acquisition of musical language thus follows the same path as that of the spoken language. (Comeau, 1995, p.42)

It has become apparent that the modelling process represents a special sort of stimuli which encourages the student to imitate some musical behaviour actively demonstrated by their teacher. Active musical modelling works on the Vygotskian principle that ‘using imitation, children are capable of doing much more…under the guidance of adults’ (Vygotsky, 1978, p.88). Musical modelling and imitation also promote immersion. Barrett (1996) argues that immersing students in rich musical experiences, which expose sound-making materials, is an important prerequisite for learning to use and control the materials of music.

Once students find their creative idea and discourse transpires, the role of teacher-as-musician also develops. Cain (1985) explains that music teachers review their students’ compositions to identify musical ideas which can be developed further; suggest appropriate forms or structures for emergent ideas to take and remind students to critically listen to their work.

Music teachers can use critical listening discussions to initiate a *cultural bridge* between personal and institutional space. Such activity can empower student voice and connect classroom music to students’ lives:

> It is important to consider how students can be supported in bringing their unique perspectives to a shared listening experience…Students can consider how their own experiences align or don’t align with the experiences described by the original lyricist. (Beach and Bolden, 2018, p.45)

Beach and Bolden’s (2018) research makes use of song lyrics, musical structure together with timbre, harmony and melody to frame a dialogic discussion about the situated, cultural meaning of musical elements. Critical listening activities consequently represent an interesting set of strategies to culturally situate a teacher-as-musician role.

Teacher-as-musician has been found to provide physical, conceptual and musical stimuli designed to establish a medium for creative action (Ross, 1978). Teachers can also apply their unique musical talents to actively model musical behaviour for their students to imitate. Subsequently, they engage students in musical and culturally situated critical listening dialogues to ensure meaningful creative ideas develop. 4.1.2 will now propose that the teacher must also be an adept technician: one willing to become technological guide and to understand how digital musical resources impact their role.

4.1.2 Teacher-as-technologist

A music teacher must surely be expected to develop an acute awareness of how particular digital technologies might influence their community of classroom composers. After all, research recommendations from Wise et al. (2011) implore music teachers to select music software which best aligns with their student community’s preferred learning experience.

Once students are partnered with an appropriate digital technology, Kennewell explains that a teacher’s role is ‘…to orchestrate the supporting features – the visual cues, the prompts, the questions, the explanations, the demonstrations, the collaborations, the tools, the information sources available, and so forth…' (2001, p.106). An action research study, which used the audio software 'Mixcraft' to expose the teaching tasks relevant to the use of technology in music lessons, substantiates Kennewells's (2001) account of a teacher's technological role (Minott, 2015). Over six weeks, 41 year-nine girls from an independent high school in West London completed a questionnaire about their Mixcraft experiences (Minott, 2015). While students identified the necessity for their music teacher to exhibit a range of musical behaviours, they also valued their ability as a technical trouble-shooter:

> 'He [teacher] also helped us when our headphones didn't work' (Student, 9C17).
> (Minott, 2015, p.269)

Minott (2015) follows up this student's point by recounting further trouble-shooting cases from his observations. He explains that the teacher routinely connected cords to computer sound portals and junction boxes. The teacher also gave instructions on rebooting frozen screens (Minott, 2015). The music teacher was also required to show students how to use the software including how to edit and insert loops:

> He [teacher] showed us how to insert and edit sounds in Mixcraft (Student, 9T17).
> He [teacher] showed us how to actually use Mixcraft (Student, 9C9).
> Mr. Martin explained well how to use Mixcraft and told us about different varieties and musical techniques in order to help us use the programme efficiently (Student, 9T13).
> (Minott, 2015, p.267-269)

Some of this technological behaviour took place when the music teacher demonstrated the software on a projected screen in front of the class (Minott, 2015).

Alongside purely technological knowledge, music teachers might also construct knowledge about how technology and pedagogy 'intertwine' during creative musical activity. Jennings (2007) researched how students aged 11-12 years composed music with graphical digital technologies, despite their lack of prior musical training. Each student spent 5-8 hours working within two interfaces (Hyperscore and DrumSteps) which graphically represented their musical ideas. The screen graphics made music tangible for manipulation and editing (Jennings, 2007). Jennings discovered that while both interfaces supported a range of musical actions, they equally supported '…a range of actions that were not primarily musical in nature' (Jennings, 2007, p.92). In Hyperscore, the less musical actions were kinaesthetically motivated 'drawing', whereas DrumSteps placed emphasis on learning software procedure (Jennings, 2007). Critically, Jennings found that students' responses to the interfaces ranged:

> …from the clearly musically motivated to interactions with more 'superficial' aspects of the interface. In fact, most students were seen to move fluidly and comfortably along this continuum' (2007, p.92-93)

This finding, especially its expression of a continuum, describes well students' emergent musical – technological spectrums (see 4.1).

Continuing with the technological-pedagogical implications of digital music technology, Hein (2017) advises that digital music software's potential for 'tinkering' has pedagogical implications.

Namely, that the best way to 'teach' creative music-making is via opened-ended experimentation:

> As teachers in the digital studio, our main job is to facilitate tinkering. This does not just entail opening up options to our students; we also need to help them select from the digital studio's vast musical possibilities. (Hein, 2017, p.591)

Tinkering requires music teachers to be '…willing to do things in ways that are different from ways they may have used before, even if they are unsure of how successful the outcome will be' (Dorfman, 2013, p.73). Part of this approach is an acceptance that a teacher might not, in fact, possess the technological knowledge necessary to overcome any problem:

> Teachers cannot know everything…questions and problems will always arise to which we do not know the answers. Sources of answers may include professional organizations, online help, or even your students. (Dorfman, 2013, p.73)

Tinkering suggests a move away from music teacher-as-instructor to someone who works dialogically with students because they recognise (in an emancipatory/student-centred fashion) their musical interests and existing technological skills set. As part 4.2 will now indicate, such student-centred behaviour is not mandatory and any music teacher must carefully consider what sort of identity they aspire to portray during creative music-making.

4.2 Music teacher as pedagogical chameleon

A music teacher's personal pedagogy can emerge from their innermost beliefs and peculiar skills and Dolloff (1999) discovers that this is something seldom explored during teacher training courses. Personal pedagogy communicates something of a teacher's identity. Identity is defined here as '…a socially constructed view of self' (Dolloff, 1999, p.192). Russell observes that music teachers typically fashion a volatile identity, one which manifests itself in a wide range of classroom roles:

> In-service secondary music educators seem to develop a varied and occupational identity that can encapsulate the myriad of roles they assume almost every day. (Russell, 2012, p.162)

Hargreaves and Marshall (2003) explain that a music teacher's identity might draw upon composer, performer, music teacher, critic and musician roles and/or forward specific instrumental or genre-based specialisms in their classroom. Dolloff consequently believes that very different teacher identities can emerge because music teachers '…all come with vastly different perspectives on the role of the teacher' likely built up from their own years of study in school, studio and/or university (1999, p.192). Burnard (2012b) explains that any resultant identity contributes to a distinctive classroom 'taste culture', which is intentionally and not accidentally formed or experienced. Critically, Burnard (2012b) suggests that taste cultures have pedagogical, as well as musical (content) implications. Taste cultures are found to influence how teachers model musical creativities and what value they place upon the 'things' to be learnt (Burnard, 2012b). For instance, a music teacher who is encultured in the practices of the Western Classical tradition might 'teach' composition in ways which '…tend to encourage children to learn abstracted, decontextualized small units of rhythm and pitch in the belief that these can be combined into lengthier sections of music' (Rowe et al., 2015, p.114) Whereas, Savage and Fautley (2011) note that a different music teacher, one who adopts a more empathetic stance towards their students (for whatever reason), might approach the same challenge in a pedagogically different way. That teacher might expect their students to use a personal stimulus for their composition, for example (Savage and Fautley, 2011). That is, students could be invited to compose music around an issue or challenge in their lives, one which requires them to reflect on their beliefs, thoughts, peers, fashions, tastes, lives and environments (Savage and Fautley, 2011).

The aforementioned, contrasting pedagogical approaches, both designed to support creative musical activity, describe well a symbiotic pedagogical tension around the question of agency: a polemic which every music teacher might consider carefully. This polemic is epitomised by the following question:

> Should music teachers continue to preserve and transmit traditional music knowledge or exercise leadership in developing technology skills through authentic, “real world” tasks? (Peters, 2017, p.434)

To answer this question, Greher (2017) proposes that the binary mindset which polarises teacher-centred and ‘progressive’ child-centred approaches should be dispensed with. In its place, an interplay between both approaches would accept that there ‘…needs to be room in the curriculum to encompass the variety of ways in which students can be musical’ (Greher, 2017, p.549). To realise this intention, music teachers would do well to create conceptual learning spaces which incorporate ‘…multiple methods for instruction, multiple modals of materials, and opportunities for learners to play an active role in decision making…’ (Dickey, 2006, p,249). The forwarding of student decision-making also promises to better reflect young people’s contemporary music-making practices:

> The understanding of the contexts and ecologies of young people’s music making is central to adapting instruction for them. Therefore, sociocultural issues are directly connected to curricular issues. (Peters, 2017, p.436)

Simultaneously, Medvinsky (2017) argues that traditional musicianship and perhaps the ‘instruction’ to which Peters (2017) and Dickey (2006) refer, cannot be lost as a consequence. Pedagogy for digitally-mediated creative musical activity need not therefore adhere to one (e.g. deterministic/instructional *or* humanistic/progressive) perspective. It might be neither wholly instructional nor wholly student-centred but it *would* respond to student need. Parts 4.1 and 4.2 have indicated that some students do in fact require their teacher to instructionally impose musical and technological structure. Teachers might also collaborate as a composing musician and flex their musical and technological dexterity to facilitate students’ creative musical intentions. This approach infers a ‘pedagogical mashup’, an apt phrase coined by Marshall (2001) and here it is applied to suggest that the music teacher is a pedagogical chameleon, ready to instruct *and* facilitate student intention *and* musical technological collaboration in order to achieve a goal forged during creative musical activity.

A framework which describes a ‘mashup’ view of a music teacher’s pedagogical knowledge is Kirkman’s (2016) conceptual spaces of learning. The framework, which is based around four conceptual learning spaces and their associated pedagogical approaches is visually represented as Figure 4-3:

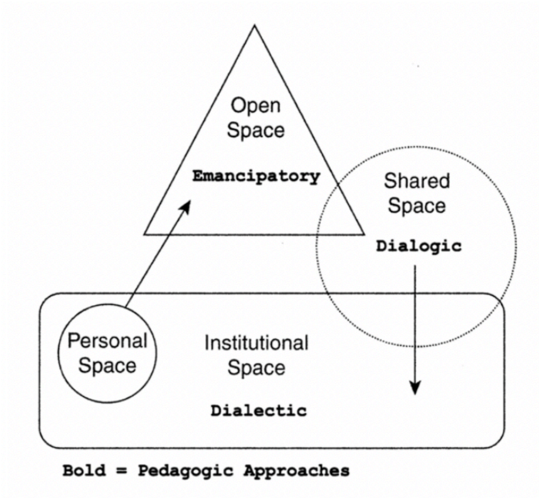


Figure 4-3 The four conceptual spaces of learning and the types of pedagogical knowledge which define them. (Kirkman, P., 2016)

At Figure 4-3, Kirkman (2016) is proposing that interactions *between* student, teacher, peer and technology are organised into four spaces of learning, all of which are conceptually situated in the music classroom. They are listed as *Institutional Space*, *Personal Space*, *Open Space* and *Shared Space* (Kirkman, 2016). Kirkman proposes that within '…each space a different kind of development is made possible as the context is more or less open, dynamic, supported through scaffolding or collaborative through dialogue' (Kirkman, 2016, p.165).

The arrows at Figure 4-3 indicate that as digitally-mediated creative activity traverses time, there could be directional movement through the conceptual spaces of learning. Like Burnard and Younker (2004) and Wallas (1926) (see chapter two), Kirkman (2016) suggests that creative processes can emerge sequentially. In institutional space, students first encounter the teacher's scaffolding/structures (e.g. compositional stimuli) as provided by the digital technologies and other (human/material/conceptual) resources. Learning in this space is Dialectic because the teacher occupies a role as 'knowledgeable other' and the student is questioned in order to develop understanding (Kirkman, 2016). A dialectic pedagogy is perhaps better understood as a monophonic approach because:

> Monophonic interaction…is characterized by command and control, when the partner is taken to be an inanimate rather than an interactive being. The commander's message takes precedence… (Kathard et al., 2015, p.223)

Looking through an idealist but progressive lens, as informed by philosophers Dewy (1933; 1938) and Mead (1934), it is easy to see why philosopher Freire (2003) rejects dialectic teaching. He describes it as a 'banking model of education', one which defines knowledge as a transferrable commodity. Freire (2003) argues that dialectic teaching is bound up with the belief that 'teacher knows best' and the students know nothing; the teacher thinks and the students are thought about; the teacher talks and the students listen and the teacher chooses and enforces that choice. His argument, designed to abolish dialectics in favour of emancipatory approaches, is challenged by Hirsch (1999). Hirsch (1999) argues that Dewey's (1933) belief that untutored human growth and development is intrinsically 'good', is naïve. Accordingly, Hirsch (1999) continues to attribute value to a teacher's verbal monologue. He proposes that:

> Verbal understanding is not "merely" verbal. Words are the indispensable human tools for understanding realities. (Hirsch, 1999, p.110)

The 'romantic' attack by Dewey (1933) and others on all things verbal, Hirsch (1999) argues, has had 'fateful consequences' for education. He robustly argues that:

> Gaining a broad knowledge of words, and therefore also a knowledge of the things to which words refer, must be among the most practical and significant educational goals in our time. (Hirsch, 1999, p.111)

Amongst a sea of popular Chicago-school idealism [see Dewey (1933) and Mead (1934)], Hirsch (1999) helps us to reconnect with institutional space but his ideas should be applied pragmatically. For instance, dialectic teaching would surely be more successful if the learning activity happened to align with the student's personally-held constructed reality. That is, a student's individual consciousness: their Personal Space (see Figure 4-3) (Kirkman, 2016).

Now traversing to 'Open Space' (see Figure 4-3), student composers begin to examine the potential of the classroom tools according to their personal range of cognitively-held resources, which have been assimilated both inside and outside the classroom (Kirkman, 2016). Open Space then, is a context wherein '…learners take ownership of their own learning and their development becomes more exciting, personal, dynamic, and maximizes their potential' (Kirkman, 2016, p.166). Open space describes an 'emancipatory', that is student-centred approach to digitally-mediated learning, because:

> …it relies on them [students] building their own 'computer-mediated environment': that is, a physical and conceptual set of digital technology tools that allows them to build on their previous knowledge and experiences in such a way that they can directly interact with and shape new ideas for themselves. (Kirkman, 2016, p.166-167)

This anecdotal and digitally-situated description of an emancipatory approach requires theoretical unpacking. Beginning with a contemporary account, emancipatory pedagogy:

> …entails methods of teaching and learning that encourage the students to become aware of their individual reality by investigating their daily life. The results of their investigation will expectedly stimulate their questioning of "reality" and propose changes to the status quo. (Winarti, 2018, p.115)

Nouri and Sajjadi (2014) adopt a similar viewpoint because like Winarti (2018), they inextricably link emancipatory education to social transformation. They explain that '…students possess the maximum power and they are allowed to interfere in social affairs' (Nouri and Sajjadi, 2014, p.82). Critical educator Freire (1970) enlarges on this perspective. He forwards the necessity for students (and teachers) to become aware of their context and humanistic condition (Freire, 1970). This philosophical belief manifests itself in students developing their own critical and conscious understanding. Freire (1970) describes this process as conscientization. He defines it as learning '…to perceive *social, political,* and *economic contradictions* and to take action *against the oppressive elements of reality*' (1970, p.17).

In addition to students' individual perceptions students also '…share and collaborate through transformed ways of working with their teacher and peers in dialogue' (Kirkman, 2016, p.167). These dialogic, 'transformed ways of working' place value on talk. Mercer et. al explain that even though talk between learners has been 'shunned' by institutions in the past:

> Talk is now recognized as more than a means for sharing thoughts: it is a *social mode of thinking*, a tool for the joint construction of knowledge by teachers and learners. (1999, p.95)

Talk, when described as a 'social mode of thinking', suggests that dialogic space promises '…more of a dynamic continuous emergence of meaning than a static 'space'' (Wegerif, 2011, p.180). The dynamic emergence of meaning, Wegerif argues, is a consequence of '…the tension between different [human] perspectives held together in proximity around a dialogic gap' (2011, p.182). These 'tensions' are brought about because '…we have different bodies and histories' (Wegerif, 2011, p.182). Tensions serve to define dialogic discourse as '…the direction of becoming more able to dwell in the contradictory, multiple, and creative space of dialogue' (Wegerif, 2011, p.144).

When tablet technologies are used in dialogic space, it is perhaps less clear how their use changes the nature of classroom talk and dialogic teaching. Engin and Donanci (2015) undertook a study to examine the impact of iPad use on dialogic teaching at a United Arab Emirates university. Surprisingly, their most significant finding was that '…the impact of using iPads on dialogic teaching rests primarily on the extent of the teacher and students' dialogic stance' (Engin and Donanci, 2015, p.278). It was the teachers' attitude and students' cultural histories, experiences and expectations which became definitive for tablet-mediated action:

> Opportunities for dialogic teaching ultimately depend on the teacher's use of the iPad according to his/her attitude to dialogic teaching. Similarly, students' expectations and previous learning experience impact on the extent to which there is take-up of opportunities for dialogic teaching. It is not the iPad per se which impacts on the opportunities for dialogic teaching, but rather the teacher and the students' response to the iPad. (Engin and Donanci, 2015, p.278)

In consequence to these findings, Engin and Donanci (2015) conclude that more awareness of how to teach in dialogic space is required. This plea will be addressed at part 4.2.3, where a music-teacher-as-dialogical-partner role will be introduced.

Kirkman's pedagogical approaches as concepted by his three spaces of learning have been enlarged here in an attempt to cumulatively describe a music teacher's pedagogical knowledge. This PK encourages music teachers to debate with themselves how and when they behave in monologic (dialogic) ways or conversely, design emancipatory student activities which ultimately lead to dialogically-forged outcomes, for example.

This chapter has suggested that music teachers might discard binary mindsets of traditional *or* progressive approaches to pedagogical knowledge, replacing them with a framework which aims to observe the relationships *between* these once opposed theories of knowledge.

This chapter will now continue by exploring how classroom music teachers, namely ones who work creatively with digital technology should develop their classroom identity as dialectical instructor, emancipatory enabler and dialogical partner.

4.2.1 Dialectical instructor

Music teachers are imposers of constraints. That is, they introduce creative domains to their students because they are an unavoidable consequence of creative musical behaviour. Bennett (2015) agrees, arguing that successful creative individuals only become successful once they have acquired the requisite skills through long-term immersion in a domain. Seemingly therefore a '…person cannot be creative in a domain to which he or she is not exposed' (Csikszentmihalyi, 1997, p.29). In the music classroom, the teacher introduces a domain to students both *through* their chosen digital technology and how they behave *around* it. In terms of the former, part 3.3 discussed how music teachers can use digital resources to constrain student creative behaviours in ways legitimised by a domain (i.e. an institutionally approved set of musical practices).

Classroom music teachers equally influence creative activity *around* digital music technologies by devising '…a relatively high-level system of constraints, encapsulating a defined space for potential expression…' (Magnusson, 2010, p.62). In institutional space, a music teacher might behave dialectically, that is as an instructor, '…chiefly concerned with passing on his own knowledge, skills and ideas about music' (Cain, 1985, p.6). Teachers developing a dialectic role would be 'the knowledge other' and therefore required to set a creative challenge *for* students (Kirkman, 2016). That is, '…plan suitable challenges in relation to a pupil's developmental stage…challenges which stimulate the pupils and set them a problem they have a realistic chance of solving' (Philpott, 2007a, p,124). The teacher then imposes structures to help students meet this challenge, these can be musical or technological and assume any mode (e.g. linguistic, visual, audio, gesture). A worksheet is an example of a common structure. Van Loon et al. argue that structures are the means for '…providing help, support, appropriate strategies, and guidance for students to carry out a task successfully' (van Loon et al., 2012, p.1018). By internalising these structures, group creative discourse develops a '…shared system of creative conventions…a kind of codified practice' (Burnard and Haddon, 2015, p.15). The teacher's ability to model musical ideas and determine the range of compositional stimuli available to students typifies the teacher's dialectical role in institutional space. Pea (2004) believes that by reducing the degrees of freedom for a task in this way, the student's attention is recruited and focussed, thus increasing the likelihood of effective action toward task achievement.

As Hirsch (1999) has argued, it is perhaps a mistake to see institutional, dialectic teacher behaviour as 'outdated' and out of touch with student taste cultures. Bennett (2015) worked with music teachers, songwriters and songwriting students for over ten years to propose a range of strategies for inducing creativities in popular songwriting. One strategy encourages teachers to design Constraint-Based Tasks (CBTs) where students are asked to write a song according to a given constraint. Critically, Bennett explains that while the tasks are chosen by the teacher, these '…can be varied according to the particular background and aspirations of each student…' (2015, p.51). This point is picked up by Lapidaki who acknowledges the positive role of institutional (structures) and their relationship with 'personal space':

> Most composers need to build on musical material of the past, in order to produce a new and personal style. Thereby the past is seen as being comprised by a static system of rules and techniques that needs to be innovated and emancipated during the composers' search for their own musical identity. (Lapidaki, 2007, p.103)

Consequently, Philpott (2007b) argues that music teachers have a duty to forward the materials of the past and not leave pupils entirely to their own devices.

As an official representative of organisational and governmental institutional agendas, the music teacher must also make judgments about students' work. There in, music teachers are charged to assess students' creative products. Assessment '…is a means of judging what pupils know, understand and can do' (Adams et al., 1995, p.62) This knowledge, skills and understanding is typically measured in relation to attainment targets. 'Attainment targets defined in the National Curriculum identify the skills, knowledge and understanding expected of pupils in each subject' (Stephens, 1996, p.4). Attainment targets provide summative accounts of students' work. Summative assessment and musical creativity are, at best, a tentative marriage because 'Who is right: the individual who believes in his or her own creativity, or the social milieu that denies it?' (Csikszentmihalyi, 1997, p.25). To avoid this dilemma, music teachers might choose to feedback to students in more 'formative' ways, that is, '…identifying what may next be done to build on present achievement…as part of the teaching/learning process' (Pratt, 1995, p.9). In essence, the music teacher has '…learning conversations with pupils, talking with them about their work and making decisions, often in the moment, about what it is that could be done to…take it on to the next stage' (Fautley, 2013, p.31). This is formative assessment, a process based upon conversation and not testing. The application of formative assessment signals a transition into 'open space' and even 'shared space'. This is because, as Fautley (2013) explains, student composers are awarded agency to discuss, reflect and make judgements about their work in response to their teacher's perspective. 4.2.2 will now explore those other behaviours a music teacher might exhibit in open space in order to facilitate emancipatory creative practice.

4.2.2 Emancipatory enabler

The conceptual spaces of learning (Figure 4-3) accommodates the view that students '…relate to their world both objectively, in clinical and absolute terms [institutional space] and subjectively, through the indefinable but no less important mental processes of the emotions' [e.g. personal/open space] (Paynter, 1989, p.237). In terms of the latter, a new challenge is faced by the music teacher: how should students' particular mental processes and associated culturally-mediated musical identities be accommodated during creative musical activity? The solution proposed here is for the music teacher to transition from instructor to emancipatory enabler: this latter role will now be reviewed.

Part 4.2 established that in ‘Open Space’, students take ownership of their learning and therefore, they can be perceived ‘…as social actors in their own right [and] are active participants in the construction and determination of their experiences…’ (O’Kane, 2000, p,136). For this type of action to emerge, music teachers must ‘…allow students the freedom to express their creativity in contexts that are relevant to them and support this with knowledge, skills and resources appropriate to what the students are doing’ (Wise et al., 2011, p.121). Placing value on such competencies in ‘Open Space’ would help students like sixteen year old Adrian. Adrian enjoys agency in sub-cultures of like-minded peers who consume and produce techno, hiphop, rap and hard rock music, out-of-school. Burnard draws our attention to Adrian’s difficult relationship with school music:

> Adrian is one of several underachieving disruptive learners at school…He is not into school music…[and yet] Adrian is heavily into music. He purchases, listens to and supports, playing in several different social and cultural units out-of-school. His bedroom plugs into multiple media sources which emulate a recording studio...Adrian is not simply a consumer, he is an impassioned producer… (Burnard, 2006, p.353)

To better integrate musicians like Adrian into formal settings, Lucy Green (2008) argues that music teachers should resist introducing those compositional stimuli and musical styles which their students would never likely encounter outside school. A music teacher participating in the Wise et al. (2011) study (introduced at 4.1.2) frankly agrees:

> I think for the kids in this school, if you were to say, ‘Right, this is a crotchet and this is a quaver, and this is what you will do,’ they would go, ‘F@#$ off!’ It is as simple as that. But with this [GarageBand], it is, like, ‘Hey, woo, you have got a good little idea there, let’s find a beat, let’s find this, let’s find that,’. (Wise et al., 2011, p.126)

Initiating creative musical behaviour through students’ constructed realities is suggestive of an emancipatory pedagogical approach: that is, teacher-as-enabler. Cain (1985) explains that ‘enablers’ adopt a very different position. The teacher is happy to abandon their own skills in order to avoid imposing on students, so as not to inhibit their natural musical development (Cain, 1985). It subsequently becomes a music teacher’s role ‘…to determine what a student composer’s intentions are, and then to suggest ways that he or she might better achieve them.’ (Wilson, 2001, p.28).

When it is students who outline their creative intentions, they assume the role of student-as-artist. Burnard (2012b) recounts music teacher John’s approach, which admirably describes this perspective:

> John: To me, working with [students as] artists is about several things. One important thing for me is to look at and try to model their different ways of working… (Burnard, 2012b, p.399)

Responding to students’ ways of working describes an open learning arrangement, one which respects students as people who harbour valuable artistic intentions. Research undertaken by Bolton (2008) introduced student Josh’s narrative which explained how he harnessed personal artistic intentions through digital classroom technology:

> You got to like the sound and then work with it . . . I did a lot of experimenting like I added a piece, didn’t like it, took it out, cut it a little bit, made it a little bit shorter, made it

> longer . . . I use my own voice like in the helium voice, use the special settings to make it sound better . . . You have to change your settings. I changed settings with the loop and I learnt to make a sound myself like a chord. (Bolton, 2008, p.48-49)

The seminal point is that 'open space' aligns with Craft's (2003) view that new musical ideas (like Josh's) are met with encouragement and support; uncertainty is tolerated; risk-taking encouraged; the student initiative is taken and interaction with others promoted.

Craft's (2003) final point, that student composers should interact with others, signals transit toward Kirkman's (2016) Shared Space of learning. This is where meaningful dialogues between multimodal human (e.g. teacher), conceptual (e.g. musical tradition) and physical (e.g. computer) resources further determine a student's creative musical behaviour. Part 4.2.3 will now forward the dialogical role of music teacher in this Shared Space.

4.2.3 Dialogical partner

In digitally-mediated shared space, student composers dialogically engage with other students, a computer and their music teacher, for example. Part 2.3.1 presented an account of how student collaborators can influence creative action and parts 3.2, 3.3 and 3.4 examined how computers also promise dialogical partnerships in social, that is, shared space. Perhaps the first step is to expand the application of distributed intelligence introduced at 3.2.1 and 3.2.2 by promoting Reusser's (1993) view that intelligence located inside both the student composer and computer but it is *also* distributed across the whole pedagogical setting:

> Intelligence should not be seen as a property of the mind alone but rather as a quality that is distributed among the components of learning systems and the social-cognitive environments in which they are embedded. (Reusser, 1993, p.146)

Shared Space then, describes the student's dialogic use of their social environment and its situated intelligences to transit towards a creative goal. The teacher and their student composers '…share their creative representations with others and engage in a process of dialogue, shared meaning making and socio-cultural and socio-political associations (Bolden and Nahachewsky, 2015, p.178).

In terms of the music teacher's effectiveness as dialogical partner, it is proposed that they actually participate, that is work, alongside students. In doing so, '…the teacher can manipulate the situation so that the pupil reveals his/her musical understanding and development' (Adams et al., 1995, p.73). Maintaining a verbal dialogue with students during collaborative music making is essential then for better understanding their personally constructed musical realities:

> Pupils also reveal much about their understanding and development when talking about music. The words they use and the way in which they use them can give an insight into what they see, hear, think, feel and know. Their talking may arise from purposeful teacher-led discussion or questioning or from incidental talk with another person. (Adams et al., 1995, p.73)

Engaging with student talk in shared space then ensures that the music teacher knows the student '…well enough to discern his immediate and prognose his long-term needs; well enough to recognize when, how and to what extent a cultural 'playground' might be evoked between them…' (Ross, 1978, p.28). A cultural playground is an important concept because it proposes a way for students and teachers to dialogically develop. When students and teacher 'jump in' and play together, they '…grow together through the ongoing exploration of new digital creativities…' (Kardos, 2017, p.490). As Mantie (2017) suggests, rather than fading away from encounter, music teachers should become key members of the musical pedagogical experience. Consequently, Mantie (2017) argues that both teacher and student musicianship are affirmed to each other to the extent that they are perceived as equal dialogic contributors.

This chapter has proposed that a music teacher influences digitally-mediated creative musical activity with their unique blend of content (musical) knowledge, technological knowledge and pedagogical knowledge. Consequently, *the music teacher is found to be a musician, technologist, instructor, enabler and collaborator*. This diverse TPACK role promises to be influential for how student composers initiate and develop their creative music ideas with a tablet computer.

Literature chapters two, three and four have now presented theoretical understandings for each of the classroom components thought seminal for tablet-mediated creative musical activity: the student composer(s); tablet computer and the music teacher. The next chapter will now situate these classroom dimensions into a systemic model of tablet-mediated creative musical Activity in order to constrain and make tangible the unit of analysis for this research project.

Chapter 5:
An Activity System framework for the analysis of tablet-mediated, creative musical activity in the classroom.

This chapter integrates the literature on creativity, digital technology and pedagogy presented in the preceding three chapters. Its aim is to conceptualise a case – a bounded system – from which a methodology can be developed and the research questions investigated. The proposed system will primarily respond to concepts of community conventions (from Lave and Wenger, 1991); creativity as a ‘multiple’ not individualistic process (from Burnard, 2012a); distributed intelligence (from Pea, 2001); mediated action (from Wertsch and Rupert, 1993) and Activity Theory (from Engeström and Miettinen, 1999). While these theories will prove influential some are applied in ways to meet the specific needs of this research. For instance, while the fundamentals of Activity Theory are adopted here (see 5.2 and 5.3 for an account of these) the ubiquitous Engeström mediational triangle model (Cole and Engeström, 2001) is replaced with a concentric framework which has no outcome *from* the Activity. This is because research questions here are interested in cases of creative musical development: any musical products are contextual rather than central to the analysis. More justifications for the development of a fresh concentric model are presented at 5.1.

The starting point for building a conceptual case is Lave and Wenger’s (1991) community of practice definition, as introduced at 2.4.1. Communities of practice, with their culturally, historically and institutionally defined physical, human and conceptual mediational artefacts configure young composers’ meanings (Lave and Wenger, 1991). Over time, these young composers become more entrenched in their community’s emergent conventions. This ‘domain’ of action (Csikszentmihalyi, 1997) describes transactions based on symbolic knowledge. That is, knowledge which carries meaning for one community and perhaps not another.

The concept of community constructed meaning aligns with Small’s (1988) definition of ‘musicking’. This definition argues that ‘music’ should be defined as an *act*; not an *object*. In short, music as action is ‘…seen as something that is done in relation to and with others – a reconceptualization from a previous individual perspective towards a relational one’ (Lagerlöf, 2015, p.304). If musicking is adopted, music becomes ‘…socially available…for interpersonal coordination and emotional convergence - a tool for shared action and feeling’ (Krueger, 2011, p.11). Specifically, Small’s (1988) set of relationships between people, sound and society define music as a fundamentally distributed phenomenon. Distribution is concerned with ‘…sharing authority, language, experiences, tasks, and a cultural heritage’ (Salomon, 2001b, p.112). Distributed intelligence, which ‘…emphasizes mainly the performances of joint systems of individuals and peers or cultural artifacts’ therefore becomes another seminal tenet (Salomon, 2001b, p.128-129). Distributed intelligence was first introduced at 3.2 and it was expanded across the whole pedagogical setting in Chapter Four. Distributed intelligence will now help to conceptually explain the personally, locally and culturally distributed nature of creative music

Activity. This explanation will be embodied in a new analytical framework helpful for describing a community of tablet composers (the unit of analysis). This new framework will combine theories of distributed intelligence and Activity Theory to conceptualise how musicking might emerge through and around a tablet computer in a situated classroom setting. It is this case which will become the prime analytical unit for fieldwork. It will also the determine research questions and influence those philosophical decisions necessary to develop an appropriate research strategy. It will also suggest a series of research methods designed to capture a community's emergent creative music-making.

5.1 Creative musicking as Activity System

The first tenet of case-as-activity-system is that knowledge '…is commonly socially constructed through collaborative efforts toward shared objectives or by dialogues and challenges brought about by differences in persons' perspectives' (Pea, 2001, p.48). A second tenet is that '…the environments in which humans live are thick with invented artifacts that are in constant use for structuring activity, for saving mental work, or for avoiding error, and they are adapted creatively almost without notice' (Pea, 2001, p.48). The system therefore aims to explain how both resources *and* people directly affect what individuals *do* in their local setting. In this instance, local setting is defined as the music classroom. This is a space which contains a range of influential forces:

> …little is accomplished by individuals working in isolation with only their minds to guide them; instead, individuals depend on a wide variety of tools, people, and other resources to help them carry out their activities. (Hatch and Gardner, 2001, p.168)

Local settings might therefore include a teacher, tablet computer and student partner as situated in a music classroom, for example. Hatch and Gardner (2001) also accept that locally-situated, problem-solving behaviours may not be applicable to or may not be produced in other settings. Thus, like Salomon (2001b), they define 'intelligence' as distributed *and* situated.

Hatch and Gardner's (2001) work on the 'forces affecting cognition' is important for bounding the case because their 'three concentric rings of force' conceptualize how community conventions emerge during action (this is adapted for Figure 5-1 presented below). 'Local Forces' (e.g. resources and people/the classroom) constitute the middle circle of force. An outer circle also describes how community institutions, practices and beliefs can affect an individual's local cognition (Hatch and Gardner, 2001). These are 'Cultural Forces' and they are found to have three principal effects on behaviour. 'They influence the kinds of skills people can exhibit, the way those skills are developed and the purposes to which they are directed' (Hatch and Gardner, 2001, p.167). These behaviours emerge because teacher and students '…bring to the classroom a history of experiences which relate to their previous cultures of learning and tool use' (Armstrong et al., 2005, p.458). Consequently, when new technologies are introduced, they are 'made sense of' or, as Cole and Englestrom (2001) suggest, 'culturally mediated' in terms of previously constructed technological experience:

> Cultural mediation implies a species-specific mode of developmental change in which the accomplishments of prior generations are cumulated in the present as the

> specifically human part of the environment; culture is, in this sense, history in the present. (Cole and Engeström, 2001, p.9)

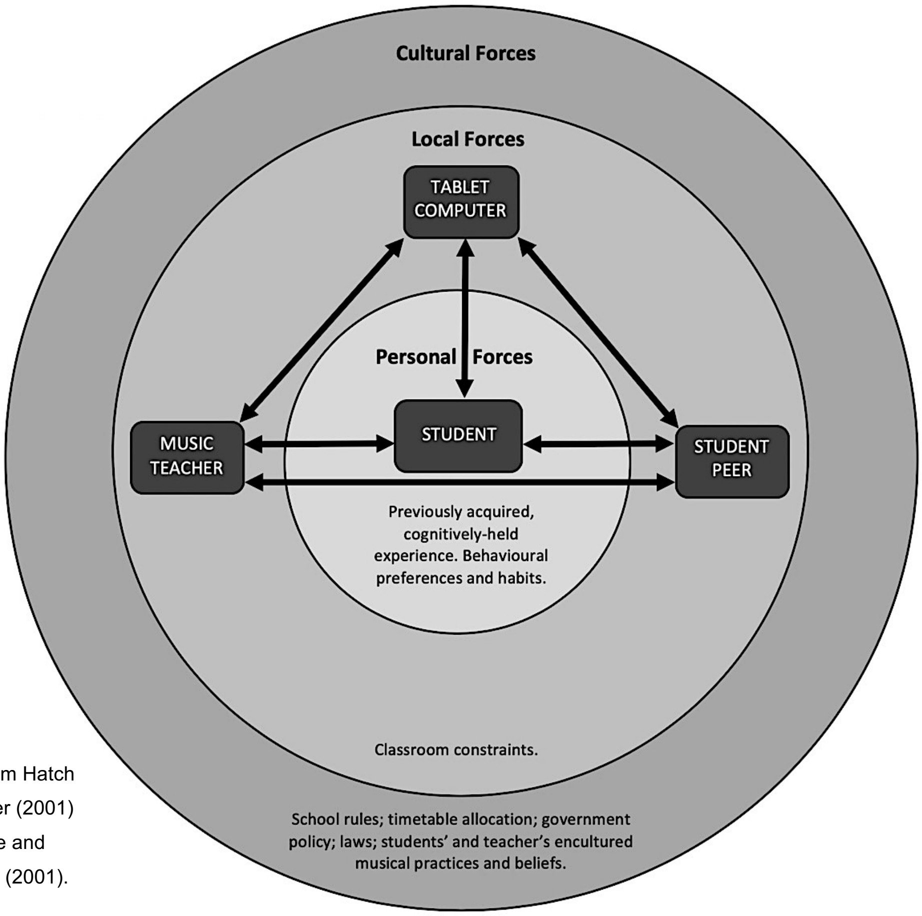
Cultural mediation explains how cultural forces can define what happens in any present moment. For example, cultural forces are thought to account for the situated nature of communities and any ‘divide’ between formal and informal music-making practices (as described in chapter one).

The innermost circle of concentric force describes ‘Personal Forces’. These refer to that culturally mediated bundle of personality traits, habits, interests and desires which students carry with them in the moment:

> The innermost circle of the concentric model represents the attributes and experiences that individual children bring with them to many of the "local settings" where they spend their time (Hatch and Gardner, 2001, p.169)

Personal Forces account for the ‘…wide variation in people’s abilities and the vast array of individual differences that influence the development of those abilities’ (Hatch and Gardner, 2001, p.169). Consequently, when ‘abilities’ develop, they do so according to a person’s (perhaps genetic) proclivities and historically encultured experiences (Hatch and Gardner, 2001). Personal Forces are found to relate to the uniquely assimilated nature of a student composer’s cognitively-held schemata. These forces influence how student composers exercise Kim and Baylor’s (2006) ‘personal agency’. That is, planning, selecting, motivating, regulating and evaluating their cognitive activities (Kim and Baylor, 2006).

Hatch and Gardner’s ‘expanded view of human intelligence’ has now been presented. Next, those dimensions of classroom-based creative musical Activity to which research questions relate (i.e. tablet computer, student, student peer and music teacher) will be super-imposed over Hatch and Gardner’s model and positioned into their appropriate ring of concentric force. A conceptual representation of tablet-mediated creative musical activity can then be visualized. In essence, this new framework represents the Activity System a secondary school classroom community might develop through and around a tablet computer



Adapted from Hatch and Gardner (2001) and Cole and Engeström (2001).

Figure 5-1 An Activity System Framework (ASF) which identifies those Local, Cultural and Personal Forces proposed influential for creative musical Activity through and around a tablet computer situated in a secondary music classroom.

The newly proposed ASF at Figure 5-1 builds upon a social cultural definition of creativity (see pages 17 and 32) and a definition of Activity which emphasizes its transformative nature (see pages 78-82) to propose that cultural forces (e.g. school rules and government curriculum requirements), local forces (e.g. a tablet computer and classroom music teacher) and personal forces (e.g. a student's own musical interests and ambitions) work upon (or mediate) creative development to ensure that a creative product emerges.

As a direct consequence of Figure 5-1, a theoretically defendable unit of analysis is set up which naturally suggests a number of research questions. Further, the next chapter will cite this framework to develop a complementary research strategy. This will include a case-based research design and an iterative, thematic data analysis strategy. *This is a pivotal moment for this project because this Activity System framework (ASF) not only visualises the literature presented hither-to but it also signposts how data will be collected, analysed and presented in this thesis.*

This chapter will now establish the ASF's value both as a systems-based analytical unit and its ability to serve the research questions. Beginning with the former, to view the framework as a singular yet interrelated group of analytical variables, is to view it as an Activity System. Cole and Engeström (2001) explain that Activity Systems are a natural unit of analysis for the study of human behaviour. They are defined as '…historically conditioned systems of relations among individuals and their proximal, culturally organized environments' (Cole and Engeström, 2001, p.9).

At first glance, the ASF at Figure 5-1 appears to showcase little of the mediating Activity triangle as published by Cole and Engeström (2001). However, systemic dimensions of their mediating triangle *are* represented in the ASF. The ASF includes a SUBJECT (student), MEDIATING ARTIFACTS (tablet computer, music teacher, student partner), an OBJECT (the goal of creating a piece of music), RULES (cultural forces which include government policy, curriculum requirements and school expectations) and a COMMUNITY (a situated secondary school acting upon its own conventions/ethos). There is also a DIVISION OF LABOR because, for example, I as music teacher design the task, the tablet computer provides the timbres and interface through which the music is made tangible for listening and editing, the student imposes their musical experience and desires to find a musical goal and the student partner provides additional musical and/or technology know-how. In essence, all of these personal, local and cultural forces must influence the Activity for effective creative musical development to emerge.

The concentric ASF at 5-1 is thought more intuitive for classroom music teachers to relate to because the personal, local and cultural force concept illustrates at a glance how creative musical development is a fundamentally distributed phenomenon. Teacher-centeredness is exchanged for an egalitarian approach which forwards situated musical interests and community conventions. Finally, unlike Cole and Engeström's (2001) mediating triangle, there is no outcome from the Activity. This is because research questions seek understanding about how creative ideas develop through and around a tablet computer (e.g. RQ5). Therein, musical products only have a contextual, rather than a primary analytical role in this research.

The word 'activity' has been casually applied in the preceding chapters, perhaps without a proper definition and explanation of the term's ramifications:

> Activity is a specific form of the societal existence of humans consisting of purposeful changing of natural and social reality…societal laws manifest themselves only through human activity that constructs new forms and features of reality, thus turning the initial material into products. Any activity carried out by a [human] subject includes goals, means, the process of molding the object, and the results. (Davydov, 1999, p.39)

Sharing Davydov's multidimensional view of Activity, Wertsch (1991) explains that when action is given analytic priority, researchers should not consider environmental or human aspects in isolation. Welch (2007) agrees, arguing that that to unearth 'reality' in music education settings, we must consider the biographies and neuropsychobiological dispositions of music teacher and student(s); pedagogical processes, the exhibited musical behaviours and the historical, social-cultural contexts for learning.

Theories of Activity also align well with the musicking concept (Small, 1988) because both concepts rely upon emergent, situated, interrelated dimensional relationships which emerge during *action*. These relationships define how intelligence is distributed and configured during Activity:

> Activity is enabled by intelligence…When I say that intelligence is distributed, I mean that the resources that shape and enable activity are distributed in configuration across people, environments, and situations. (Pea, 2001, p.50)

At Figure 5-1, the core Activity dimensions are shown in black boxes and their interrelatedness, or how intelligence might become distributed, is symbolised by the bi-directional arrows. Hanks (1991) comments that such classroom Activity is a participation framework, within which learning is distributed among its coparticipants rather than residing ‘inside’ any one person. This is because, in ‘…formal educational settings, teachers, peers and other educational and social actors, utilising a variety of human and material resources, mediate intervention’ (see personal and local forces) (Lagerlöf, 2015, p.141). These Activity dimensions have been specifically highlighted in the framework (see black boxes) in order to ensure research questions remain in focus. For instance, by thematically coding observation or interview data to the ‘tablet computer’ dimension, the following research question might be answered:

> *How, if at all, can tablet computers enhance or constrain musical creativity (RQ 1)*

In much the same way, if data is thematically coded to the ‘music teacher’ and ‘student peer’ dimensions, research questions which seek new understandings about how classroom music teachers and student partners influence tablet-mediated creative musical development might be better answered:

> *How, if at all, can classroom music teachers influence tablet-mediated creative musical activity? (RQ 2)*
>
> *How, if at all, can student partners influence tablet-mediated creative musical activity? (RQ 3)*

The framework (Figure 5-1) also forwards cultural and personal implications. Lagerlöf (2015) explains that human and physical resources are themselves culturally defined, that is, defined by their context and background (see cultural forces). This reinforces the mutual relationship which exists between music, individuals and their situation. To summerise such a perspective:

> …the teacher and students work within a local classroom culture, which is influenced by local, national and global factors…the teacher and students [also] bring to the classroom a history of experiences which relate to their previous cultures of learning and tool use. (Armstrong et al., 2005, p.458)

To understand the ‘history of experience’ students bring with them to the classroom, interview data might be coded to the ‘student’ dimension of the framework, in order to better answer the following research question:

> *To what extent, if at all, can students’ broader musical cultures, current musical interests and experience influence their tablet-mediated creative behaviour? (RQ 4)*

Returning to theories of Activity, Burnard and Dragovic (2015) explain that Activity Theory grew out of Vygotsky’s (1978) law of cultural development, which defines learning as a fundamentally social process. This starting point, essentially social constructivism (see 2.3.2), was then expanded, not only to acknowledge social participation but also, the mediational influence of community artifacts, rules and goals (Burnard and Dragovic, 2015). During creative Activity then, ‘the subject’ (depicted as the ‘student’ in Figure 5-1) is situated in a community (represented here by the 'Cultural Forces' in Figure 5-1). 'Community' and 'subject' form a partnership during which action is mediated through rules and artifacts:

> ...the relations between subject and community are mediated, on the one hand, by the group's full collection of "mediating artifacts" and, on the other hand, by "rules" (the norms and sanctions that specify and regulate the expected correct procedures and acceptable interactions among the participants). (Cole and Engeström, 2001, p.7)

For this research project, the community's mediating artifacts are a tablet computer, music teacher and student peer (see Figure 5-1). Examples of the 'rules' which specify and regulate interaction among the participants are included in the new framework as Cultural Forces (see Figure 5-1). Thus far, research questions have sought new understandings about single dimensions of the ASF. Such questions are important but they circumvent the true value of Activity Theory and the distributed nature of intelligence. For instance, when students and teacher create music with a tablet computer, the ASF conceptualises that all local, personal and cultural forces are 'in play' simultaneously (their influence perhaps varying overtime). Cumulatively then, they create a symbiotic tension which necessitates human action for it to be overcome. Only then can a creative musical idea become fixed or achieved (the system's goal). This account of how the ASF produces a music product will be theoretically substantiated at 5.2 and 5.3. Meanwhile, a research question is posed to investigate how the aforementioned symbiotic tensions between concentric forces and their associated dimensions come together during action to create musical ideas:

> *How, if at all, are creative musical ideas initiated and developed during tablet-mediated creative musical activity? (RQ 5)*

To better understand the implications of this, perhaps the most challenging research question, parts 5.2 and 5.3 will now explore the known characteristics of Activity Systems in some theoretical depth. These characteristics will ultimately describe the proposed tablet-mediated system (Figure 5-1) as simultaneously unique and general; both momentary and durable; in equilibrium and tension; goal-based in nature and potentially transformative over time (Cole and Engeström, 2001; Davydov, 1999; Engeström and Miettinen, 1999). This examination of system characteristics will directly justify the methodological decisions taken in the forthcoming chapter.

5.2 Goal-based, experiential creative action

Activities, Davydov (1999) reports, respond to means, processes, products and critically here, goals. Engeström and Miettinen (1999) argue that a goal catalyses internal tensions and contradictions within the system, which in turn propel change and development. Creative Activity then, '…has to be appropriated by individuals in order to be used…for concrete learning goals that depend on learning motives, objects, and conditions' (Giest and Lompscher, 2003, p.269). Unsurprisingly then, Davydov (1999) identifies Activity Systems as purposive and transformative in nature (explored further at 5.3). This view is shared by the following, albeit sociocentric, definition of an Activity System:

> An activity system is a group of people who share a common object and purpose over time and who share tools to act on and realise their purpose. (Jewitt, 2006, p.4)

When students and music teacher share 'common purpose', '…the activity of structuring music is, more often than not, a collective process, in which groups of people coordinate and regulate their actions to achieve common goals' (Windsor and de Bézenac, 2012, p.110). Tikhomirov identifies goal formation as '…one of the most central acts in the structure of creative activity' (1999, p.351). He defines 'goal' as '…the image of the future desirable results indirectly connected with the motive' (Tikhomirov, 1999, p.351).

Responding to Tikhomirov, it might be questioned who defines 'desirable results'. Specifically, who sets and/or approves goals within a classroom Activity System? Simon (1987) argues that without a target, how can a music teacher teach, or make checks on what has been learnt? This perspective reinforces a dialectic strategy which '…emphasizes goal orientation in the sense of presenting learning goals in a ready form, explaining them, if necessary, and expecting or demanding an appropriate learning behaviour…' (Lompscher, 1999, p.268).

Conversely, emancipatory pedagogy might argue that '…learning goals concern how the pupils would like to work musically and what resources they would like to use' (Burnard, 2007b, p.38).

The music teacher might also choose to jointly forge goals with his students, so '…there could be greater emphasis on joint planning as students themselves begin to employ pedagogical reasoning' (Webb, 2005, p.730).

It is now evident that the Activity System framework at Figure 5-1 potentialises creative goals to be emergent or imposed, in personal (emancipatory), dialectic and dialogic ways.

Once young composers set out upon a quest to achieve a musical goal, constraints or barriers to action might soon be discovered in the Activity System. Digital technology is a common barrier to goal-based action:

> In the enactment of their goals, then, people must contend with the material agency of the technology. That is, people must figure out how to manoeuvre around it. (Leonardi, 2011, p.148)

This is an example of what might happen when student composers begin to *experience* their digitally-mediated local setting. An '…experience is always what it is because of a transaction taking place between an individual and what, at the time, constitutes his environment' (Dewey, 1938, p.42). During experience, '…conceptions of *situations* and of *interaction* are inseparable from each other' (Dewey, 1938, p.43). The fact that goal-driven Activity Systems are fundamentally experiential is found essential for creative music-making:

> Immersion in an environment which is rich in musical experiences is perhaps one of the most important prerequisites for developing the understandings and skills necessary for learning to use and control the materials of music. (Barrett, 1996, p.65)

Immersion in musical experience aligns with Swanwick's (1994) belief that knowing *about* music can never be a substitute for knowing *how* to experience music. Experience then is when student composers are '…working with a sense of purpose and interest, demonstrating a level of understanding, competence and mastery, and taking delight in what they are doing because they see the activity as having some point and meaning' (Plummeridge, 1996, p.30). Any 'point and meaning' is surely an individual, collaborative or imposed goal, which the student intrinsically believes in.

Now that the goal-based, experiential nature of the proposed ASF has been described, part 5.3 will complete an account of this community framework by proposing it as a pluralistic and transient system.

5.3 Transiency and pluralism in creative Activity Systems

From an analytical perspective, systems of Activity promise not to privilege the individual person/subject – in this case the student composer. The '…activity system as a whole, rather than the individual, is the basic unit of analysis for understanding human learning and development…' (Hargreaves, 2008, p.322). Lave and Wenger's (1991) community of practice construct (introduced at 2.4.1) also proposes an analytical unit much broader than individual action. For instance, like the ASF (Figure 5-1), communities of practice recognise the importance of mediational means, those 'irrational' aspects of human action and the relationships/tensions between collective motives and individual goals (Lave and Wenger, 1991). Such an analysis rejects '…a sharp boundary between the cognitive and social…' (Giere and Moffatt, 2003, p.302). This symbiotic relationship between the personal (cognitive) and environmental manifests itself in a pluralistic view of reality. It concedes that '…individuals relate to their world both objectively, in clinical and absolute terms, and subjectively, through the indefinable but no less important mental processes of the emotions' (Paynter, 1989, p.237). Engeström and Miettinen cite Marx to explain that Activity systems transcend the subjective (idealism) and objective (materialism):

> [Marx]…shows that neither mechanical materialism nor idealism will do. Mechanical materialism eliminates human agency, and idealism put it in the head or soul of the individual. What both are missing is the concept of activity that overcomes and transcends the dualism between the individual subjective and objective societal circumstances. (Engeström and Miettinen, 1999, p.3)

Engeström and Miettinen (1999) find that when dualisms between 'thought and activity' and 'theory and practice' are transcended, commonality can be found between pragmatism and Activity. Pragmatism recognises '…the existence and importance of the natural or physical as well as the emergent social and psychological world' (Robson, 2011, p.28). This pluralistic description of action has implications for a theory of knowledge in Activity Systems and it will form the basis of a research strategy in the forthcoming chapter.

Knowledge in Activity Systems emerges in consequence of culturally-situated material(s) and mind(s) meeting during action. It has to be stated then that '…knowledge is not just some accumulation of facts…sitting there waiting to be called upon; rather, knowledge is sought after, accessed, and situationally and purposefully constructed *ad hoc*' (Salomon, 1998, p.5-6). Such a description of knowledge describes well the pluralistic complementarity between system and subject (i.e. student composer) during Activity.

Once humanistic dimensions are included in theories of knowledge construction, the temporal, transient nature of Activity systems can be understood. At 5.1 and 5.2, Jewitt (2006), Engeström and Miettinen (1999) and Davydov (1999) have made reference to the emergent nature of Activity. Additionally, transiency was highlighted during a discussion about students' compositional pathways in chapter two (Burnard and Younker, 2004). That discussion explored the many ways creative behaviour can change and/or develop over time. Lave and Wenger's (1991) communities of practice concept also describes how social conventions emerge according to community needs and goals, which are themselves situated in time and space. Activity Systems seemly share many of these perspectives. They pragmatically view '…current truth, meaning and knowledge as tentative and as changing over time' (Robson, 2011, p.28). Consequently, Activity Theory aligns with Lagerlöf's (2015) view of musical identity, namely that it is multifaceted, contextually dependent and constantly evolving.

Cole and Engeström (2001) suggest that when researchers follow an Activity system through time, overall transformation may be observed. To define Activity then, we can say that it is a phenomenon which '…undergoes functional development in the course of its realization' (Tikhomirov, 1999, p.350). It involves the fashioning of '…a product that didn't exist before…the functions of construction, generation, and creation of the new are the most important (Tikhomirov, 1999, p.349-350). To create a new, there must exist a '…dialectical relationship between continuity and change, reproduction and transformation….in local activity systems' (Engeström and Miettinen, 1999, p.9). This relationship describes an internalization and externalization process which operates continuously and simultaneously at every level of human Activity:

> Internalization is related to reproduction of culture; externalization as creation of new artifacts makes possible its transformation. These two processes are inseparably intertwined. (Engeström and Miettinen, 1999, p.10)

It is the interplay between internalization and externalization which ensures that meanings '…are constantly changing, and are produced and reproduced in each social situation with slightly different nuances and significances depending on the nature of the context as a whole' (Ezzy, 2002, p.3).

By looking across this whole system to understand how meanings and creative ideas develop therefore, it is now better understood how a range of personal, local and culturally situated human and material dimensions might interrelate over time to forge creative musical products.

This chapter has now described and visualised classroom-situated, tablet-mediated creative music-making as an Activity System framework (ASF). This system defines the unit of analysis for this research project as embodied by five research questions, all of which have been presented here.

The next chapter will align the Activity system framework and its research questions with a compatible range of epistemological and ontological philosophical traditions to propose a research strategy. It will then respond to the culturally-situated, temporal nature of the system to propose a research design, research methods and a data analysis strategy.

Chapter 6:
A qualitative methodology to describe two school communities and their tablet-mediated systems of CMD

This chapter introduces a methodology designed to theoretically align with the Activity System framework (ASF) as presented in the previous chapter. A research strategy, design and methods will therefore be presented which forward the emergent nature of meaning, social cultural theories of social development and the necessity for active experience. This methodology is also a singular, reflexive statement which presents my positionality as a researcher and music teacher. In the field, I am the music teacher who designs the fieldwork activities and I also make every teacher-led musical, technological and pedagogical intervention during that tablet-mediated musicking which emerges in the research settings (see the music teacher dimension at Figure 5-1). Simultaneously, I am also the researcher who is collecting, interpreting and discussing a range of multimodal data. In the field, my role as researcher is primarily manifested in a participant observer role (albeit enhanced by video data). As well as teacher then, I am also researcher-as-instrument. As Bryman (2008) remarks, I am the main instrument of data collection, so what is observed and heard is very much a product of my predilections. Therefore, this chapter will evidence in some detail how I interpret the social world. It will achieve this by making explicit those philosophical approaches which inform my interpretations of human behaviour (see the research strategy at 6.1). *These philosophies are essentially a series of biases which I carry with me into the field*. As a music teacher, I also advocate a student-centred approach to musical development, which is rooted in my own historical experience of music education. This has been evidenced in my research rationale, which forwards students' informal digitally-mediated music-making practices (chapter one), an alignment with a social cultural definition of creativity (chapter two) and the adoption of pedagogies which encourage me-as-teacher to work alongside students in an egalitarian fashion (see 4.1.1 and 4.2.3). Of course, these theoretically-informed beliefs influence the nature of my student interventions in research settings. To help readers understand *why* I have aligned with these arguments, is important to include a statement which provides more insight into my positionality as music teacher. This is presented below:

> Although I wanted to own a piano from a very young age, I held absolutely no desire to take lessons. It was my Mother who finally insisted upon lessons: I was five years old. I promised little natural talent for 'classical' music and an informal, private approach to music-making would come to define my relationship with music in later years. Begrudgingly, music became a primary strength at school. A hefty music scholarship enabled me to attend an independent secondary school. Much to the Director of Music's disappointment, I spent countless hours honing the art of improvisation and boogie-woogie, as opposed to practising Mozart. While I did 'press on' with a classical musical education, musical passions lay elsewhere. While at university reading music, I became friends with a neighbour who was a singer/songwriter. With his encouragement, I began to write songs for piano/voice and reconnect with my identity as a musician with something to say. I was soon accepted to train as a secondary music teacher. The course was rated number one in the UK. The course leader, a prolific and well-published music education lecturer, passed on his inspiring narrative; namely his utopian, liberal vision for a student-centred, active music education. Given the ancient nature of the institution, I was very surprised and yet very inspired by his progressive approach. His training sessions were practical, egalitarian and promised only limited reference to abstract theoretical concepts. Such an approach underlines my own ambition to help all students (through the application of computers or otherwise) to develop their own musical interests in formal settings whatever their musical starting point.

My position as a researcher (see 6.1 and 6.2) and the liberal approach that I take into music education settings has now been made explicit (see above statement). This will help readers to better situate the findings from this research project and if necessary, transfer them to their own comparable setting (see 6.4.4). For more information on my role as participant-observer and my reflexive approach, please see 6.3.1.1 and 6.4.1.1 respectively.

Now that my teacher-researcher positionality has been forwarded, a methodology can be presented. This is a methodology designed to capture, analyse and present new understandings to credibly answer the research questions. For clarity and easy reference, they are re-presented here:

> *RQ1: How, if at all, can tablet computers enhance or constrain musical creativity?*
>
> *RQ 2: How, if at all, do classroom music teachers influence tablet-mediated creative musical activity?*
>
> *RQ 3: How, if at all, can student partners influence tablet-mediated creative musical activity?*
>
> *RQ4: To what extent, if at all, can students' broader musical cultures, current musical interests and experience influence their tablet-mediated creative behaviour?*
>
> *RQ5: How, if at all, are creative musical ideas initiated and developed during tablet-mediated creative musical activity?*

The methodology presented here will describe the paradigms and design chosen to develop the *process* of this inquiry, a process intent upon answering the research questions presented above. Only then might this project be defined as *research*, that is, '…the notion of inquiring into, or investigating something in a systematic manner' (Merriam, 2009, p.3).

Part 6.1 presents a research strategy which responds to constructivism – an ontological foundation for Activity Theory. It also responds to the pragmatic, symbiotic nature of interaction between physical, human and cultural tools in Activity Systems.

A research design is introduced from part 6.2. It responds to the situated and temporal nature of Activity Systems because it repurposes the ASF – the unit of analysis – as a case. Case here therefore will be defined as a bounded system; one inherently transient and situated. Case will also be applied in the macro, multiple sense. Part 6.2.4 adopts a multiple case study design to select, sample and report on two school communities and their tablet composing practices.

To capture those situated meanings which emerge in the ASF, a video-enhanced, participant observation method is introduced from part 6.3.1. While this method is valuable for answering certain research questions (e.g. RQ 1/2/3/5), it does not satisfactorily provide data to explain *why* participant behaviours occur in the system (RQ 4). Part 6.3.2 describes the semi-structured, group interviewing method developed to collect data of this nature.

Part 6.4 introduces a data analysis strategy which details the five sequential cycles of analysis which were necessary to credibly explain 'how' and 'why' action emerged in a community's tablet-mediated systems. To better answer RQ5, a new visual mode for presenting Activity system data was developed and this is introduced at 6.4.4.

Part 6.5 reports those methodological decisions taken to support the credibility of findings. Namely, the deployment of two research methods for triangulation, prolonged and persistent engagement and community member checking. Part 6.5.2 adds the necessity for case reports to include thick description. Thickly describing communities is proposed to improve the extent to which readers can transfer findings to their own comparable settings for further testing.

Researching school communities raised a series of ethical challenges. Part 6.6 introduces those procedures instigated to minimize risk for participants and researcher.

Part 6.1 will now introduce a research strategy which will fundamentally influence every subsequent aspect of this methodological design.

6.1 A research strategy which interprets meaning as situated and emergent.

It is clear from the literature (chapters one to four) and the ASF (chapter five) that this researcher has tacitly aligned himself with a set of theoretical beliefs about the social world. These beliefs are all pervading. They have influenced the topic, research questions, chosen literature, theoretical frameworks and they will also guide the methodological decisions taken here. Such tacit beliefs have also influenced how data is coded and presented in case reports. Therefore, in the interests of reflexibility (see 6.4.1.1 for a definition), these theoretical assumptions will now be made explicit in the form of a research strategy.

A research strategy sets out '…a logic of enquiry, a series of steps for establishing knowledge about the social world' (Blaikie, 2010, p.6). This researcher-as-instrument must inform readers of his own personal, political and theoretical knowledge of the social world by aligning with a series of compatible intellectual traditions, that is a paradigm (Ezzy, 2002). A paradigm '…is a loose collection of logically related assumptions, concepts, or propositions that orient thinking and research' (Bogdan and Bikeln, 2010, p.32). Part 6.1.1 will introduce interpretivism as the guiding epistemological paradigm for this research project. At 6.1.1.1, the sociological theory symbolic interactionism further elucidates this perspective but ultimately, theories of Activity determine an alignment with pragmatism (see 6.1.1.2).

While the aforementioned epistemological approaches can define the 'relationship of the knower to the known', what of ontology: 'the nature of reality'? (Lincoln and Guba, 1985, p.37). The inherent theme presented in the literature on creativity, digital technology, pedagogy and Activity Theory is constructivism. This is no coincidence. Constructivism describes this researcher's belief that there exists multiple realities because '…social phenomena and their meanings are continually being accomplished by social actors' (Bryman, 2008, p.19). This ontological perspective is consistent with interpretivism and it is expanded at 6.1.2.

It might be expected that interpretivism and constructivism would prescribe a purely inductive approach. This is one which would uncover participants' realities to develop hypotheses about the Activity Systems. Induction will be upheld as 'an ideal' but it is conceded that this researcher's own substantive, constructed realities of the System under investigation (outlined in the preceding chapter(s)) will undoubtedly influence what is observed and what is not.

Consequently, 6.1.1.3 details the iterative relationship which ultimately developed between theoretical concepts and field observations.

6.1.1 An interpretivist epistemological approach to classroom knowledge

The ASF (chapter five) is underpinned and even determined by its implicit epistemological beliefs. Epistemology is defined as '…a particular set of ideas about what it is to know, how knowing occurs and how knowledge is possible…' (Derry, 2007, p.505). For example, the ASF forwards the importance of a classroom student's broader musical interests, habits and desires by accepting that personal and cultural forces are influential to human action.

To understand the influence of personal and cultural forces, this researcher must *interpret* participants' behaviour in the system. Interpretive researchers '…begin with individuals and set out to understand their interpretations of the world around them' (Cohen et al., 2007, p.22). Like me, interpretivists believe that '….truth is always historical, cultural and socially created' (Ezzy, 2002, p.2). Consequently, I agree with Ezzy (2002) who underlines the importance of listening to and respecting 'the truth' of other people. Such an approach defines an interpretivist epistemology which defines social reality '…as the product of its inhabitants; it is a world that is interpreted by the meanings participants produce and reproduce as part of their necessary activities together' (Blaikie, 2010, p.99). Rather than looking for some singular truth then, it is '…sets of meanings which yield insight and understanding of people's behaviour' (Cohen et al., 2007, p.22). There is alignment here with Alasuutari (1995) who explains that to understand meaning is to engage with the symbolism that participants associate with specific objects or activities. Meaning therefore is not some static objective 'thing' and grasping it presents a consummate challenge:

> Meanings are constantly changing, and are produced and reproduced in each social situation with slightly different nuances and significances depending on the nature of the context as a whole. (Ezzy, 2002, p.3)

Given this account of meaning as situated and emergent, meaning must be interpreted and analysed by the researcher. An emphasis upon the interpretation rather than the discovery of social reality hallmarks this research study as fundamentally qualitative in nature. This is because:

> Qualitative researchers are interested in understanding how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences. (Merriam, 2009, p.5)

In terms of interpreting participant meanings, qualitative research builds '…theories about how these meanings and interpretations are patterned and produced' (Ezzy, 2002, p.3). Here of, this researcher is a phenomenologist, whose aim '…is to depict the essence or basic structure of experience' (Merriam, 2009, p.25). Bogdan and Bikeln (2010) concur. They describe a phenomenological approach to Activity Systems as the intention to understand the meaning of events and interactions of ordinary people in particular situations (Bogdan and Bikeln, 2010).

Interpretivist phenomenology brings together the perspectives introduced here to recognise the personal (embodied), social and cultural construction of meaning, as situated in time and space:

> The human is embodied, situated, finite, and thrown into a particular culture, time, and place. This situated, social, and sentient person dwells in a world of common meanings, habits, practices, meanings, and skills…These…are the foci of interpretive phenomenology. (Benner, 2008, p.461)

This interpretivist, phenomenological, epistemological perspective shares with Activity Theory a desire to discard individualistic, monological assumptions. Studying Activity instead searches for those common meanings, habits, practices and skills which define the socially constituted person (Benner, 2008). One particular social theory in this paradigm – symbolic interactionism – is relevant because it explains how such common meanings, habits, practices and skills 'symbolically' develop during interaction.

6.1.1.1 Symbolic interactionism

Smith and Bugni (2006) argue that symbolic interactionism (SI) is an important interpretivist paradigm for the study of Activity Systems because it concepts how designed physical environments (e.g. the tablet workstation) and the self are intertwined to the extent that one influences and finds expression in the other. SI argues that '…Individuals are created through *interaction*; society too is created through *social interaction'* (Charon, 2009, p.28). Importantly, when interaction is defined as symbolic, objects are defined as social creations, not objective realities:

> The nature of an object - of any and every object - consists of the meaning that it has for the person for who it is an object. This meaning sets the way in which he sees the object, the way in which he is prepared to act toward it, and the way in which he is ready to talk about it. (Blumer, 1969, p.11)

Meaning in Blumer's sense then is configured via the '…*symbolic* dimensions of human communication' (Tracy, 2013, p.51). These might be physically designed aspects of the environment (e.g. a tablet computer or worksheet) or human symbols (e.g. language or gesture) but whatever their form, they can symbolise something else (Tracy, 2013). This epistemological assumption aligns with the definitions of symbolic mediators and signs introduced at 2.4.

This account of symbolic interactionism has acknowledged my belief that human and material objects influence each other during action to create new realities. This complementarity will now be expanded at part 6.1.1.2 by introducing a pragmatic perspective.

6.1.1.2 Pragmatism

Symbolic interactionism is a useful perspective for researching the ASF because it defines meaning as neither a completely subjective reality held in the mind or as an objective, transferrable commodity. It acknowledges meaning as dualistic; that is, the interrelated nature of self and situated environment. Engeström and Miettinen (1999) also define Activity Systems as dualistic. They explain that:

> Activity system as a unit of analysis calls for complementarity of the system view and the subject's view. (Engeström and Miettinen, 1999, p.10)

This complementarity necessitates the system analyst (me) to construct, 'from above', the key components of the system (e.g. computer, teacher) but also, to select different members of the local activity so that interpretations of that system can be constructed. Bazeley recognises that if a complementarity between system and person is accepted, one person's 'truth' might bear similarity to another's. Therein, while a person's reality is unique, it is also a reconstruction of something that exists 'out there' (Bazeley, 2013). Pragmatism then, argues that, '…all knowledge is tentative, and needs to be tested against experience' (Bazeley, 2013, p.22). Consequently, the aim here is to place theoretical understanding and experiential action into a symbiotic relationship, not to polarise them. This approach was further influenced by Welch (2007), who has assessed the potential benefits of applying Activity Theory to music education research. Like me, he argues that music education research should include methodological approaches which facilitate multifaceted, holistic perspectives to unearth diverse (perhaps traditionally opposed) knowledge bases. Then, there is potential to gain '…insight into how any contributing elements might be related' (Welch, 2007, p.25).

This pragmatic attitude to disparate knowledge bases also informs an iterative relationship between theoretical assumption and action: this will now be presented.

6.1.1.3 An iterative relationship between theory and classroom action

This research strategy has forwarded the necessity to seek out those meanings which student participants and music teacher-as-researcher develop as they act through and around the tablet computer. The assumption is that by coming to understand these meanings, this research would inductively '…build toward theory from observations and intuitive understandings gleaned from being in the field' (Merriam, 2009, p.15). While this a commendable aim, this researcher is also '…an *interpreter* whose interpretations cannot be separated from the data that will emerge from the research' (Hamilton and Corbett-Whittier, 2012, p.53). Consequently, any field interpretations are grounded in my reading (presented hither-to) and experiences (as a secondary school music teacher and humanist, for example). These theoretically and experientially-informed assumptions are essentially biases and they have influenced:

- what is observed and what is not;
- my behaviour as music teacher in the ASF;
- the selection of digital technology;
- the selection and design of each community's learning activity;
- the nature of the research questions and their associated theoretical foundations.

As Merriam (2009) suggests, it is now clear that this researcher does not, in fact, have an empty mind absent of any thoughts about tablet-mediated composing. After all:

> All investigations are informed by some discipline-specific theoretical framework that enables us to focus our inquiry and interpret the data. (Merriam, 2009, p.16)

Merriam's pragmatic advice informs a research strategy which is neither simplistically inductive (findings first) nor deductive (e.g. hypothesis testing). In any case, Tracy (2013) asserts that most qualitative research involves both inductive and deductive reasoning. Strauss agrees, commenting that '...few scientists would see these processes standing alone…' (2003, p.12). Even grounded theorist Strauss (2003) rebukes pure induction in favour of an iterative approach, which advises this researcher to '…develop theories on the basis of a true transaction between the previous and newly evolving theory' (Strauss, 2003, p.14).

An symbiotic relationship between old and new theory aligns with the complementarity concept Engeström and Miettinen (1999) use to describe system and subject in the ASF. Luttrell (2010b) believes that such an iterative approach is essential for reconciling the abstract and concrete in the field.

Despite the symbiotic approach to human and system proposed, the realities constructed by human participants are not rendered any less valuable. Part 6.1.2 will now propose an ontological approach to reality which forwards the value of accessing those participant realities which are constructed during creative musical action.

6.1.2 A constructivist ontological approach to reality

Given the situated nature of Activity Systems, the communities of practice they represent and the interpretivist epistemology presented here, any positivistic search for what Lincoln and Guba (1985) term a single tangible reality, is rejected. A range of commentators explain that the nature of reality is an ontological concern (Lincoln and Guba, 1985; Robson, 2011; Bryman, 2008). Any ontological approach summoned to complement the ASF and its identified epistemology must accept that '…social phenomena and their meanings are continually being accomplished by social actors' (Bryman, 2008, p.19). This is a central tenet of interpretive research which:

> …assumes that reality is socially constructed, that is, there is no single, observable reality. Rather, there are multiple realities, or interpretations, of a single event. (Merriam, 2009, p.8-9)

Bazeley (2013) defines this ontological approach as constructivism. This approach advocates that reality is constructed as a consequence of individual histories and social inter-action (Bazeley, 2013). If there is one theoretical perspective which underpins this entire research project, it is constructivism. Vygotsky's (1978) application of social constructivism to learning and development is the theoretical assumption expanded across communities, rules and tools to propose how Activity Systems work (Cole and Engeström, 2001). Constructivism has also influenced a multiple/distributed definition of creativity (see chapter two) and a definition of the tablet computer as a computer-based cognitive tool and intellectual partner (see chapter three).

Constructivism, Stake explains, expects '…that phenomena are intricately related through many coincidental actions and that understanding them requires looking at a wide sweep of contexts: temporal and spatial, historical, political, economic, cultural, social and personal' (1995, p.43). In response, a research design will now define each ASF as a case, so that their historical, transient, cultural, social and personally mediated realities, as constructed via symbolic interaction, can be interpreted.

6.2 A research design which concepts two school communities as bounded systems

This research design responds to Blaikie (2010) who instructs this researcher to 'state and justify the technical decisions' taken to research two school music communities and their tablet-mediated ASFs.

Firstly, part 6.2.1 will concept ASFs as case-based, bounded systems. ASF-as-case is a concept which aligns well with the interpretivist research strategy because cases make it possible to '…explicate the ways people in particular settings come to understand, account for, take action and otherwise manage their day-to-day situations' (Miles and Huberman, 1994, p.7). This application of 'case' also aligns with Activity Theory because cases can reveal those situated meanings which emerge over time. This is thought especially fundamental for RQ4, which seeks to understand how creative musical ideas are initiated and developed over time.

Part 6.2.4 will outline a second application of case: a multiple case study design will be developed to explain how and why two school communities were selected. Part 6.2.5 describes the purposive sampling strategy applied to each school community population. Finally, part 6.2.6 considers how a community's action and the meanings participant members associate with that action should be reported. A situational, narrative-based case report format is developed. This will include descriptions of participants, their school and the learning activity designs which were developed by me for them. This design of case report is proposed because it promises to acutely reflect situated peculiarities and enhanced case transferability, where appropriate.

6.2.1 Case study: in search of particularistic phenomena

The ASF proposed in chapter five is concepted as a bounded system and this will be defined ultimately as a ready-made case unit. The ASF already contains a series of empirical (theoretically developed) personal, local and cultural variables. These variables remain important for this investigation because they relate to research questions and collectively define the broad parameters of each system.

The definition of case study proposed here cites a need to assess untried educational interventions while remaining compliant with the iterative, pragmatic nature of the research strategy hither-to described. Consequently, this study:

> …seeks to access an organisation to find out what the impact of a new technology has been. The researcher may have been influenced by various theories about the relationship between technology and work and by the considerable literature on the topic and as a result seeks to examine the implications of some of these theoretical and empirical deliberations in a particular research site. (Bryman, 2008, p.56)

This approach surely satisfies Engeström and Miettinen's (1999) interest in the 'theoretical system' but what of capturing that system's participant meanings to better understand or refute those systemic conceptions? It is proposed that this research design should utilise what Stake (1995) terms 'the real business of case study'. That is, its ability to celebrate *particularisation* and not systemic *generalisation* (Stake, 1995). Merriam (2009) defines particularistic cases as those which seek to understand a particular situation, event, program or phenomenon. Comparatively, the ASF has been also been defined as a *particular* situated phenomenon. When studying an ASF as a particularistic case, Stake (1995) believes that the aim is to find out 'what it is' and 'what it does' and not 'how it is different from others', at least in the first instance.

The ASF has now been defined as a particularistic case. Part 6.2.2 will add to this understanding by conceptualising particularistic cases as bounded systems.

6.2.2 The case as bounded system

A primary argument amongst case researchers, Merriam (2009) recalls, is whether 'case study' is a methodological design, a research process in itself, or something to contain the unit of study. Adopting the latter application, this study bounds each of its cases as follows:

> *…two students and this researcher (in the role of music teacher) creating music through and around a tablet computer situated in a school community*.

This case is a bounded unit which '…captures the essential notion of coherence and limitations' (Hamilton and Corbett-Whittier, 2012, p.11). Merriam cites the benefits of limiting case boundaries in this way:

> I can "fence in" what I am going to study. The case then, could be a single person who is a case example of some phenomenon, a program, a group, an institution, a community, or a specific policy. (2009, p.40)

For this research project, each school community was ultimately described through five cases, each of which were 'fenced in'. Each case contributed to their community's report. Each substantial report document used narrative, dialogue and images to report how five student pairs created music in partnership with a tablet computer and music teacher.

Case-as-bounded-system responds to those particularistic, interpretivist concepts which forward the inherently subjective nature of human participants. Secondly bounded system cases do not bias any particular aspect of the phenomenon (e.g. by solely focussing on the teacher, student or cultural forces, for example). This is a seminal tenet of the systemic principle, which underpins theories of Activity. After all, Engeström (2006) decrees that system dimensions hold equal potential to influence action at any point in space and time.

What is now clear is that reporting on a bounded system is a courageous endeavor. 6.2.3 will now add to the challenge. It determines this researcher must capture and analyse action as it emerges through space and time in order to meaningfully understand situated creative musical action.

6.2.3 The case unit and Activity Theory: a cordial marriage

Particularistic cases have been proposed to understand the systemic nature of creative musical action. Chapter five revealed the situated, goal-based, emergent and temporal nature of Activity Systems. Cohen et al. (2007) assert that like Activity Systems, cases also possess temporal characteristics which define their nature. They also find that cases are defined by human individuals, geography, group role or function and institutional arrangements (Cohen et al., 2007). It is concluded that the definitions of case and Activity System presented here facilitate a cordial methodological marriage.

A primary reason for the adoption of case-as-bounded-system is its potential to capture the transient nature of systemic action. This aspect of case study will now be considered in more detail.

6.2.3.1 Transiency

Cases pose special interest for studying digitally-mediated creative processes because they promise to account for the transient nature of that discourse. Tomlinson remarks that music improvisation of any kind poses difficulties for analysis because '…it is a communicative and interactive art form that is temporally instantiated in time' (2014, p.535). This view is shared by Hewitt (2009) who explains that composing sessions can involve a sequence of processes. Burnard and Younker's (2004) model for plotting compositional pathways also supports this process perspective via their pathway concept (see chapter two). Accepting these compositional practices, Lagerlöf et al. (2014) report that for their study, which investigated how children interact with and around a new music technology, a detailed analysis of how events unfolded was required.

Given these emergent, process-based descriptions of creative musical action, any case must be concepted as a *temporal* unit – that is, have a beginning, middle and end. Cases then are inextricably linked with discourse which '….deals with the production and organization of *meaning* about the world…' (Kress, 2010, p.110).

In summary, the application of case study proposed at this point defines a micro unit of analysis and no broader strategy or design. For the purposes of this research study:

> *…school-situated, tablet-mediated, creative musical activity is defined as a particularistic, temporal and bounded case*.

Part 6.2.4 will now introduce a secondary application of case study, one designed to enable two school communities to be selected, sampled and reported.

6.2.4 Two school communities: a multiple case design

The ASF has now been defined as a particularistic, temporal case of interest for the research questions. However, this application of case describes just one instance of creative musical activity. This is case as unit of analysis. In a school community however, *many pairs of students* engage in their own particularistic creative musical activities. Obviously, understanding these multiple cases might describe a broader series of emergent conventions which define that community's tablet composing. To overcome this second design-based challenge, a multiple case study design is introduced. It guided the selection, sampling and reporting of two school communities and their creative musical conventions.

6.2.4.1 Selecting the school communities

Ultimately five pairs, sampled from two secondary school communities, took part in this research. Initially, feasibility as a lone researcher and challenges of securing access decreed that just one school community and their tablet-mediated composing practices would be reported. Following a pilot study (see 6.4.2), which pre-tested equipment and methodological decisions, it became clear that the selected school community might be especially unrepresentative of other school communities in England. While the particularistic nature of individual communities *is* celebrated here, it was concluded that one community was insufficiently representative of secondary music education in England. Consequently, a multiple case study design was proposed because, as Stake (2006) suggests, multiple case studies promise to develop understandings about how the ASF operates in both typical and atypical settings.

Community one was perhaps an atypical setting (see case report one, chapter seven) and naturally, a more typical proposition was sought. Fortunately, a second community was interested in participating in this research. It promised a co-educational student body, religious and ethnic diversity and parents who proudly supported the school's exam-centred teaching (see the community two case report presented as chapter eight).

The selected communities justify the use of a multiple case design because there are good opportunities to learn about diverse contexts. As described here and visualised by the ASF, context can be understood through cultural factors such as '…school ethos, policies, subject culture, classroom rules and the home background of students' (Kennewell et al., 2008, p.67).

As well as contextual diversity, for '…multicase research, the cases need to [also] be similar in some ways – perhaps a set of teachers, staff development sessions…' (Stake, 2006, p,1). The similarity *between* the cases in this research is the systemic framework for tablet-mediated composing (the ASF) which, in Schostak's (2006) words, is cautiously 'thrown over' both communities for experiential testing.

How two school communities were selected, according to Stake's (2006) multiple case design requirements, has been explained. Part 6.2.5 will now discuss how these large communities were purposively sampled to ensure student participants represented the diversity of musical interests and experience evident in their particular community.

6.2.5 Sampling strategy

Case has been defined as both a bounded system, representative of the ASF and a design to research two diverse school communities. In terms of its latter application, a four-part sampling strategy was devised to ensure that a feasible number of participants represented the musical interests and experience prevalent in their school community. This strategy will now be reviewed here.

6.2.5.1 Purposive sampling requirements

From the outset, the research rationale (chapter one) determined a desire to recruit students with the broadest possible range of musical interests and experiences. These students were selected from cohorts of Year 7, 8 and/or 9 students, aged between 11-14 years. These students compulsorily attended a weekly classroom music lesson in their school.

The core tenet of the sampling strategy was its purposive nature. Purposive sampling, as proposed by Weiss (1994), is a strategy for overcoming unwanted duplication in the sample. With this in mind, Weiss (1994) suggests participants be purposively selected to obtain instances of those important, dissimilar forms present in each school community. Consequently, the student who took individual music lessons on violin or piano, for example, posed as much interest as the student for whom music played little or even no conscious part in their lives.

A pilot study (see 6.4.2) revealed that video-enhanced observation produces an immense quantity of data, very quickly. Consequently, just five purposively sampled pairs from each of the two school communities were selected to ensure feasibility. This researcher selected '…the cases to be included in the sample on the basis of…[his] judgement of their typicality or possession of the particular characteristics being sought' (Cohen et al., 2007, p.114-115). This was difficult given that I was newly introduced to both communities. Fortunately, participant selection was carried out in partnership with the heads of music in both schools.

In accordance with ethical requirements (see 6.5), students voluntarily stated their interest to their head of music, who then developed a list of names from which the sample could be purposed and students naturally paired. In community two, data-driven records for each student indicated their current compositional, music performance and listening appraising skills. Those participants selected ultimately represented the broad range of assessment data evident in their year 7-9 community. The community two head of music skillfully interwove assessment data with anecdotal knowledge of individual students to determine the final sample.

In community one, small class sizes and the nature of the relationship between the head of music and her students meant that she could immediately list a broad range of students in some loose hierarchical fashion. These students were approached by the head of music and subsequently, many volunteered once parental consent was received. By adopting this purposive approach, a cohort of musically diverse young people were able to represent their respective communities. The aim was act upon Stake's (1995) advice: to maximize what could be learnt, given that time and access for fieldwork was limited.

A commitment to search out diverse musical backgrounds describes this strategy's intention to develop a 'maximum variation' sample and this intention will now be justified.

6.2.5.2 Maximum variation

The second tenet of this purposive sampling strategy is maximum variation. A maximum variation sample '…is one in which researchers access a wide range of data or participants who will represent wide variations of the phenomena under study' (Tracy, 2013, p.135). Following Tracy's advice, maximum variation was applied in a bid to reveal the complete diversity of compositional pathways that communities might develop as they work to achieve their creative goals in their ASFs. Seminal to adopting maximum variation was Tracy's (2013) view that underrepresented or marginalised groups should be recruited, so their views (and behaviours in this instance) could add complexity and breadth to a case report. This strategy required the seeking out of 'negative cases' and this practice will now be introduced.

6.2.5.3 Negative cases

Achieving maximum variation sampling is challenging because working with young people acutely necessitates voluntary participation. Put simply, if a student has little interest in music or perceives formalised music-making to be a negative experience, they will likely not volunteer. This was a concern because Robson (2002) argues that negative cases help counteract a researcher's biases by describing behaviours which dismantle their theories. Fortunately, both communities did promise negative cases. Firstly, some students rebelled against classroom music. In classroom settings, these students could be disruptive and/or possessed little or no 'traditional' musical training. Secondly, the heads of music who gatekept each community were inspirational people. They instilled any anxious participants and their parents with the confidence to consent and willingly participate in this research.

Recruitment of negative cases ensured a better purposed, maximum variation sample, which was constructed relative to the community population. Consequently, five pairs of classroom musicians aged between 11-14 years were thought to represent each of their two communities: ten pairs in total. The promised variation in students' musical interests, experiences and backgrounds become evident when they are introduced at the beginning of each case report (see chapters seven and eight). The fourth and final part of the sampling strategy addressed how students should be paired-up to create music in the ASF. This will now be introduced.

6.2.5.4 Natural pairings

The ASF introduced in chapter five, identified the student and student peer as Activity dimensions which could work individually, cooperatively or collaboratively to create music through and around the tablet computer. Thompson (2012) and Green (2002) both discovered that young peoples' informal music-making practices typically revolve around friendship groups and family members. In response, the ASF was in part conceived to better connect informal (e.g. cultural/personal) with those more formal (e.g. local/classroom) music-making settings. To follow up this naturalistic intention, natural student pairings were encouraged in both communities. This was especially appropriate in the field because classroom music lessons were not set by ability in either community. Classes were grouped by mixed ability and students often worked with their preferred partner, with only some exceptions. Critically, when students enrolled onto this research project, they often enrolled with a friend. So, where possible, these 'natural pairings' were preserved.

The sampling strategy for this multiple case study of two, tablet composing communities has been presented. Part 6.2.6 will now consider how these communities were represented as case report media.

6.2.6 Representing school communities as case reports

This research, like many qualitative investigations, is fundamentally case oriented. This implies that findings should be presented in relation to their case and its situated narrative. To present each community case, that is five pairs of students composing with the tablet computer and me as music teacher, 6.2.6.1 will argue that cultural situatedness should be forwarded. To enhance situatedness further, 6.2.6.2 proposes that situated learning activities should be presented alongside information about that community's head of music, music curriculum and school ethos. Finally, 6.2.6.3 argues that each case report should be a stand-alone document, capable of being read by that community and non-specialists alike. In consequence, a narrative, conversational writing style is ultimately proposed.

6.2.6.1 Forwarding cultural situatedness

Stake (2006) has established that each community case is a complex entity located in its own situation. In this instance, a community's situation might be determined by school ethos and the rituals of current classroom music provision, for example. That is, those cultural forces forwarded by the ASF. The importance of this cultural situation is amplified when paired with a multiple case design because it can '…tease out how the situation at each of several different sites influences program activity or the phenomena' (Stake, 2006, p.29). When I began to work with each school community, it became obvious that these different institutional sites would influence how the tablet workstation learning activity would be designed. This situated relationship between learning activity and community will now be summarised.

6.2.6.2 Situating the learning activities in case reports

As for Crawford's research (2014), the head of music in community one approved a learning activity, the parameters of which were set by this researcher. In community two, the rigorous school-wide curriculum and assessment requirements ensured that a learning activity was created in close partnership with the head of music. Beetham defines a learning activity as '…a specific interaction of learner(s) with others using specific tools and resources, oriented towards specific outcomes' (2007, p.28). It is unsurprising that in the formal setting, the teacher-researcher heavily influenced the nature and emergent nature of learning activities.

Accepting the situated nature of each community, the learning activity designs were themselves a record of each community's conventions. The inclusion of these learning designs in case reports and their proposal as local (music teacher) and cultural (school/government policy) influences, was thought to better explain participant behaviour.

6.2.6.3 Presenting findings as a community narrative

Each case report introduces a community of volunteer tablet composers to the reader. The intention was that even non-specialists should come to know a particularistic, distributed world of creative music-making. Each of the two worlds reported were situated in space and time, full of personal desires, local tools, resources and historical cultural conventions. Importantly then, case reports identified and synthesised the storyline (Bazeley, 2013). To achieve this, Ezzy (2002) advised that the reports move between my voice and a variety of other voices (e.g. the participants) to support my narrative. Video captures presented as digital sketches further add credibility to that narrative. Lincoln and Guba (1985) suggested that the writing style remained informal so that the community's world could be portrayed through the participants' natural linguistic constructions. The case reports are consequently indebted to the twenty participants who were keen to grant me access to and co-construct their emergent musical realities.

A research design has now been presented. It simultaneously applies two definitions of case study (bounded system and multiple case). Its committed aim was to capture, analyse and present both individual systems of creative musical activity and those common themes which emerge from two different communities of tablet composers. Part 6.3 will now explain how observation and interview research methods were configured to capture creative musical activity and participant accounts of that phenomenon.

6.3 Research methods which capture a school community's emergent creative musical activity and participant accounts of that phenomenon

The research methods introduced here were configured to capture the sort of data which satisfies research questions and the research strategy, which itself emerged from the theoretical principles of Activity Systems.

In terms of the research questions, Robson (2002) suggested they posed a requirement to find out what student, student partner and music teacher *do* in the Activity System (e.g. RQ 1/2/3/5). The questions also required this researcher to investigate participants' musical backgrounds and their opinions about the tablet composing experience (RQ4). Robson (2002) argues that to capture these types of understanding, observation and interviewing methods must be developed. Interview data was thought especially valuable because it promised a student narrative to corroborate or refute my own interpretations.

Interview and observation methods are very broad concepts applicable to almost any theoretical assumption (e.g. positivist or interpretivist). They consequently require acute configuration. Responding to the research strategy, Benner (2008) suggests that an interpretive phenomenologist would typically seek out first-person or near accounts of real events. To achieve this aim, she suggests that videos, participant observation and interview methods be developed (Benner, 2008). The aim was to develop these methods so they can:

> …understand the world of the participants or events. A dialogue is created between practical concerns and lived experiences of the group or practices being studied... (Benner, 2008, p.463)

This interpretivist application of research methods describes well my own strategic vision for how the social world should be studied. It is an empathetic stance that aims to see through participants' eyes (Bryman, 2008).

An interpretivist approach to research methods justifies this researcher's engaged participation in the activity system as music teacher (see 6.1.1).

Part 6.3.1 will now introduce aspects of the observation method thought seminal for the study of Activity Systems. The method is found capable of tracking situations over time; systematically and permanently collecting a range of environmental and multimodal interaction data; building trust with participants and providing data to compliment other methods. Finally, to feasibly observe creative musical Activity, the use of video is proposed at 6.3.1.3.

6.3.1 Observation method for capturing creative musical action

Following Robson's (2002) advice, observation is considered to be a natural technique to watch and record what participants do in the ASF. The method can then describe, analyse and interpret that behaviour (Robson, 2002). An interpretivist application of observation method promises to '…draw the researcher into the phenomenological complexity of the participants' worlds…situations unfold and connections, causes and correlations can be observed as they occur over time' (Cohen et al., 2007, p.397). This direct access to tablet-mediated composing is surely the major strength of observation. It will be found that this access, '…offers a permanent account of a transient situation' (Simpson and Tuson, 2003, p.16-17). A transient situation reveals information about:

- the *physical* setting (e.g. the organisation of the classroom)
- the *human* setting (the characteristics of the community participants being observed)
- the *interactional* setting (e.g. the interactions taking place to include the formal, informal, verbal and non-verbal)
- the *programme setting* (e.g. the worksheets used, pedagogic styles, broader curricula influences and assessment). (Adapted from: Cohen et al., 2007, p.397)

These tenets of the observation method align well with the various personal, local and cultural influences found in the ASF (chapter five).

Partti (2014) and Burgess (1991) also advise that spending time in a school community can help to build closer participant relationships, the nature of which are impossible to develop in interview settings.

While some broad benefits of the observation method have now been forwarded, what of this researcher's participant role as music teacher in the field? Part 6.3.1.1 will now propose a participant-as-observer method.

6.3.1.1 Classroom music teacher as participant-observer

If a teacher is researching their own practice, Hamilton and Corbett-Whittier (2012) suggest that participant-observation is appropriate and consequently, such a role was developed for my role as music teacher. A new intervention was tested and I situated myself '…in the midst of the research process' (Hamilton and Corbett-Whittier, 2012, p.99). This participant-as-observer role is defined here as '…situations where the researcher participates as well as observes by developing relationships with informants' (Burgess, 1991, p.81). This role '…involves a researcher in one or more periods of sustained immersion in the life of the people being studied' (Blaikie, 2010, p.206). As participant observer, I intended to develop a music teacher role and a naturalistic rapport with each pair of students. It is notable that this role was participant-observer and not observer-participant. Students volunteered to leave their regular classroom music lessons and work on this alternative tablet project. Therefore, my role as music teacher was institutionalized and serious. My first duty was to ensure that all students developed their composing skills, met school learning development objectives and experienced a fun activity. In the field, the observation component of the role appeared secondary but when video material was reviewed away from the field, the observation method became fundamental (see 6.3.1.3).

The participatory nature of the role aligns with an Activity System perspective which decrees that observed conceptual systems are '…complex encounters in which personal meanings, individual perspectives, and dynamic interactions are the key factors' (Simpson and Tuson, 2003, p.12). Consequently, Bryman (2008) advises that involvement with the people being investigated is essential, to acquire meaningful understanding about their conceptual worlds. Fortunately, my invented role of visiting teacher necessitated deep involvement in the setting and such a role was natural because '…students are used to working with new teachers (many of whom they don't know personally) on a daily basis' (Robson, 2002, p.319). Additionally, before any data collection began, I fashioned a preparatory role as classroom teaching assistant so that potential participants would know who I was before they enrolled onto the research project. This was also a response to Bryman (2008) who advises that the longer researchers hang around, the more participants become accustomed to them.

While a participant-observer role was adopted, challenges remained. Part 6.3.1.2 will now outline how the participant-observer method was adapted to capture the multimodal and transient nature of creative musical action.

6.3.1.2 Observing multimodal and transient creative musical action

A multimodal approach to communication has been defined as one which perceives language (e.g. in speech and writing) as just one communicational mode among many (as argued by Jewitt, 2012; Kress and Van Leeuwen, 2001). Both tablet computers and human actors have been hither-to defined as multimodal tools, capable of eliciting or presenting touch, gesture, audio, visual and verbal modes of communication, for example. To complicate matters further, the nature of these modes and their associated symbolic meanings have been found to be inherently transient. Fortunately, participant observation, as adopted here, is:

> …inherently longitudinal in character because the observer is present in a social setting for a period of time. As a result, change and connection between events can be observed. (Bryman, 2008, p.468)

Capturing the sheer variety and quantity of the multiple modes which concurrently emerge in the ASF was thought impossible for a researcher, who was primarily committed to 'teaching' students. Consequently, a video-enhanced observation method was devised and it will now be introduced.

6.3.1.3 Video-enhanced observation

There were two research studies which influenced how video cameras were used in this research project. The first study was undertaken by Burnard and Dragovic (2015) and it drew upon Engeström's Activity Theory and Lave and Wenger's work (1991). The researchers used video recordings of school music rehearsals to '…observe the pupils and teachers 'in action', in their natural settings and to note down concrete recurrent behaviour patterns/events/episodes' (Burnard and Dragovic, 2015, p.378). A second study undertaken by Gall and Breeze investigated how multimodal software provided new opportunities for students to compose music. Two difficulties were identified:

> The first was to be able to capture the process as shown on the computer screen, whilst also capturing the ways in which the student(s) used the musical keyboard – and to ensure that these were synchronised. The second was to capture the sound from the computer as well as the sound of the students talking. (Gall and Breeze, 2008, p.32)

Gall and Breeze deployed video cameras to capture the interactional modes they identify. Deppermann (2013) also found that video data can record minute bodily activities, objects involved in activities, those features of spatial surroundings which become relevant to participants and the properties of technical devices, to include screens and control panels. It was concluded then that video footage was the ideal tool for the sequential, real-time capture of multimodal, transient creative musicking.

The method of observing and capturing creative musical Activity Systems has been presented. Part 6.3.2 will now explore how conversational group interviewing was used to reconvene participants after their tablet composing activity had ended.

6.3.2 An interview method developed to relive shared experience and unearth participant meaning

According to Stake (1995), the interview method is paramount for accessing multiple realities. For instance, he explains that much of what I fail to or incorrectly observe will have likely been observed by the system participants (Stake, 1995). Cohen et al. (2007) advise that it is not uncommon for participant observation to be combined with an interviewing method to present both participant accounts of the situation (interviewing) and those organising constructs which account for situations and behaviour (participant observation). This is not the only reason interviewing was necessary here. RQ 4 seeks to understand participants' broader musical cultures, interests and experiences and these are likely impossible to fully understand via observation methods alone.

For the purposes of this research project and in accordance with the research strategy, interviewing is broadly defined through the lens of symbolic interactionism and constructivism:

> …interviews are viewed as experiencing subjects who actively construct their social worlds; the primary issue is to generate data which give an authentic insight into people's experiences… (Silverman, 1994, p.91)

To gain such authentic insight into each community's participant experiences, a naturalistic, conversational, semi-structured group interview method was developed. This method, which will be outlined in more detail from 6.3.2.1, intended to:

- develop detailed description;
- describe process;
- learn how events were interpreted;
- bridge intersubjectivities. (Adapted from Weiss, 1994, p.9-10)

6.3.2.1 will now introduce a group interviewing method which enabled system participants to collectively relive their tablet-mediated, creative musical experiences. During this reliving, the aim was to ensure that Weiss' (1994) intersubjective descriptions, processes and events could be assimilated into an agreed, co-constructed narrative.

6.3.2.1 Reconvening the system's participants: group interviewing

Group interviews are found especially useful for understanding Activity Systems because, as Robson (2002) asserts, they explore collective, not individual phenomena. It has been well established that as community conventions emerge, they represent the shared meanings of that community (see Lave and Wenger, 1991). In the spirit of communities of practice and Activity Theory then, it is the situated emergence of community convention and not any one individualistic account which poses interest.

For Cohen et al. (2007), group interviewing represents an opportunity to bring together people with varied opinions and work out an agreed reality for their experienced phenomenon. As Cohen et al. (2007) suggest, this strategy would enable the young composers to challenge each other during the interview.

A group interview only took place only once a pair of participants had been observed both in person and through the camera lens. This ensured that my developing narrative of events could be tested with the participants (see 6.4.3). The point of music teacher and students sharing, questioning and validating their shared experience is that a co-constructed narrative might emerge during the interview:

> Co-constructed narratives are stories jointly constructed by relational partners…This approach offers a way for participants to actively construct a version of a relational event that provides insight, understanding, and an in-depth and complex reflection on what occurred. (Ellis, 2008, p.84)

It was soon found that to effectively develop such a narrative, a conversational, naturalistic interviewing style was required. Roulston's definition was adopted because it acknowledges the conversational and informal nature of the approach but it also pragmatically accepts the necessity to discuss pre-planned topics:

> Conversational interviewing is an approach used…to generate verbal data through talking about specified topics with research participants in an informal and conversational way…. (Roulston, 2008b, p.127)

Given the participatory nature of the observation role, the use of natural pairings and an interpretivist research strategy, a conversational group interviewing method was a natural choice. The method also promised to be useful for working with children because the collaborative nature of school life could be emulated during interview. The overall effect was a less intimidating setting, as compared to one-to-one, more structured interviews (Cohen et al., 2007). This said, Bryman (2008) warns that group interviewing runs into problems when there are either quiet or vocal speakers. Consequently, interview questions were occasionally directed towards one participant or another.

While the presented naturalistic approach was promising, it needed to be counteracted with the requirement to answer research questions. A semi-structured questioning format was ultimately found necessary and this will now be described.

6.3.2.2 A semi-structured design

A range of research into creative music-making has made use of the semi-structured interviewing format and it has helped other researchers to:

- collect information about participants' musical backgrounds (Gower and McDowall, 2012)
- address participants' views about interactive music video games (Gower and McDowall, 2012)
- explore the process of musical skill and knowledge acquisition in some detail (Thompson, 2012)
- discover common learning practices in different informal musical communities because similar questions were asked (Thompson, 2012)
- build up a shared understanding of how creative learning played out in musical ensembles (Burnard and Dragovic, 2015).

The research questions for this project comparatively required information about musical background and participant accounts of their experience (RQ4); how musical-technological skills and knowledge developed as creative ideas emerged (RQ5) and how the tablet, teacher and student peers influenced the development of common learning practices (RQ1/2/3). It was concluded therefore that a semi-structured questioning format would also present value here.

According to Bryman (2008), a semi-structured interview scenario is when an interviewer has a list of questions or a fairly specific range of topics to be covered but interviewees retain much flexibility in how they answer. In the field, this scenario ensured that although the interviews were semi-structured, with questions arranged by topic, meanings were still negotiated in a conversational way.

Balancing the necessity to extract answers for premeditated questions with ample space for participants to construct their narratives necessitated a carefully constructed interview guide (see Appendix A). Each section of the guide sought answers for a different research question and began with an open-ended question. Open-ended questions were found essential because they:

- allowed unexpected or unanticipated answers;
- questioned theoretical relationships or hypothesis;
- cleared up misunderstandings;
- allowed me to test the limits of participants' understandings;
- encouraged cooperation and established rapport. (Adapted from Cohen et al., 2007, p.357)

Each open-ended question was commonly followed up with a range of closed questions relating to the same broad topic. These closed questions responded to Roulston's (2008a) advice to specify the parameters within which participants framed their answers. The closed questions are indented beneath open-ended topic starter questions in the schedule (Appendix A).

Part 6.3 has introduced the research methods configured to collect observation and interview data to develop understanding about two communities and their tablet-mediated creative musical Activity Systems. Now part 6.4 will introduce those strategies designed to uphold the credibility and transferability of the research findings.

6.4 Strategies to uphold credibility and transferability

In one sense, credibility and transferability strategies aim to enhance the internal and external validity of the research findings. Bryman (2008) explains that external validity is concerned with the extent to which research findings can be generalised beyond specific research contexts. Whereas, internal validity examines how well research projects generate theory from the findings; in essence, their believability (Bryman, 2008).

Luttrell (2010a) rightly calls out 'validity' definitions as troublesome for qualitative researchers because of their undoubted grounding in positivist claims of absolute truth and certainty. Their use here would counteract a research strategy which believes multiple realities (truths) prevail over any absolutist way of knowing. To overcome this issue, Guba and Lincoln (1985) propose qualitative researchers consider the term credibility as a substitute for internal validity. Their argument is that qualitative researchers (like me) study meaning. Secondly, they assert that interpretations and meanings are situated (Lincoln and Guba, 1985). This desire to understand situated meaning influenced the development of a case study design, an observation-as-participant method and the enactment of conversational, group interviews.

Part 6.4.1 will now explain how research methods and this broader research inquiry were configured to uphold trustworthiness in the qualitative sense. That is, how credibility strategies contribute to this methodological design.

6.4.1 A credible application of data collection, analysis and reporting strategies

When site visits were made to each community of tablet composers, I took with me a range of theoretical assumptions about how tablet composing might work in formal settings. These assumptions were empirically developed from the literature and the account of the ASF presented as chapter five. They were admittedly extensive to the point that an iterative and not inductive research strategy was made explicit. These theoretical beliefs about the nature of creative music-making and human action more generally threatened to undermine the credibility of this research. For instance, Cohen et al. (2007) argue that these beliefs can produce expectancy effects in the data. That is, instances where the researcher '…knows the hypotheses to be tested, or the findings of similar studies, or has expectations of finding certain behaviours, and these may influence her/his observations' (Cohen et al., 2007, p.411).

To minimise selective attention and expectancy effects in this project, there was an intention to make procedures and theoretical approaches as credible as possible (Simpson and Tuson, 2003). The starting point was to develop a reflexive attitude to the field, data collection, analysis and reporting (see 6.4.1.1). To further address expectancy effects, persistent observation and prolonged engagement (6.4.1.2) strategies were developed. Additionally, a critical approach to video camera placement helped to ensure the lens was no less selective than was essential to answer research questions (see 6.4.1.3).

6.4.1.1 A reflexive attitude

Reflexivity is a recognition of the necessity for this project to counteract bias. As Ogden (2008b) remarks, bias threatens to compromise the accurate sampling, data collection, data interpretation and reporting of this project's findings. In fact, bias is all encompassing. It has already entered this research by choice of topic, the research questions and a particular set of theories to accompany them (Ogden, 2008b). This is not as cataclysmic as first thought: ultimately, these peculiarities can even be celebrated. Aligning with the interpretivist research strategy, we can say that:

> …interpretivist knowledge is embedded within the world of practice. Being value laden, interpretivist knowledge is not neutral or even critically neutral…[it] is also permeated by the values and interests of the inquirer. (Greene, 2010, p.70)

Actualising this definition of knowledge, Ogden (2008b) suggests that I too am a product of the social world and therefore, I have values that will be more or less apparent in this research. For Dowling (2008), being reflexive is about recognising those values by continually engaging with them and explaining how they have influenced a research project. It is a critical, self-conscious awareness and the first chapter of this thesis explains how this project developed in consequence to my practice-based experiences as a secondary school teacher. These experiences manifest themselves in the accounts of creativity, digital technology and pedagogy presented here and they continue to define the research questions, strategy, design, methods, ethical strategies and data analysis. In essence then, this researcher has answered Luttrell's (2010b) reflexive requirement to make the research process and all decision making visible at the personal, methodological, theoretical, epistemological, ethical, and political level.

To enhance credibility further, video footage was used to develop a persistent and prolonged approach to collecting data. The approach was developed to heed Cohen et al.'s (2007) warnings of attention deficit, selective attention and selective data input.

6.4.1.2 Prolonged and persistent engagement

It was established in chapter five that Activity Systems emerge over time. They might develop and reach their goal quickly, or conversely, emerge over weeks, months, or even years. Comparatively, musical composition has been concepted as an emergent pathway which can take time – perhaps many weeks to complete (see chapter two). While time spent collecting data was necessarily curtailed to comply with school term lengths, classroom projects, access requirements (e.g. maximum number of days permitted in school per week) and feasibility issues (lone researcher), the aim was to persistently engage with tablet composers over a suitably prolonged period. In community one, students attended thirty-minute sessions. The amount of sessions each pair attended was slightly flexible (to factor in different pathways and student experience) but most completed a composition within six or seven sessions. In community two, each pair of participants replaced their entire one-hour music lesson with the tablet composing project. Pairs from both communities also attended a forty-five minute group interview (see 6.3.2 for details of this method).

To prolong engagement further, months before data collection began, I volunteered in each community as a music specialist teaching assistant. In this role, a rapport was developed with potential participants before they made a choice about their participation in this tablet research project. It was also an excellent vantage point from which to observe the music teacher, classroom culture and broader community forces and how they influenced musical learning in the classroom (see case reports). Prolonged engagement before (teaching assistant), during (participant observation) and after (group interviewing) tablet composing activities was thought to improve credibility because, as Wang and Reeves (2006) suggest, the research context, classroom culture and the music department's curriculum approach could be better understood.

The persistent collection of data was found equally fundamental to uphold credibility. Cohen et al. (2007) worry that transcription processes have the potential to cause massive data loss, distortion and the reduction of complexity. Consequently, to improve completeness, an ambitious decision was taken to transcribe all video (observation) and audio (interview) recordings. After all, it was necessary to ensure that data sets were complete to combat selective representation. Every piece of dialogue which occurred around the tablet computer and during interview was transcribed in a verbatim, time-ordered fashion. This decision aligned with Cohen et al.'s (2007) belief that participants' direct phrases are more illuminative and direct than a researcher's own words. There also remained an epistemological duty to faithfully communicate the exact words participants used to describe their tablet-mediated experiences.

Persistent engagement then, became a commitment to develop an accurate, complete data set. An equal intention to achieve prolonged engagement ensured a natural rapport was developed with community members. This led to a community's situated meanings becoming unearthed. 6.4.1.3 will now consider how a video camera was deployed credibly in each community.

6.4.1.3 Video: framing the action

This researcher was overwhelmed by the infinite choice posed by the use of video cameras in the field. During the pilot, one member of each participant pair wore a lanyard camera. However, Jewitt (2006) suggested the lanyard camera had the potential to distort reality by focusing on some events in the Activity System and not others, rather than capturing events as they were. To quickly improve credibly, a tripod camera was introduced during the pilot study. It was placed '…in a fixed position using a single viewpoint' (Heath et al., 2011, p.40). Heath et al. advised that fixed cameras:

- provide a consistent, more complete and less biased view of the stream of action;
- can anticipate future events without having to be moved;
- enable the researcher to move around, teach and even leave the scene;
- ensure that the researcher can appear in the video frame as an active participant;
- are less obtrusive than roaming cameras. (Adapted from: Heath et al., 2011, p.40)

Based on these essential field characteristics of fixed cameras, the fixed camera was thought necessary. Further, the ability of fixed cameras to simultaneously capture every visible Activity System dimension (tablet/teacher/student/student partner) without favouring one over another was thought necessary to uphold credibly.

During data analysis, video-enhanced fieldnotes were coded and researcher observations were ultimately presented alongside group interview data in a further bid to improve the credibility. This triangulation by method credibility strategy will now be summarised.

6.4.1.4 Triangulation by method

Two research methods were used here to answer research questions. This necessitated the collection of both participant narratives (e.g. to understand musical backgrounds) and my own observations (e.g. to understand how the situated Activity Systems emerged). It was soon found that group interview data could be triangulated with field observations and first-person dialogue. Data triangulation '…entails using more than one method or source of data in the study of social phenomena' (Bryman, 2008, p.379). Triangulation of method was developed here because:

> Any tool for data-gathering provides only one picture of the social world, and matches and mismatches between data gathered by different techniques help to enrich understanding of what is going on. (Simpson and Tuson, 2003, p.17)

The case reports presented as chapters seven and eight enrich understanding of the ASF by intertwining researcher (video-observation generated) and participant (interview generated) narratives to present 'multiple pictures' of each school community and their tablet composing adventures.

The use of two data-gathering tools became essential because participants often developed a very different account of their musical progress as compared to their music teacher-researcher. For example, participants might describe their composing as 'amazing'; meanwhile the researcher interpreted the action as 'randomly pressing buttons'. Highlighting areas of disagreement became an essential tenet of the triangulation strategy.

Given that this project was a curriculum intervention, one which drew upon a particular set of theoretical assumptions and hither-to untested fieldwork activity designs, part 6.4.2 explains that a pilot study was necessary to ensure data was credibly collected.

6.4.2 Pilot study

Heath et al. (2011) advise that few researchers gather good quality audio-visual data upon immediate entry to a setting. An unwillingness to refine data collection instruments is thought to jeopardise the credibility of findings. Taking Yin's (2009) advice, a pilot case study was setup in community one to help refine both the content of data collected and the procedures adopted to capture it. Once the tablet music workstation had been developed, ethical clearance granted and a working plan for the investigation made ready (e.g. research design, sampling strategy, fieldwork activity design), the aim was to try out these proposals on a small-scale. This concept of piloting was influenced by Robson who defines pilot studies as '…a small-scale version of the real thing, a try-out of what you propose' (2002, p.185). A pilot study was actioned to:

(a) test the sampling strategy
(b) test out the tablet workstation equipment rig in a secondary school community
(c) test the administering of instructions to participants
(d) develop a suitable teacher role and try out different pedagogical approaches [as proposed in chapter four]
(e) make video-enhanced observations, transcriptions and adjust camera(s) to credibly frame action
(f) check timings for interviews and composing activities
(g) test the group interviewing strategy and the associated interview schedule

(h) check that all necessary information for research questions could be gathered
(i) gain some indication of what results might be expected from the main investigation. Revise theoretical and methodological concepts to accommodate this newfound understanding. (Adapted from: Yin, 2009, p.39)

Following ethical clearance, DBS checking and child protection training, pilot data was collected in community one between January and March 2017. Four pairs were sampled according to the sampling strategy.

Each pair used the tablet for just two thirty minute sessions and attended a thirty minute group interview. A complete report of the pilot study findings is available upon request.

Once the pilot study was complete, equipment and methodological design were adapted accordingly. The adapted methodology is reported by this thesis chapter.

Pilot data was also used to develop participant, gatekeeper and colleague checking practices: important strategies to uphold credibility.

6.4.3 Participant and colleague checking

Part 6.3.2.1 has already established that group interviewing was in part deployed as a form of member checking. Member checking involves '…returning to respondents and presenting to them material such as…accounts and interpretations you have made' (Robson, 2002, p.175). Robson (2002) concludes that a such practice is a valuable means of guarding against bias. In response, this project informally and formally undertook member checking as a matter of course. In the field, participants were routinely questioned and understandings and/or clarifications sought on an informal basis. This is evident from video transcripts and the final case reports. This informal type of member checking was fundamental for intentionality, that is, '…what it is that the respondent *intended* by acting in a certain way or providing certain information' (Lincoln and Guba, 1985, p.314). This is essentially a check agreement on the symbolic meaning of the observed behaviour. By actioning informal member checking, participants were given an immediate opportunity to correct errors of fact and challenge what they perceived to be wrong interpretations (Lincoln and Guba, 1985). As Lincoln and Guba (1985) predict, participants were also free to volunteer additional perspectives. Fortunately, the naturalistic, participatory role of the observer as music teacher ensured this was a naturalistic dialogic endeavour which led to credible, co-constructed meanings.

During interview, formal member checking could take place. This was because throughout the weeks prior, participants' video footage was persistently observed and a loose narrative for their systemic behaviour was constructed. Semi-structured interviewing enabled this narrative to be tested and questioned.

In addition to participant checking, excerpts of transcribed data, coding frames and associated video footage were shared with colleagues at the University of Leeds. Meetings and conferences were common settings for these peer review processes. Colleagues took interest in the fundamentally different community conventions inherent in each case. These instances of gatekeeper and colleague checking are what Guba and Lincoln term peer debriefing which:

- ensured this researcher had credible answers to questions from experienced protagonists;
- probed my biases including theoretical or methodological preferences;
- explored and clarified my interpretations of meaning. (Adapted from: Lincoln and Guba, 1985, p.308)

Together with peer debriefing and member checking, part 6.4.1 has outlined how a reflexive attitude, prolonged observation, the theoretically informed framing of action, triangulation of method and a pilot study were strategically incorporated into this methodology to enhance case report credibility. 6.4.4 will now address the epistemologically contentious issue of transferability.

6.4.4 Transferability

The impact of this research remains promising, especially in terms of its methodology and systemic frameworks for tablet-mediated CMD. However, the necessity for impact requires some level of generalization beyond the temporal situations described by two case reports here. Generalisability is typically associated with external validity. External validity is concerned with how '…findings will apply to other people and/or other situations that the study's sample supposedly represents' (Donmoyer, 2008, p.371). As an interpretivist (qualitative) researcher who believes that realities are individually constructed and multiple in number (constructivism), the generalisability notion, which tacitly subscribes to objective ways of knowing, must be rethought. In idealistic terms, constructivists like me believe that '…social situations are never sufficiently similar across time and space to make generalisation possible' (Blaikie, 2010, p.217). Fortunately, Greene (2010) suggests that interpretivists can address the issue of knowledge accumulation with the concept of transferability. Transferability:

> …shifts the inquirer's responsibility from one of demonstrating generalisability to one of providing sufficient description of the particular context studied so that others may adequately judge the applicability or fit of the inquiry findings to their own context. (Greene, 2010, p.69)

Transferability was a concept popularised by Guba and Lincoln (1985). They explain that the interpretivist researcher cannot specify the external validity of their work, they can only:

> …set out working hypotheses together with a description of the time and context in which they were found to hold. Whether they hold in some other context, or seen in the same context at some other time…depends upon the degree of similarity between…contexts. (Lincoln and Guba, 1985, p.316)

Responding to Greene (2010) and Lincoln Guba (1985), this researcher aimed to ensure that descriptive context in case reports was sufficient to ensure that those who perceive similarities with their own community could further test the ASF.

To achieve this aim, part 6.4.4.1 will now argue that contextual data, thick description and a necessity to preserve data's natural state is essential to maximise a reader's ability to better test and transfer understanding to their own setting.

6.4.4.1 Having impact: strategies to improve transferability

The primary strategy to ensure findings can be better transferred to readers' comparative settings is thick description. Each case report presented in the next two chapters includes:

> • a thorough description of the situated context of each community, to include: accounts of school values and curriculum; music department activities; music classroom curricula; participants' musical backgrounds and interests
> • an explanation of the composing activity designed especially for that community
> • a thorough description of the action-based transactions and processes relevant to understanding tablet-mediated composing systems (the problem). (Adapted from Lincoln and Guba, 1985, p.362)

In reference to the first point, accounting for situated context is found especially essential for multiple case designs such as this. Stake (2006) writes that multiple case research must describe how a phenomenon appears in different contexts. He ultimately aligns with the fundamentals of Activity Theory to say that 'Activity is generally seen to be at least somewhat determined by the situation' (Stake, 2006, p.29).

It has been established that generalisation per se contradicts fundamental empirical assumptions made throughout this thesis and those made explicit by a research strategy. This said, transferability strategies were implemented to maximise the potential impact of research findings, even given the small sample and peculiar nature of the participating communities.

Analytic generalisation is a further strategy which will be actioned in chapter ten to ensure research findings have impact. Yin (2009) explains that analytic generalisation uses previously developed theories as a template from which findings can be compared (Yin, 2009). The discussion in chapter ten will make a modicum of theoretical generalisations to strengthen or question the theoretical argument presented earlier in this thesis. This action will also make those theoretical assumptions more, or less, transferrable to new settings in the future.

An account of those strategies to uphold transferability and credibility has been presented. Before credible data could be collected from each community, this methodology was found to incur a range of ethical challenges. Part 6.5 will now explain how these ethical challenges were addressed.

6.5 The ethical implications of researching secondary school communities

Cohen et al. (2007) expect social researchers to ensure that the dignity of their participants is preserved. To action this intent, some '…principles and methods for distinguishing right from wrong, good from bad, and just from unjust' need to be established (Haney and Lykes, 2010, p.108). Establishing such a set of moral principles is to define one's ethical approach.

Researching young people and their educational settings pose ethical challenges arising from the nature of those settings and the methodological design proposed to research them. The settings were ethically challenging because they necessitated the research of young people and their gatekept institutions. Part 6.5.1 will explain that access negotiations; researcher clearance checks; additional training; strategies for working with children; informed content; careful management of data and upholding confidentially were essential to conduct ethical research into the two school communities. Ethical challenges were also raised by this research methodology. Part 6.5.2 will reveal how this case-based research design plus media-enhanced methods necessitated special ethical consideration.

6.5.1 Researching young people and their educational settings

Stein (2008) forewarns researchers that to research young people and their institutions, issues around power relations, gaining access, consent, confidentiality and research transparency must be addressed. Charissi and Rinta (2014) clearly outlined their ethical procedures for the study of children's musical and social behaviours during digitally-supported, music-making activities. These procedures became the starting point for this research into two tablet-mediated musical communities and they are summarised below:

- headteacher agreement was negotiated (gaining access);
- the research focus was explained to teachers and parents (informed consent);
- signed consent was sought from both parents and child (consent);
- it was made clear that school nor participants would be directly identifiable in the study (upholding confidentiality);
- children maintained the right to withdraw at anytime;
- data was stored safely on a password protected computer;
- the researcher had criminal records clearance from the UK government for working with children. (Adapted from: Charissi and Rinta, 2014, p.44)

These ethical procedures were thought largely transferable given the similarity of the settings and research topics. Consequently, 6.5.1.1 identifies how access was negotiated; 6.5.1.2 discusses what challenges can arise from working with children; 6.5.1.3 outlines how informed consent was achieved; 6.5.1.4 explains how confidentiality was upheld and 6.5.1.5 introduces a data management strategy.

6.5.1.1 Negotiating access

Gaining access to secondary school communities was far from straightforward. Access is '…the appropriate ethical and academic practices used to gain entry to a given community for the purposes of conducting formal research' (Jensen, 2008, p.2). Advice from Evans (1985) was heeded. She warns that permission must always be obtained and nothing should be undertaken without the knowledge and consent of school gatekeepers.

Important gatekeepers were the heads of music in each school community. They were approached via an information document detailing how the research might work in their department (see Appendix B). This document also outlined pilot study findings and confirmed ethical clearance had been granted from the University of Leeds. Further, various access promises were made. It was promised that tablet fieldwork activities could be adapted to meet local assessment and curriculum needs. Using the information document (Appendix B), an access agreement was reached for each community. This determined the nature of the fieldwork activity; contact hours with participants; days permitted in school; nature of involvement with the music department (e.g. helping out at concerts or during classroom lessons) and the level of child protection and induction training required. Reaching agreements necessitated a pragmatic, professional and flexible approach, together with a range of what Cohen et al. (2007) term goodwill and cooperation.

Once access terms were finalised with heads of music, an approval letter was sent to headteachers. A copy of this letter is attached as Appendix C.

6.5.1.2 Working with children

Researching children posed special ethical challenges. Fortunately, this researcher's prior experience as a secondary school music teacher made working with children a somewhat natural endeavour. This said, Stein (2008) asserts that unequal power relations can exist between researchers and child participants; the key differential being age. Therefore, a child-centred approach to data collection was developed. This ensured that ongoing discussions during participant-observations and group interviews were naturalistic and student-focused. For example, during interviews, children were '…allowed to set their own agenda and talk about their own concerns and lives…[to foreground] their subjective experiences' (Stein, 2008, p.16). A second issue was that children as '…members of captive populations might not dare to refuse participation' (Vandebosch, 2008, p.67). Consequently, participation was entirely voluntary, although as 6.2.5 reported, community music teachers sometimes encouraged students to put themselves forward but the ultimate decision remained with students and their parents/guardians. Responding to advice from the British Education Research Association (BERA, 2002), once children volunteered, they maintained the right to withdraw at any time and for no reason.

6.5.1.3 Informed consent

Before young people and their parents/guardians consented their participation, it was essential that they understood the process that they were to become a part (BERA, 2002). This necessitated that consent was informed. Interested students received an information letter, tailored for both students and parents (Appendix D). Finally, parents and students received informed consent forms written in tailored language (Appendix E and F respectively). Participants and parents were encouraged to contact their head of music, university supervisors or myself directly, if further questions arose. Additional written permission for video recording was sought from parents. Finally, the letters stated an intention to obscure participant identities to uphold their confidentiality. How confidentially was upheld will now be reported.

6.5.1.4 Upholding confidentiality

Upholding confidentiality necessitated a promise to protect a participant's and/or institution's right to privacy (Cohen et al., 2007). An absolutist form of confidentiality is anonymity. Anonymity is when '…a research participant's identity and responses cannot be identified' (Ogden, 2008a, p.16). Simons (1989) argues that anonymization is almost impossible to achieve in research which aspires to facilitate open dialogue between participants. Unsurprisingly, absolutist anonymization *was* found impossible because this research intended to:

- capture and reproduce participant dialogue in its complete form;
- report on participants' habits and behavioral characteristics over time;
- summarise participants' musical backgrounds to include listening habits and instrumental/vocal experience;
- reproduce still images of participants creating music through and around the tablet computer;
- document the curriculum practices, assessment practices, classroom routines, geographical area and catchment which characterise each school community.

These methodological intentions would make it straightforward for community members to identify themselves and their institutions. Fortunately, Simons (1989) advises any likelihood of identification will decrease over time and distance. Therefore, partial anonymity by confidentiality was promised to communities and relevant steps were taken to uphold it. In terms of reporting participant behaviour and dialogue, participants' identities were disguised through the application of pseudonyms (Ogden, 2008a). In terms of reproducing images of participants, the angle of the camera was adjusted so facial features were seldom captured and images were edited into digital sketches to further obscure bodily characteristics.

In terms of upholding the confidentiality of the participating institutions, Cohen et. al's (2007) practice of 'crude report categories' was applied. Crude reporting intentionally inserts general information in place of the specific (Cohen et al., 2007). In place of a school name, for example, only general characteristics are listed, thus obscuring identity.

Also integral to upholding confidentiality is an effective data management strategy and this will now be presented.

6.5.1.5 Data management

A data management strategy aided confidentially because, as Corti (2008) suggests, it ensured the safekeeping of data during the research process. This research project generated 185 gigabytes of ethically sensitive video, audio and textual data and consequently, adequate security was required. Again following Corti's (2008) advice, confidential data, which included student names, assessment levels, special educational needs, video footage and voice audio was not stored on network-connected servers or computers. Once data was captured in the field, it was expeditiously transferred to a password-protected hard drive, which was stored in a locked cupboard. To reduce the risk of damage to or loss of the data, a second password protected hard drive was used and backups made at regular intervals. This second drive was stored in a different, lockable location from the first (Corti, 2008).

To ensure that the stored data always remained an accurate account of each community, it was essential that data did not get 'mixed-up' over time. Corti (2008) suggests that data fragment filenames should contain information about the method of data collection and where, when and from whom the data was collected. Consequently, each participant was given a numeric identifier (e.g. 001, 002) and each participant pairing was assigned a letter (e.g. pairing A, B and C). Pairings A to E and participants 001-010 refer to community one. Pairings F to J and participants 11-20 represent the community two sample. A participant information table linked all of this information together to prevent retrieval errors and to make the data set more understandable and accessible to other researchers. Images, video and transcripts were also assigned filenames which reported on their longitudinal placement in the data set. A set of file names for Jenny and Inder's first two observation sessions are reproduced below.

Every observation transcript contained embedded images which directly related to dialogue fragments and descriptions in the text.

These procedures describe a data management strategy designed to manage confidential, secure and backed-up data which preserves the accuracy of what happened, when it happened and where.

Those data management, confidentially, informed consent and access strategies necessary to ethically research young people creating music in their institutional communities have been presented. Part 6.5.2 will now review how those ethical challenges which arose from this methodology were addressed.

6.5.2 Addressing ethical challenges which arose from the methodology

It is now clear that a range of ethical challenges were addressed to conduct research into young people creating music in institutional settings. Now that the challenge of researching the selected settings has been ethically addressed, those issues around audio/video recordings and still image reporting which arose from this methodological design must also be identified and addressed.

6.5.2.1 Making video and audio recordings

The use of video recording was a concern for both the host communities and the university ethics committee. This was for good reason. Jewitt (2006) explains that video data displays identity of a place, school, teachers and students. In response, a fixed camera was located behind students to ensure that facial features were largely obscured. Second, during access negotiations, it was agreed that while video data would be reviewed and analyzed, it would not be shown in public (Jewitt, 2006). Third, when Jewitt (2006) included still image captures from video data in publications, she used a graphic package to mask participant identity. A comparable strategy was adopted here and this is enlarged at 6.5.2.2

Every group interview was also digitally recorded. As for video recording, audio recording promised intrusion to the extent that conversations might have been significantly altered (Morgan and Guevara, 2008). Accepting this, participants were informed about the interview recording process and that they retained the right to withdraw at any time. Further naturalistic strategies were also devised. For instance, responsibility for making the recordings was often handed over to the participants. They were routinely asked to check on its progress. This shared ownership of the interview process helped students accept the recording equipment.

6.5.2.2 Presenting images in case reports

The inclusion of video image captures in case reports poses ethical challenges. Jewitt's (2006) advice to use a software graphics packages to obscure participant identity was acted upon. Heath et al. (2011) suggest that software packages can be used to convert images into line drawings. A template was setup inside the software package *Sketch Maestro* to convert field images into digital sketches. The resultant digital sketches ensured that participant and institutional identity were less obvious but they still conveyed a strong visual depiction of the multimodal action reported by the case reports.

Those ethical challenges which arose from this research into young people's institutionally situated, digitally-mediated musical behaviour have now been reported.

Following the development of a research strategy, research design, research methods, credibility processes, ethical strategies and the implementation of a pilot study, data collection began in two school communities situated in the north of England.

Following data transcription, data analysis began. How that data analysis was undertaken will now be presented.

6.6 An iterative data analysis strategy

Analytical decisions were determined by this methodology: its philosophical foundations and those theories of creativity, digital technology, pedagogy and Activity Theory to which allegiance has been pledged. This approach mirrors that proposed by Bazeley (2013), who rightly identifies that conceptual frameworks and research questions can provide a starting point for data analysis.

Burnard and Dragovic (2015) used Activity Theory to research collaborative creativity in instrumental group music learning. They undertook both inductive and deductive thematic coding of teacher and pupil perceptions, observations and writings. The deductive coding ensured that the concepted elements of Activity Systems (e.g. tools, subject, object and community) were applied as themes to the data set (theory first) (Burnard and Dragovic, 2015). The rehearsals were also found to contain a wide range of emergent verbal and non-verbal behavioural patterns and given their situated/unpredictable nature, these were inductively coded (data first) (Burnard and Dragovic, 2015). This approach describes the analytical strategy adopted here. It is one which constitutes an *iterative relationship between the emic (the social group) and the etic (outside categories and interpretations):*

> An iterative analysis alternates between emic, or emergent, readings of the data and an etic use of existing models, explanations, and theories. Rather than grounding the meaning solely in the emergent data, an iterative approach also encourages reflection upon the active interests, current literature, granted priorities and various theories the researcher brings to the data. (Tracy, 2013, p.184)

This approach was also selected here for its compatibility with Activity theory. For instance, when Csikszentmihalyi (1997) argues for a systems-based definition of creativity (see 2.4.2), he perceives creativity takes place in a domain: a set of symbolic rules and procedures. This symbiotic relationship between absolute (domain system) and situated (humanistic) ways of knowing reaffirms an alignment here with pragmatism, as evidenced by the research strategy.

All five data analysis stages actioned by this strategy set out to discover and then empirically understand situated meanings. These stages will now be presented.

6.6.1 Stage one: A thematic, iterative analysis by system dimension

As the data analysis strategy has inferred, analysis processes iteratively combined data immersion and open coding practices with preexisting, theoretically driven concepts. From this fusion of inductive and deductive coding practices, a coding frame emerged. This coding frame depicted a thematic analysis of each activity dimension and their sub-themes. As Benaquisto (2008) promises, a coding frame became the guiding conceptual scheme for this research. It aided development of the understanding necessary to answer research questions on how the tablet, teacher, student and student partner influenced a community's creative musical action (RQ 1/2/3/4). A summary of this first cycle of data analysis will now be presented.

Twenty, 30 minute observation transcripts recorded and interpreted community one's tablet composing behaviour. Seventeen, 45 minute observation transcripts recorded and interpreted community two's tablet composing behaviour. 44 and 67 still images were captured from community one and two respectively and these were embedded into timecoded fieldnotes. Ten, 45 minute, audio-recorded group interviews were transcribed into Microsoft Word. A consistent use of filenames was essential to keep track of data, especially during the computer-assisted analysis. A participant information table was developed according to guidance from Tracy (2013). By actioning filenaming systems and the PIT, it was possible to trace any piece of data back to its point of origin. The tabular records for Piper and Lucy (pairing B) are reproduced below. These records reveal individual participant numbers, pairing letter, school year, real name (redacted), pseudonym, musical background and basic notes about their participation.

003	B	7	[redacted]	Piper	Piper listens to Drake and Stormzy. She used to play the violin but she didn't like the scratchy sound. Piper plays classical guitar and has lessons. The music that Piper learns is primarily melodic and therefore, she struggles to understand chords. When Piper attempts to look up guitar music on YouTube, she finds chords patterns only and this understandably frustrates her.	Piper is entrenched in the music of Drake and Stormzy to the extent that she imitates their rapping and hand gestures. Piper is keen, honest and freely speaks her mind, especially when there is a point to be made. Piper enjoys learning *classical* guitar because no one else is doing that in school and she is known as an 'expert' in that area among her peers.
004	B	7	[redacted]	Lucy	Lucy plays the cornet. She is currently grade one standard but working to take Grade two. Lucy used to play in a brass group before moving schools. Long ago, Lucy learnt violin but her teacher died. At this point, her Grandma and Grandad bought her a cornet, after Lucy's Mother felt the violin didn't really suit her anyway. Lucy also played the guitar in year three. Her sister plays guitar and saxophone. Lucy listens to Justin Bieber and she has watched Olly Murs, Pharrell Williams and Littlemix (a girl band) live in concert.	Lucy is a very enthusiastic student. She is Interested in music and very confident, happy and chatty with everyone. Music plays a moderately important role in her life. Lucy and Piper are good friends and share their musical interests. They attended an Olly Murs concert together at a large Yorkshire arena.

Figure 6-1 Piper and Lucy's data records extracted from the participant information table.

The decision to use NVivo data analysis software amplified Cohen et al.'s (2007) concerns about maintaining participant integrity and wholeness in case reports. NVivo imposes a code and retrieve method and this, Bazeley (2013) argues, can mechanise coding as a drag and drop exercise. Consequently, the researcher can become distanced from their data and individual participant narratives. Fortunately, individual integrity was maintained by prefacing case reports with detailed information about each participant. Using this information, it is more possible to trace participant character traits through the case reports, even though findings are presented by issue, not participant. Additionally, when data sets were imported into NVivo, they were first coded according to each participant pair. This made it possible to maintain an understanding of what individuals 'said and did' in the software as analysis transited from participants' stories to emergent community themes.

At this stage, all data was contained within NVivo and consequently, data immersion could begin in earnest. Tracy's (2013) advice was heeded: this researcher submerged himself in the entire breadth of the data by reading, re-reading, beginning to interpret and loosely coding the data. Coding is defined here as:

> …the active process of identifying data as belonging to, or representing, some type of phenomenon. This phenomenon may be a concept, belief, action, theme, cultural practice, or relationship. (Tracy, 2013, p.189)

Initially, a strand of open coding strove to be primarily inductive. Comparable to Ezzy's (2002) experience, open coding strove to include considerable experimentation. A range of conceptual labels were coded to the data until a tentative coding frame emerged, which appeared to organize a community's data (Ezzy, 2002). At this point, themes began to emerge. Some of these themes were sub-themes which related to broader themes. The broad themes became what Tracy (2013) calls first level codes; they focused on 'what' was present in the data: e.g. tablet, teacher or student partner, for example. When data coded to these first level codes was reexamined, secondary themes emerged. These were categorised and organised to collectively represent larger key concepts (e.g. track-view editing) (Tracy, 2013). Once a coding frame existed for both community one and two, it was found prudent to amalgamate codes to ensure that, where appropriate, coding between communities was comparable. Reproduced below is an excerpt from the coding frame. It depicts iteratively developed coding themes, designed to answer what micro musical support the music teacher provided around and through the tablet computer and the external keyboard:

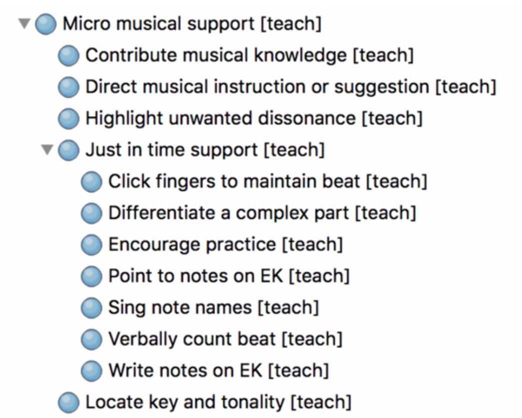


Figure 6-2 An excerpt from the coding frame. This coding indicates how the teacher (theme) offered micro musical support to participants (sub-theme).

The entire coding frame extended to seven pages and it revealed over 250 primary and secondary level codes. Using this coding frame, it was possible to ascertain how a tablet computer, music teacher, student and student partner influenced each community's creative musical action (i.e. RQs 1/2/3/4). Interview data was also included at this analytical stage. Meanwhile, RQ5 necessitated a very different analytic approach: one not driven by system dimension but by creative idea. In fact, a further two analytical stages and five coding cycles were necessary to answer RQ5 and they will now be introduced.

6.6.2 Stage two: Secondary coding for creative ideas

It has been determined that both community data sets were coded first by participant pair and then by iteratively developed themes and sub-themes. These themes related to the individual dimensions of the Activity System and their influence upon creative musical action. While data analysis by system dimension was valuable for RQs 1-4, such a strategy did not celebrate the full promise of Activity Systems. Namely, their potential to understand how different system dimensions symbiotically relate over time to achieve a situated goal (see 5.2 and 5.3). In this instance, the goals were creative musical products. Critically, RQ 5 sought to understand how a system of Activity initiated and developed these creative musical products over time. To answer this question, both community data sets required a secondary level of coding according to *creative idea* not *Activity dimension*.

Firstly, it was necessary to uproot large chunks of heavily coded data and place it into secondary analytical containers. Fortunately, NVivo permits any passage of textual data to be recoded to additional cases. Consequently, NVivo cases were used to contain all data relating to each creative idea. First, a new parent case entitled 'Creative ideas' was setup. Within that, a further case was setup for each participant pair. A range of sub-cases then sequentially listed the series of creative ideas/products which that pair produced. 35 creative ideas were coded to community one participants and 49 ideas to community two. Figure 6-3 reveals John and Botan's creative musical ideas as coded by NVivo case:

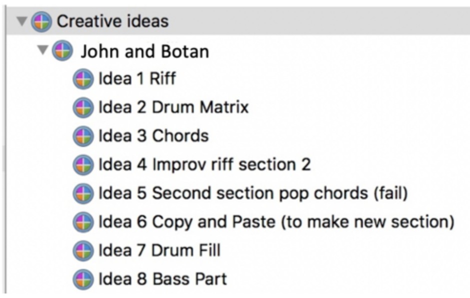


Figure 6-3 John and Botan's NVivo cases: their eight creative ideas.

Clicking on a case revealed data coded to that case. Coding for creative ideas was an overly subjective exercise. Decisions about what did and did not constitute a creative idea were sometimes straightforward and sometimes arduous. As a music specialist, it was typically obvious when students were developing a drum part, or a chord progression, for example. Additionally, all but one student pair worked upon one compositional layer at a time and they sequentially moved from one idea to the next. Each idea would be initiated by a student, the teacher (me) or tablet (or a combination thereof) and developed over time. Generally, each idea was recorded by the participants and this often punctuated when one idea was complete and another began. This said, Jackie and Mia (community one) preferred to work upon many tracks/ideas at once. Consequently, their Activity System was coded in terms of their phases of action, rather than by creative idea.

6.6.3 Stage three: compositional pathways

While coding for creative idea or phase, it was inductively discovered that for the most part, creative ideas were cyclic. They had a life cycle: a beginning, middle and end. Following this discovery, findings were iteratively compared to known theoretical models for creative musical thinking. Burnard and Younker's (2004) model of compositional pathways appeared to be a good fit because their flexible pathway concept made it easier to interpret the compositional pathway of each creative idea (see 2.2). Consequently, a third coding cycle was applied to every creative idea devised in both communities. The theoretically driven coding labels Find/Focus/Fix were especially useful to better understand the life cycle of each creative idea (Burnard and Younker, 2004). To ensure that my interpretation of the Find, Focus and Fix concepts matched, or was at least comparable with Burnard and Younker's (2004) interpretations, a matrix was created using some of Burnard and Younker's data (see Appendix G). The matrix also made reference to Wallas' (1926) and Webster's (1996; 1979; 2003) concepts of creative thinking. This was because Burnard and Younker (2004) built on these ideas to propose their own compositional pathway model.

6.6.4 Stage four: musical, technological and pedagogical knowledge:

Every creative idea the participant pairs developed was coded according to how that idea was initiated (found), how it was developed (focused) and how it was finalised (fixed). Once this coding was complete, data immersion continued. It iteratively emerged that the catalyst for how these creative ideas were found, focused and fixed was system induced, situated combinations of musical, technological and pedagogical knowledge. This finding demanded a fourth coding cycle. Cycle four coded for musical, technological and pedagogical knowledge and the practices developed will now be summarized.

Video-enhanced observation data coded to the 84 creative ideas was exported out of NVivo and inserted into tables. Coding responded to the definitions of musical knowledge and technological knowledge set out in the literature review (see 4.1). Pedagogical knowledge was ultimately defined as an interrelated, transient and situated set of pedagogical approaches. These were defined as dialectic (teacher-centred), emancipatory (student-centred) and dialogic (collaborative/shared-goal) (see 4.2). Despite these theoretically-driven concepts, the coding process was far from deductive. Coding also included induction and my subjective interpretations of the data as participant music teacher. This subjectively was borne out when Kirkham (2011; 2016) kindly agreed to review excerpts of this fourth stage coding. He rightly questioned the division of musical and technological knowledge (as does the literature presented at 4.1) and he also questioned some of my interpretations of his pedagogical knowledge framework (see 4.2). Given natural differences in constructed realities and background, some differences of opinion are to be expected. It is also right to admit that in almost all coding instances, a range of related knowledge was simultaneously observed. Therefore, any code applied was not absolutist: *the most appropriate code was selected to best describe my interpretation of that knowledge-based action*. Critically, source data is included and presented in case report tables for readers to make their own judgements about the nature of knowledge symbolised by the data.

This data analysis has now made explicit that data was analysed by dimension (theme), code (sub-theme), type of knowledge (influence and pedagogy) and stage of compositional pathway (find/focus/fix). The next analytical challenge was to understand how these system dimensions musically, technologically and pedagogically *interrelate* to influence the initiation and development of creative ideas *over time*. Part 6.6.5 will now introduce a visualization strategy which was designed to meet this challenge.

6.6.5 Stage five: visualising creative musical action in Activity Systems

The impetus to visualize creative musical action arose when textual modes were found inadequate to simultaneously reference Activity System dimensions and their emergent interrelational nature. Consulting journals, it was discovered that Tobias (2013) developed mind-maps of his participants' overarching creative musical processes. Using the maps, Tobias (2013) identified new patterns and relationships in his data and related these findings back to existing musical frameworks. Such an approach bore similarity to Miles and Huberman's (1994) extended discussion of data displays. Their network mapping concept was influential for both Tobias (2013) and the visual mapping format proposed here. Some examples of Miles and Huberman's (1994) network maps contain a time-ordered element. This enables the chronological, historical flow of a phenomenon to be presented.

The visualization format devised here created time-ordered charts for participants' creative musical ideas. The format ultimately chosen was required NVivo coding stripes to be heavily adapted. Traditionally, these stripes are vertically aligned with textual documents to graphically highlight how codes relate to source data. Knowing the approximate duration of each creative idea (from the transcript timecodes) it was foreseen that all coding relating to one creative idea could be visualized using coding stripes. Sadly, NVivo does not allow the coding stripes to be exported as a single entity and customisation of them is highly limited. After further investigation however, it was found that the stripes could be colour-coded. The first stage was to colour-code stripes by activity dimension: red (tablet workstation), blue (student partner), yellow (music teacher), green (student). That coding which related to compositional pathway (6.6.3) was colour-coded pink. Happily, NVivo made it possible to select which codes appeared as coding stripes. This enabled any erroneous or irrelevant coding schemes to be removed from the stripes. Given that coding stripes are locked to the vertical axis in NVivo, sections of stripes were then screenshot and rotated 90 degrees. This screenshot was the starting point for a chart. Charts ultimately included a title, duration and a key. Each stripe block was retrospectively numbered and these numbers corresponded to data ID numbers in the chart's partner data table. At a glance, these charts visualized:

•which Activity dimensions were in use at different stages during an idea's lifecycle;
•how Activity dimensions influenced creative musical action (via a text-based coding label);
•how Activity dimensions worked together at any one moment in time;
•how Activity dimensions were made use of in relation to the stage of compositional pathway.

This data mapping tool was ultimately used to find answers for RQ5. However, 84 charts were produced, one for each creative idea. Presenting these charts in case reports would be completely unfeasible. Therefore, a empirically-driven data reduction strategy was necessary to ensure that RQ5 could be feasibly but credibly answered.

6.6.6 Stage six: A data reduction strategy for data mapping

While it would be convenient for this researcher to select those creative idea charts which interested him and then forward them in case reports, the credibility of this research project would obviously be undermined. Accepting this, a credible data reduction strategy was required. Data reduction:

> …refers to the process of selecting focusing and simplifying, abstracting, and transforming the data that appear in written up field notes or transcriptions. (Miles and Huberman, 1994, p.10)

While data reduction processes took place throughout data collection and analysis stages, a reduction strategy was especially necessary at this stage, given the unfeasible quantity of visual and textual data which emerged in relation to the development of creative musical ideas. Just how an empirical strategy was developed will now be itemised.

A sixth and final cycle of data analysis was proposed to identify interactional trends within and between charts. This strategy intended to credibly reduce data, whilst also ensuring that interactional trends from both communities could be empirically reported. Memoing was used extensively at this stage. Benaquisto's (2008) advised that insights, ideas, patterns and connections should be noted down. When the memos were themselves analysed, it soon became apparent that visual charts belonging to both communities varied according to:

•which input modes were used to record the creative idea (e.g. microphone, external keyboard or touch screen);
•whether the creative idea was successful or whether it failed;
•the extent to which the idea drew upon primarily technological (e.g. copy and paste) or musical (e.g. playing a violin) processes;
•whether the idea was student-led, teacher-led or tablet-led;
•the musical interests and/or experience of the participants (e.g. a dubstep fan created a dubstep inspired composition);
•the community to which the Activity System belonged.

Based on these findings, it was empirically concluded that those charts presented in case reports must collectively represent:

• participant composers from both school communities;
• a diverse range of musical interest and experience;
•technological and musical processes;

- instances when individual system dimensions dominated creative musical action;
- those ideas which used different input modes to create content (e.g. external keyboard or touch screen);
- negative cases: when creative ideas failed.

It is clear from this sixth analytical cycle that the visual charts revealed in some detail how the ASF situated in two school communities influenced the development of creative musical ideas. Each chart selected for presentation satisfied one or more of the aforementioned, inductively developed data reduction criteria. Collectively then, all community defining trends were evidenced in case reports, in spite of this researcher’s personal preferences.

This chapter has now presented a methodology designed to credibly and ethically collect, analyse and present research data to better understand how the Activity System Framework (introduced in chapter five) influenced tablet-mediated, creative musical action in two school communities.

Chapters seven and eight will now present two case reports. They are formatted in alliance with the methodology presented here. Each case report will now introduce a school community and evidence how creative musical action was influenced by the cultural, local and personal forces found there.

Chapter 7:
Case report one

This chapter will introduce community one by presenting an account of its ten participant composers and their broader educational and cultural context.

Participants' formal and informal relationships with music (7.2); their school's ethos (7.1) and their regular classroom music curriculum (7.1.2) will then be forwarded as prominent cultural forces. These forces influenced the design of the fieldwork activity (7.1.3) and the nature of the creative products (7.2). Once this situated context is established, an account for how participants found (7.3) and developed (7.4) their creative ideas will be presented. Finally, newly developed charts will be introduced to visualise interactional trends believed seminal for understanding the situated, temporal nature of creative musical development in this community.

7.1 An independent, Quaker school for Girls

The setting for community one was a senior school for girls situated in North Yorkshire. The 290 strong student body consisted of local and international students aged between 11-18 years-old. The school was founded in 1785 by prominent Yorkshire Quakers. In accordance with Quakerism, students attended daily meetings in place of assemblies. Community members (e.g. students, teachers, caretakers) impulsively stood and spoke freely during a designated period of silence. Consequently, students developed a genuine empathy for the opinions and beliefs of others. This behaviour was reinforced though lesson plans which offered opportunities for collaborative, discovery-based learning. Lessons also responded to a school ethos which promoted equality, integrity, simplicity, care and service. This humanitarian emphasis was summarized by the school motto, 'Fidelis in Parvo', which translates as 'Faithful in small things'.

The Director of Music (DOM) explained that the student body promised guitarists, rappers and copious classical instrumentalists. Such a diverse population met the sampling criteria. The school also operated a tablet scheme and it required every student to furnish themselves with an iPad device upon entry to the school. This community-wide initiative ensured widespread enthusiasm and support for this tablet research project.

7.1.1 Director of Music

The director of music (DOM) was approximately thirty-years-old and full of enthusiasm for music. Her genuine love for rap artists such as Drake and Stormzy had implications not only for the type of curriculum on offer but also for how student relationships developed. She openly discussed and interpreted the music her students listened to and in return, students genuinely valued her input into their work.

7.1.2 Classroom curriculum

Nine months prior to data collection, I volunteered as a teaching assistant to develop students' trust and to support the DOM. Students aged between 11-14 years-old experienced three, fifty-five minute classroom music lessons per fortnight. Lessons broadly responded to the national curriculum for music (see DfE, 2013) but routinely moved off-plan in response to student need. Typically, the DOM created worksheets specifically designed to help students learn their favourite chart pop tracks. In essence, students preferred self-regulated learning activities which authentically connect to their broader cultural interests.

7.1.3 Fieldwork activity

A genuinely student-oriented classroom curriculum was thought a good ‘fit’ for this research project, which forwards the influential role of participants’ encultured musical habits and interests in shaping new musical behaviour (Burnard, 2006). To this end, participant pairs were encouraged to make use of the tablet computer to compose any music they like over a flexible number of thirty-minute sessions. From a pedagogical perspective, the initial aim was to set up open space for participants to agree their own goal and assign roles (Kirkman, 2016). Only then could I begin to support that goal by devising appropriate, more formalized support. Such an approach closely emulated the self-regulated learning styles students were expected to develop in classroom settings.

7.2 The participants and their music

A situated context for this first fieldwork cycle has now been established and a summary of participants’ musical experience, interests and their creative products will now be presented.

7.2.1 Jackie and Mia (Pairing A)

Year seven student Jackie played netball and listened to pop music whilst at the gym, especially that music released by Shawn Mendes. She preferred those music tracks which are ‘really subtle’ at the beginning and then become more powerful as they progress. Jackie was taking singing lessons but in her opinion, the classical music she was made to sing did not suit her voice. Jackie wanted to sing chart tracks. Even so, a grade one exam was imminent and she intended to take grade two. During fieldwork it was discovered that Jackie was ‘high energy’ and possessed a vivid, photographic imagination.

Year seven student Mia was a dubstep and death punk fanatic. She attended gigs and explained that dubstep artists adapt their music to a particular city or venue.

Mia enjoyed talking about how dubstep and death punk originated and she identified seminal artists. Mia called these artists ‘legends’ and used key terms such as ‘drop’ and ‘troll’. Mia did not play a musical instrument but she taught herself to use synth and launch-pad phone apps to imitate the styles she listened to.

Jackie and Mia’s tablet Activity began with an attempt to develop musical ideas for detailed narratives, as imagined by Jackie (phases 1 and 2). This was unsuccessful and the pair eventually yielded to Mia’s enthusiasm for dubstep and looping (phases 3-6). This said, every phase, apart from phase five, was ultimately discarded. For the fifth phase, the pair relied exclusively on the Live Loops interface to create music. They developed this content quickly and proudly submitted the work (CD track 1). Despite my interventions as teacher, the pair failed to record any self-inputted musical material.

7.2.2 Piper and Lucy (Pairing B)

Year seven student Piper was entrenched in the rap music of Drake and Stormzy to the extent that she imitated their verbal techniques and hand gestures. Piper could be a challenging student to engage so her DOM built upon their shared love of rap artists to build a meaningful relationship. Piper used to play the violin but she didn't like the scratchy sound and consequently, she took lessons in classical guitar. Piper enjoyed learning the guitar and she was keen to use the instrument during this project.

Year seven student Lucy played the cornet. She was grade one standard but working towards grade two. Lucy used to play in a brass group before moving schools. Long ago, Lucy learnt violin but her teacher died. She also played the guitar in year three and her sister now plays guitar and saxophone. Lucy listened to Justin Bieber and she had seen Olly Murs, Pharrell Williams and the girl band 'Littlemix' live in concert.

Piper and Lucy's compositional work was layered on top of a drum beat (idea 1/track 3). Major and minor chords (idea 2/track 4) and rapping (idea 3/track 5) formed the core of the work. Additional riffs were subsequently added using the external keyboard (idea 5/track 7) and Piper's own acoustic guitar (idea 6/track 8).

7.2.3 Nora and Aria (Pairing C)

Year nine student Nora was a dancer who listened to HipHop and electronic music because that music formed part of her dance routine. When not dancing, Nora listened to Drake, Zara Larson, Bruno Mars and Will.I.am. During the early years of her primary school education, Nora learnt guitar, violin, piano and participated in whole-class recorder performances.

Year nine student Aria listened to the same artists as her partner, with the addition of Justin Bieber. She enjoyed tennis and she also danced occasionally. Aria used to play the drums and her primary school taught every student how to play the flute.

Nora and Aria's dance composition began with two drum tracks (ideas 1 and 2/tracks 10 and 11), minor piano chords (idea 3/track 12) and a catchy piano-based riff (idea 4/track 14). The music ended with an exploding 'woosh' effect (idea 6/track 15).

7.2.4 Zoe and Emily (Pairing D)

Year nine student Zoe listened to Indie bands and guitar music. She had taken grades one and two on flute. During fieldwork, it was discovered that Zoe was a confident young person who enjoyed helping her friends in music.

Year nine student Emily listened to music in the top 40 chart and enjoyed tracks which included drums, bass and keyboard. Emily used to play the flute and sing. She achieved grade one in both. Emily's primary school music teacher made choral attendance compulsory. Consequently, Emily will no longer sing in choirs.

Zoe and Emily's music was characterised by a powerful bass riff (idea 4/track 23), a copy and pasted guitar riff (ideas 4 and 5/tracks 20 and 21) and an A minor/C major/G major chord progression (idea 2/track 18).

7.2.5 Hazel and Cora (Pairing E)

Year nine student Hazel listened to rap artist Drake and had some experience of playing the ukulele, piano and clarinet. She also sang and listened to the pop charts but preferred 'chilled-out songs'.

Year nine student Cora often assumed the role of group leader during classroom composing tasks. Cora listened to the pop charts, especially what's 'up there' at the top. She also listened to Drake, played a little piano and guitar. Cora was an experienced tablet user. She learnt how to use the GBIOS app at her local social club.

Hazel and Cora's composition (track 24) made use of texture, structure and digital technology to create a catchy, yet varied work. Primary creative ideas included a trance-like synth sound which was input manually (idea 6/track 28); a 'bass wah' loop strategically placed to build tension (idea 2/track 26); chords to fill out the texture (idea 5/track 27) and a catchy bass hook, which was introduced for structural variety (idea 8/track 29).

7.3 Community one searches for their creative ideas

The account at 7.2 of participants' musical interests and creative ideas will now situate reporting on how students, music teacher and tablet computer influenced the search for creative ideas.

7.3.1 The Student

The student drew heavily upon their own musical habits, interests and broader cultures to find creative ideas. They also developed passionate beliefs about what composing music means. These beliefs were acted upon when students took control of the activity, invented or adapted new ideas, experimented and developed goals.

7.3.1.1 Built upon their musical habits and interests

Students were inspired by artists, bands, songs and other out-of-school musical activities. These included concert going, dance lessons, the use of digital music technologies and one-to-one music lessons.

Piper and Lucy discussed how their shared interest in popular artists helps them to find a goal:

> P: In a way, when we first came in to do it, there was not really much ideas, we were just kind of sat there, thinking about what to write about.
>
> L: …We didn't know what to do.
>
> P: But then, we just thought about stuff that we liked…I quite like Drake.
>
> L: …Justin Bieber.
>
> P: Yeah and Stormzy because we quite like rapping. We just thought we'd do a bit of a cool thing, based on that.
>
> L: I think if we hadn't listened to a song before, it would be so much different.
>
> P: I think if we didn't listen to the music we do now, it would be really different.

Jackie explained that listening to different songs catalysed new ideas because those songs can be adapted to make new material:

> J: If we listen to different songs, if one is 'ding, dong' and the other is 'ding, ding, ding, ding', we kind of know how to change it because we can go 'dong, ding, dong, dong, dong'.
>
> T: So, you want to change what you listen to at home?

J: Yeah but we didn't want something completely different from that, so we're listening to what they're doing and we say 'we might be able to add that in somewhere and change it up'.

Dubstep enthusiast Mia identifies the tablet project as a way to integrate her musical interests into a school setting:

M: Well my goal was to add some dubstep, that's all I want. Because almost every single time we had a music lesson, we never did something that I liked.

J: …and if I didn't do what Mia said, I'd be killed!

Additionally, Jackie and Mia not only set out to replicate the Dubstep 'sound' but also the process through which the music is constructed:

J: There wasn't even a key to it, we kind of pressed loads of buttons and realised that it sounded really good. That's what dubstep is, you don't know or make something up [beforehand], you just press loads of buttons and it just works in your head.

M: Well, if you've ever been to a concert, where all these different DJs press random buttons and the crowd goes absolutely crazy.

Similarly, Hazel and Cora imitated the structures their favourite songwriters use:

T: How do you actually think about the piece then?

C: Well originally, we just searched around until we found something we wanted to do and once we got into it, we set it out sort of like a pop song, so you have an intro, a chorus and a verse-ish to go in there.

Zoe and Emily set out to include their favourite pop music instruments in their own music:

Z: I quite like guitar music, so we've got quite a lot of guitar in our music. I think that's where I sort of influenced it.

INT: How about you?

E: The drums probably because I like drums and pop music and I do like the bass as well…the keyboard as well. I listen to a lot of keyboard in the songs that I listen to.

Nora's love of dance ensured her group's composition was rhythmically interesting and performed in strict time:

N: …because I'm dance-y, happy and you find a variation of songs to use if you're doing a music project. For dance, you need to add rhythm and beat and everything, so that helps a lot during [this tablet] stuff.

INT: So, when you dance to music, that gives you that sense of beat.

N: Yeah and rhythm.

INT: Actually, your piece was really in time, like the chords, for example. You could dance to it. So maybe that was down to you dancing?

N: A lot yeah because I've been dancing since I was two years old, so I've obviously had the rhythm.

Nora also used touch-screen technologies to create her own songs out-of-school. During the tablet project, Nora and Aria listened to the 'build up' section of their new composition. Their heads were 'bopping' and Nora reached for her smart phone:

N: I'm just going to record it on my phone because I really like it.

Figure 7-1 visualises the moment Nora used her smart phone to record her group's composition, presumably for listening and sharing purposes:

Figure 7-1 Nora records her group's composition on her smart phone.

As suggested by part 7.2, a number of participants also took music lessons. For instance, Piper was learning classical guitar and consequently, she used that instrument to create a riff. Dubstep enthusiast Mia did not take music lessons but curated her own informal, self-taught musical curriculum:

> M: I don't really play an instrument but sometimes I teach myself how to use things but it's sometimes quite hard because the music I listen to is just sounds, according to my sister!...
>
> INT: Where do you look for that stuff?
>
> M: Well, using apps.
>
> INT: Playing instruments on apps?
>
> M: Yeah, just random like launch pads…some of them are good…I can't really name any.

Mia preferred this approach over classroom music lessons but others found those same lessons influential for their tablet composing. Zoe explained that her chords originted from the pop song 'Counting Stars', which was learnt in class. Similarly, Aria convinced her partner to use chords from the song 'Timber' by Pitbull, which was also introduced during classroom lessons.

7.3.1.2 Developed opinions about the composing process

Evidently, community members brought with them a range of formal and informal musical experiences. They also harboured a diverse set of opinions about what composing means. Jackie described a composer as someone who wears a suit and conducts an orchestra with a wand:

> J: Well straight away when you say composing, I can see a guy with one of those wands…I think of an orchestra with violins and piano and things like that. Then just a guy in a suit having a wand thing and composing music.

Partner Mia took a very different view. She perceived the composer as someone who *produced* music by *remaking* a song. That is, by remixing music live in front of a live audience:

> INT: What does composing mean…Could you give me a definition of what it actually means?
>
> M: Remaking a song…urm just being creative with it and going with the flow. They [producers] go to all these shows and stuff and sometimes, when they're in the middle of shows, instead of playing their normal songs, they will remix it and it's not like one you've seen already. You can't hear it [ever] again.
>
> INT: Would you call that a composition?

> M: Urm, well if you heard a remixed audio from a show, it's quite shout-y, so I guess that's why they don't put it into their album.
>
> INT: So, things really change in that live setting…It depends on the producer's mood?
>
> M: Yeah sometimes, it's really chilled. Sometimes they…you know dubstep often has a really hard drop…instead of making that drop, they mix a tune from a random song – that's called a troll…

Mia is explaining that dubstep composers disseminate music which is responsive both to their mood and the situated performance space. The necessity for personalisation was also important for Piper and Lucy. They believed that the music they write must connect to a style of music with which they are familiar. For them, composing in an alien classical style would not encapsulate what composing is about:

> P: In your music…if you're trying to write a piece about pop, I'll think I can just copy what someone else has done but if I've never heard of classical before and I try and do it, I feel like it wouldn't be more my own…
>
> L: …totally different.

Piper clearly responded to artists who communicated something of her own personality. For both Piper and Mia then, composing was an act of personal expression.

7.3.1.3 Took control

Such well-formed opinions about 'what composing music means' ensured that students were not afraid to ignore teacher advice and take control. Students deleted hard-won musical ideas, abandoned their work altogether in favour of starting over and used GBIOS is ways their teacher had not foreseen. These behaviours suggested a determination and commitment to their creative approach. Table 7-1 explains how students worked to seize control of their composing task:

Table 7-1 How community one students took control of their tablet-mediated activity.

Community: One			**Dimension:** Student **Finding:** The student takes control of the activity	
The Student…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…uses the app in their own way	2	C	Teacher recommends looping but Nora proposes a solution, which the teacher remains unfamiliar with. That is, extending the track by tapping and dragging it horizontally right.	1
…deletes key content	1	E	The students have deleted their main motif. It no longer appears in the track. For the teacher, this is the most musical aspect of the composition. It was forged between teacher and student, each adding their components to the finished motif. While the teacher is disappointed, the students are deciding how their work evolves.	4
…abandons composition	1	A	J: Can we make two and see which one is better? So here, the strategy is, create another piece in the same way. This is frustrating for the teacher, who would like to see additional skills developed.	3
…has determination	7	B;C;D;E	Nora is immediately focused and brushes off teacher chat to get on with the task. Learning a chord progression motivates Zoe. She moves her chair, sits up and focusses to play it in full.	2 1
…has an idea	5	B;C;D	L: We need to add words. P: But you were going to play your cornet and I was going to play my guitar…. P: I've got a great idea, watch me. [Nothing happens.] Then, Piper does break up a chord.	4 3
…extends duration of music	7	B;C;D;E	The participants now embark on another mass copy and paste to extend the duration of their music. This is fiddly work because all of the new tracks need to vertically align.	3
…makes a suggestion	1	B	P: I feel like it needs to be a bit louder.	3
…upholds high standards	2	B;C	Piper has high musical standards. The second note of her guitar pattern is quiet (she likely played it with less force than the other notes). She exclaims: Can we go again?	4
…progresses by trial and error	2	E	Cora begins to expand her melody, adding additional notes after the initial 5th interval. Through a 'trial and error' approach, Cora settles on a genuinely catchy hook.	2

The table indicates that participants made sure they were influential during tablet-mediated, creative musical activity in order to realise their personally-held musical desires.

7.3.1.4 Invented narrative or other content

During Jackie and Mia's first two phases of creative Activity, Jackie extended the take control concept by assuming responsibility for the invention of her group's creative ideas. Jackie's ideas assumed the form of detailed stories, which she invented:

> J: We could put it from the wolf's prey point of view, so it will be nice and peaceful for the deer's point of view. Nothing is wrong and then suddenly he [the wolf] hears something like [plays two low notes on the keyboard at random] and then 'What's that?'.

These ideas were soon discarded in favour of a dubstep composition. At this point, Jackie continued to determine creative ideas:

> The students find a 'wa wa' bass line (classic dubstep).
>
> J: I think we should start off with more this, because it's got more of a beat.

Piper and Lucy's goal to create a rap also required them to invent content. Their first session finds them creating lyrics (track 5):

> Piper picks up the microphone.
>
> P: We need to make up some lyrics.
>
> L: [Singing.] Sunshine's and rainbows [giggles].

Nora tapped a drum pad in GBIOS to create a backing beat, which she used to create a vocal hook:

> Nora sings a catchy hook melody, while tapping the drum pad. An interesting use of the app to facilitate a live, improvised performance.

Students also set out to create 'something different' in their work. Jackie explained that, 'other songs are quite repetitive, we wanted to make it different'. Her pair discussed their ideas and while Mia searched for a theme, Jackie was more concerned with developing a contrasting structure for their music:

> J: Right, so. We need a theme.
>
> M: Futuristic? Robotic?
>
> J: What about something quiet, then BOOM, then quiet, then BOOM!

Piper also invented something unexpected for the ending of her music. She recorded herself shouting 'drop the mic'. This was an idea her teacher would never have imagined and one likely influenced by the rap music Piper listens to.

7.3.1.5 Adapted existing Ideas

While ideas *were* invented by the students, they were also adapted from those materials available in and out-of-school. Nora decided to reuse a fragment from the song 'Timber' (the notes C, A, G, A) and then repeat an adapted version of this motif throughout her work. Emily and Hazel discovered that the Live Loops interface actually suggested musical ideas to them, which they adapted for their own purposes:

E: I think it's almost like, if you're listening to those sounds…It's like the Live Loops, I've listened to some Live Loops on the app and you can recreate the sounds and then adapt it and then you can even go on to make your own kind of sound with it.

H: I think we started by seeing what loops we could find on the app and then we sort of got inspired by them, made our own loops and chords and stuff.

Hazel and Cora also searched YouTube to find ideas and inspire their composition:

H: We listened to Drake, I think but that was about it. We did that on the tablet. We went on YouTube.
INT: Did that help?
C: It inspired us.

The student community also adapted the music teacher's chords, melodies, lyrics and structures as detailed by table 7-2:

Table 7-2 The students' adaption of their teacher's musical ideas.

Community: One			**Dimension:** Student **Finding:** Students adapt the teacher's ideas	
The Student…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…adapts chords	6	B;D;E	Cora is playing a new, repetitive note motif, based upon the teacher's chords.	6
…adapts scale, melody or riff	7	B;D;E	The teacher suggests that Piper repeats an A pitch. This is a response to her guitar experience, which is melody and not chord based…Piper then develops a small melody based around the pitch A. She uses the notes A C B G A.	4
…adapts lyrics	2	B	New lyrics added 'Put your hands in the air like you just don't care'. The teacher's lyrics have now been extended/adapted and it is long forgotten who instigated the lyrics and the rap creation process.	2
…adapts structure	1	D	Now Zoe suggests her own idea by inserting a G major chord. Seemingly, the teacher's initial structure has led to a new idea.	1

Evidently Jackie, Mia, Hazel and Cora did not adapt their teacher's ideas. Presumably these ideas were not sufficiently compatible with their loop-based musical goals.

7.3.1.6 Experimented

Students experimented with acoustic instruments, tablet-based drum parts, loops and timbres. During her fourth tablet session, Piper found a new way to make use of her acoustic guitar:

Piper experiments with some hand taps on the guitar body. Lucy tries out the same thing from her seat, leaning over to tap the guitar. Lucy invents a rhythm which Piper likes.

The GBIOS drum matrix and drum pads also proved ripe for experimentation. Using the drum matrix, Cora persistently moved drum icons around to vary their complexity and dynamic. Hazel tapped every drum pad once to audition the timbre.

Instrumental and sample auditioning also led directly to the discovery of new ideas. Jackie and Mia experimented with a range of audio effects such as 'robot' and 'sci-fi'. These effects distorted the sound of the human voice in such a way that general hysteria broke out. Cora also experimented with the keyboard synths to try out an idea adapted from her teacher:

Cora loads the standard keyboard interface and is soon experimenting with timbre at the external keyboard. She taps through synths, while playing variations of an A minor chord modelled previously by the teacher.

Nora and Aria chose to work methodically through the app's range of virtual instruments:

N: I like it. Now piano, or smart strings?

Many different instruments are loaded and much experimenting (tapping the screen) takes place.

Zoe and Emily experimented with on-screen amp simulators to enhance their guitar melody. These virtual audio effects infused the guitar melody with a more distorted, driven sound.

7.3.1.7 Developed Goals

Students were found to have independently developed compositional goals prior to enrolling onto the tablet project. Jackie admitted that initially, she wanted to create a piano-based, melody-driven composition:

> J: I [originally] wanted to make something like on the piano, maybe something like a normal tune but then I realised that I couldn't play piano for a start and it just wasn't really working. Then, Mia saw some dubstep and I tried playing and messing around with it and then, yeah.

Nora, Aria, Piper and Lucy also came to the project with a goal in mind:

> L: Well we had an idea to start, which was just writing a pop song, didn't we?
>
> N: Well, we came with the idea that we were going to do a song but we didn't know it would turn out this good.

Other students also devised goals but they emerged over time. Hazel described how her group's goal to compose a piece of beat-driven dance music emerged as their composition developed:

> INT: You say you didn't have a goal to start with – did that change, as you worked through?
>
> H: I think as we developed it, it sort of went like this. We wanted to develop [the piece] by putting more of a beat in, or something different.
>
> INT: So it became clearer as you went along? By the end then, what do you think you ended up with?
>
> H: Sort of a bit like dance music but sort of pop music.
>
> C: I think if it had vocals, it could be like one of the songs that we listened to.
>
> H: Yeah.

Given the range of musical experience that participants brought to their tablet music project and their school's focus on independent thinking, it is perhaps unsurprising that students worked hard to impose something of themselves upon their tablet-mediated activity. 7.3.1 has suggested that students imposed their will upon the system by developing goals, experimenting, adapting or inventing ideas and by building upon their musical interests and opinions.

Now this report will be expanded to review how the tablet computer supported or impeded those same students as they searched for musical ideas.

7.3.2 The Tablet

Field observations and participant accounts identified that the tablet computer's bundled media stimuli, virtual instruments, external keyboard and the visual layout of the track-view screen influenced the nature of musical ideas. Participants also developed passionate opinions about the tablet's role in this process and these perspectives are presented at 7.3.2.2 and 7.3.2.3.

7.3.2.1 Initiated musical ideas

The audio-visual stimuli preloaded onto the tablet by the researcher was broadly influential during some early tablet sessions. Jackie and Mia reacted against it:

> INT: Did you use any of the included media on the tablet – pictures, videos?

> J: We looked but none of them really kind of matched with what we were thinking and what we wanted to do.

Hazel and Cora watched a preloaded video which depicted a teenager using GBIOS to layer up an Adele song. They intensely focussed upon which virtual instruments were in use and how they were played.

In fact, the app's virtual instruments were a source of musical ideas for the whole community. The drum matrix interface was especially popular, to the extent that every participant pair with the exception of Jackie and Mia, experimented with that interface during their first session. Zoe and Emily's gestural behaviour was typical. Figure 7-2 captures them simultaneously dragging drum-kit icons onto the matrix screen:

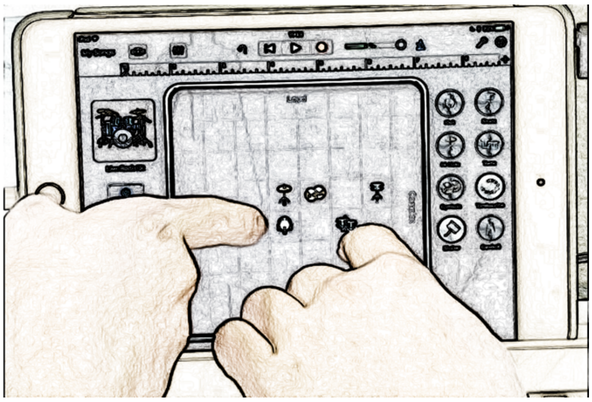


Figure 7-2 Zoe and Emily determine the volume and complexity of their drum kit part by simultaneously dragging drum kit symbols around the GBIOS matrix interface.

Cora was equally determined to manage the role of the drum matrix in her composition. She made a range of rhythmic and timbre changes based on cycles of focused listening:

> Cora changes the drum matrix sound set to 'electronic'…She drags drum parts onto the screen and makes tiny changes to their position on the grid. After each change, she freezes for a number of seconds to listen to the impact of that change.

GBIOS contained additional drum interfaces such as 'drum pads' and 'Kyle', which participants also selected to find drum beats. The audio recorder, live loops, smart guitar, piano and strings interfaces also influenced musical ideas. A tabular review of this interaction is presented below as table 7-3:

Table 7-3 The virtual instruments and their influence as selected by community one participants.

Community: One			**Dimension:** Tablet **Finding:** Virtual instruments influence musical ideas	
Participants are influenced by…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…the drum matrix	16	B;C;D;E	Nora loads the drum matrix. Both students drag drums onto the matrix and Nora begins to become 'entranced' by the music. Head, arm and hand gestures accompany the listening.	1
…the drum pads	11	B;C;D;E	Experimenting with the drum pads. It's decided by everyone to make use the drums pads to add extra percussion parts into the music. This goes wrong and Zoe panics.	1
…Kyle the drummer	6	B;C;D;E	Because Cora tapped on 'Kyle' earlier in the session, two completely automated drum parts have appeared in the track-view.	1
…the smart acoustic guitar	4	C;D	Aria loads the smart acoustic guitar and experiments by strumming chords on screen. Zoe and Emily scroll through instruments. Smart guitar is selected. Chords and strings tapped.	3 1
…the smart electric guitar	6	B;D;E	Piper finds the smart electric guitar and taps the interface.	1
…the smart piano	16	A;B;C;D;E	N: Piano, do you think? The smart interface allows three note chords to be triggered with one finger. Nora decides the rhythm. The overall effect is powerful.	1
…the smart strings	5	A;D;E	Jackie loads the smart violin and experiments with a few notes to represent 'running'. Zoe tries to find something for Emily to get involved in. They discover the synth strings and the teacher introduces plucking the strings on-screen.	1 2
…the audio recorder	7	A;B;E	The students now discover strange vocal effects such as 'robot' and 'sci-fi'. General hysteria takes over…Play fighting takes places as they 'fight' to control the tablet.	2
…the live Loops	17	A;E	Hazel and Cora remain determined to use automation. Cora appears to lose control, tapping many, many loops, over a duration of seven minutes or more. The teacher is disappointed. T: Do you think there is any musical value in loops? H: Yes, because you are able to see what goes and line it up.	6

Despite their evident use, the virtual instruments were not universally welcomed. Lucy and Piper preferred to use the external keyboard (EK) to find musical ideas, as it offered them a more authentic keyboard experience:

> L: [The tablet]…helped me compose by having so many instruments to choose from…It was quite good that it was connected to the piano. That was quite clever because you don't want [to use] the piano on there [the tablet]…
>
> P: …because it's too annoying. When you do it on your iPad, you don't actually feel like you are doing it in real life and I feel like I wouldn't learn how to actually play it [on a real piano].

In fact participants used the EK to find or learn chords, develop or revise ideas and experiment with this tablet-connected instrument. In terms of learning chords, the EK made it possible for Cora to include chords in her work, even if they were suggested by the teacher:

> T: Have a go at that then [teacher hands Cora a hand-written chord chart]. Each chord is play-miss-play…If it has a flat sign written by it [pointing to the 'b' symbol], that means it is a flat or black note.
>
> Cora accepts the teacher's resource and uses the tablet as a music stand to learn the chords outside the app interface.

Figure 7-3 visualises this moment:

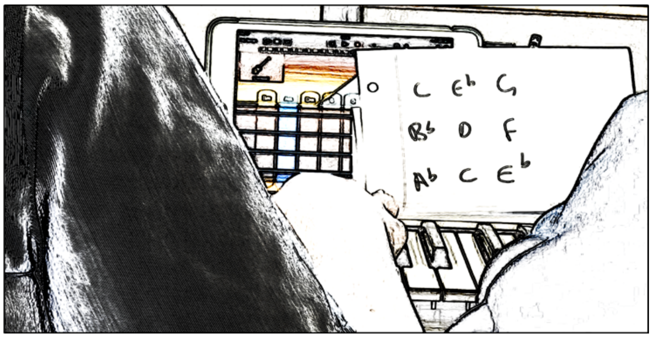


Figure 7-3 Cora finds chords at the external keyboard as indicated by her teacher's chord chart.

Table 7-4 records the broader ways in which the EK influenced creative ideas. In addition, the keyboard's potential to influence experimentation and the development or revision of ideas is presented:

Table 7-4 The external keyboard and its role in finding musical ideas.

Community: One			**Dimension:** Tablet **Finding:** The external keyboard is a musical influence	
The Student…	**Coding Count**	**Pairing Code(s)**	**Seminal data extract(s)**	**Obs. Session**
…found chords	8	B;D;E	Zoe is playing an A minor and C major chord. Lucy practises the chords on the external keyboard. Zoe relearns the chords in order to make use of the synth strings timbre. Emily successfully plays the A, C and G chords using the synth strings timbre.	1 2 2
…developed ideas	4	A	Jackie plays two C pitches an octave apart and then enlists her partner to add extra unplanned notes in the bass part. J: That actually sounds quite good! Jackie plays a pop melody using a synth lead and then adapts it to create her own melody.	1 4
…experimented	7	A;B;D;E	The piano virtual instrument is loaded (non-smart) and Piper and Lucy play random keys on the external keyboard. Jackie is back using the synth via the external keyboard. Her musical material is ever-changing and unplanned. There is no tonality, or wider goal.	1 4
…revised ideas	10	A;B;D;E	At the external keyboard (now making a guitar sound), Emily plays the chords for 'Someone Like You', by Adele. Cora loads the electric guitar interface. She now plays the chords, which she already recorded last time.	1 4

In concert with virtual instruments and the EK, the primary track-view screen helped participants to visually determine the structure of their work. Hazel and Cora explained how track-view proposes new musical possibilities and helped them to plan out their composition:

> C: I liked the home screen [track-view], when you see what you've done and you can line things up with chords and then add things in and see when they line up.
> INT: How did that help you? To see everything?
> C: I think it did because we could add in the choruses and the verses.
> H: …and we could see which bits were empty and then maybe, we could put more bits in there.

Zoe and Emily's composition featured two sections but the tablet screen revealed a sizeable gap between them. Interestingly, a drum solo was devised for that space and this structural pattern was replicated to create future sections. Again, empty space was 'filled-in' with musical material, which in turn determined the structural and textural nature of Zoe and Emily's music.

7.3.2.2 Impeded musical creativity

The tablet computer has been found to influence the rhythmic, harmonic, melodic, timbral, structural and textural nature of the musical ideas participants find. Even so, participants believed that the performance-enhancing design of the GBIOS app impeded the musical and technological aspects of their creative process.

Jackie and Mia found that GBIOS had the potential to offer unmusical experiences:

> INT: Do you think you learnt any musical skills?
>
> J: Urm no.
>
> M: Not really because you are pressing buttons but when it comes to producers, I feel that they actually do the same but like better.

Even when participants *chose* to work in musical ways, the tablet remained unaware of that behaviour. For example, there were no consequences for when students input music that bore no harmonic resemblance to their existing tracks. In Jackie and Mia's case, the harmonic complexity of the automated Live Loop content made it impossible for the teacher or student to invent a musically compatible part:

> Sadly, the melody doesn't really work with the loops. In this case, the merging of technology and humans hasn't proceeded well. There appears to be too much automation and any attempt from student and/or teacher to invent a musical part that 'fits' the looping material has, so far, failed. To Jackie's credit, she uses her ear to identify that the recording attempt was unsuccessful.

Jackie and Mia also selected the external keyboard to try out bass chords and a high-pitched melody. Sadly, these ideas clashed in both the rhythmic and harmonic sense and the tablet's lack of musical intelligence became evident. When Hazel and Zoe answered questions on this issue, they protected their right as composer to exercise choice:

> Z: I genuinely don't think they [the app] could judge whether a piece of music was good or not because it's personal preference. I might like a song and you might hate it, it's just personal preference. So, I think it's actually impossible to have it.
>
> INT: Do you think the app could have told you when your work was finished? Or, is that up to you?
>
> H: I think that's up to us. Music can be however long and however short but it can still be finished, no matter what the length is, or how many instruments you have in it.

Nora agreed and consequently took responsibly for her own creative process. She explained that '…you have to make your own mistakes and try and learn from them yourself'. Zoe's partner Emily, warned that any tablet feedback might actually detract from this process:

> E: …if somebody thinks that music is good to them and then the app says 'no, now do this, this and this', then that person might get disheartened by that. If you're going to get disheartened, some people take things the wrong way and they just give up a bit more on it and stuff. So, I don't really agree with giving the feedback.

When the tablet did make tacit suggestions via its instruments and sound-based resources, they were found to be generic and not unique enough. Mia enlarged on this issue:

> M: Well there were sounds there [on the tablet] but sometimes when I look at dubstep, I notice that some artists use their own sounds, or like they have at the beginning of the song…It's kind of their signature. It's an audio. Someone's saying it in a way that goes with the song but you know who the person is and who made that song [just by listening to it].
>
> INT: You thought that was missing from yours, a unique signature of you both?
>
> M: Yes.
>
> INT: Do you think the app would have let you do that, if you'd have wanted to?
>
> M: Well, not really. I know you could record your voice and stuff but the way they [dubstep artists] do it, I don't think they would use their own voice.

Hazel and Cora experienced a similar lack of customisation. Even though they 'liked' the loops, they could not 'tweak' or 'fade' them to meet their musical aims:

H: I think maybe I quite like some of the loops but maybe if we could tweak them.

INT: So, more freedom on loops?

H: Yeah and obviously fading on them, or whatever.

INT: So, you were looking for more control?

H: I quite liked some of them but…

C: ….there is always something more you could do.

Piper and Lucy found that the tablet does not offer them sufficient percussion or brass instruments:

L: The only thing they could have, is a trumpet or something like that.

P: Yeah, if there was brass but you need a trumpet on its own, like a bit of a blown instrument.

L: You could add in, what are they called, you know you can have these like little percussions, you need more percussions. I know they've got the drum features but that's not enough. You could add the sound of a frog maybe, I don't know.

Lucy also found that the tablet did not authentically replicate musical experiences from the real-world:

L: I feel like in real life, you learn so much more. Like on here, you just go [tapping screen]. You look at it and go 'this is just not real'.

INT: So, the interface is not helping you progress musically?

L: No, not really.

INT: Why is it [the tablet interface] not real then?

L: It just looks fake and it just doesn't…

Additional to questionable methods of musical input, instrument choice, customisation and correction, participants found the tablet *technologically* impeded their musical creativity. Nora and Aria compared GBIOS to other apps and found its inbuilt help lacking:

INT: Do you think the app could have done more to instruct you how to write a piece?

N: It should have showed you at the beginning, I think.

A: Some apps, when you open them for the first time, say like 'this button does this'.

Such technological guidance *was* needed because some participants found the button icons ambiguous in their meaning. Piper and Lucy explain their failure to understand the Fx and metronome buttons:

P: Well it was like how you had to sometimes…you know how there are little buttons at the top…

INT: Are they too small then?

P: Well I just get confused between them.

L: Which ones are which. They could maybe say words on it.

P: The ones with the little things on them [pointing to iPad].

INT: The sliders?

P: Yeah, those are quite obvious but I didn't know what 'Fx' is and I don't know what this is [pointing].

L: I don't know what that is either.

INT: ...ah the metronome icon but it's not clear to you is it because I know what that is because when I was young, metronomes looked like that. They are those things in the practice rooms which tick.

P: Oh yeah!

Lucy also struggled to understand app functionality and she found the tablet's touch screen inadequate for musical input:

INT: Did the tablet hold you back and limit your creative freedom?

L: Yeah because sometimes, you didn't know what it means and you didn't know how to…it's also a bit fiddly and it's not massive.

> INT: Do you think tapping is the best way to write music?
>
> L: No! Mouse.
>
> INT: Why?
>
> L: I think mouse because you know how many bars you want, then you can move it [musical tracks and structural elements] and it's easier to drop it somewhere if you are trying to hold something [drag and drop].

Dragging and dropping content in track-view did pose difficulties and tracks easily moved out of alignment. This was frustrating for participants, as the issue impeded students' creative progress. The touch screen also invited forms of interactive behaviour which were not always conducive to learning. 'Fights' to control the tablet screen were surprisingly common. Figure 7-4 depicts Jackie and Mia, as they apply their full body weight to force each other's hands away from the screen:

Figure 7-4 Jackie (right) uses her elbow to push Mia's hand (left) away from the tablet screen.

An account for how the tablet impeded community one's musical creativity has now been presented. In comparable terms, the tablet was also found to enhance participants' creative opportunities. This influence will now be reviewed from 7.3.2.3.

7.3.2.3 Enhanced musical creativity

Despite musical and technological barriers, participants also discovered a range of creative opportunities during their tablet partnerships. These included the opportunity to compose multiple layers, use an external keyboard and access sonorous inspiration. Participants also developed a range of creative skills. They learnt how songs were made, how musical structure can work and how popular music production techniques can be imitated. The tablet also mediated the initiation and development of creative ideas.

Zoe and Hazel found the tablet made the process of musical creation easier and quicker, as compared to acoustic instruments:

> Z: … it's not necessarily a short cut but it's easier than having to go playing it on the drum kit over and over again. You can just click things and play around with it quite easily, so it does make the process quite a lot quicker.
>
> H: I think it's easier because you can record it straight away. With piano music or whatever, you have to figure out what notes they are and where to put your bars and stuff. Therefore, I think it's easier to put your music down on the app, than it is to write it down.

In addition to this performance-enhancing support, some creative freedom remained. Hazel described how the drum matrix enabled her to both find an automated drum part and then to retain sufficient creative control over it:

> H: I think it was sort of cool how you could pick an instrument and it could automate stuff for you and I liked the fact they had a drum pad [matrix] where you could add [percussion] instruments. [You could] see how complicated you want your beat, or how loud it was. I quite liked that and I think that was one of the main things we used.

During session five, Hazel's partner Cora also manipulated pre-loaded audio samples:

> C: Wow! Wait, look at this.
>
> Cora discovers a window where loops can be manipulated in real time, with a number of pads and buttons. One pad transforms the bass drop, so that it intermittently cuts out on every quaver beat. This intensifies the effect of the drop loop in the texture.

When this loop was played in track-view, Cora gestured vertically-oriented patterns with her finger. If the record button was tapped, the manipulation commands were captured permanently. Figure 7-5 depicts Cora playing the loop and deciding on her manipulative gestures.

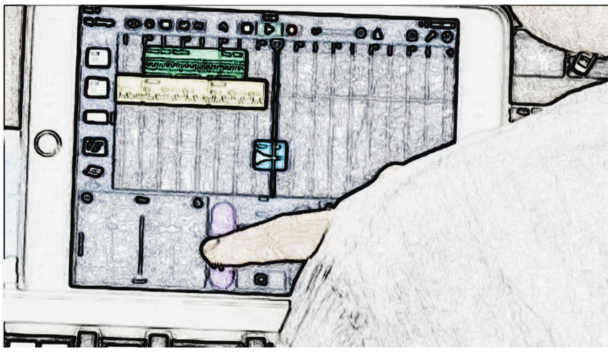


Figure 7-5 Cora discovers a way to manipulate loops in order to fulfil her musical goals.

The ability to manipulate pre-loaded content proposed new musical possibilities. Nora and Aria manipulated the automated Kyle drummer to ensure they 'got the rhythm more' when they recorded in other parts. Mia, Emily, Hazel and Cora found that the pre-loaded loop library inspired new stages of creative endeavour:

> M: You kind of listen to the sound and come up with it and you might listen to a loop, then put it on another instrument and see how that sounds.
>
> INT: So by hearing the loops on the app, you are forming ideas?
>
> M: Yeah.
>
> E: It's like the Live Loops, I've listened to some Live Loops on the app and you can recreate the sounds and then adapt it and then you can even go on to make your own kind of sound with it.
>
> H: I think we started by seeing what loops we could find on the app and then we sort of got inspired by them, made our own loops and chords and stuff.
>
> INT: You started with the automated parts then?
>
> C: We found what we liked and then based the rest of it around that.

Participants evidently found pockets of opportunity to creatively manipulate heavily automated aspects of GBIOS. Participants also explained that GBIOS offered broader creative freedoms. Jackie commented that 'if we wanted to add a sound in that wasn't there, we could have just made it up ourselves'. Similarly, Lucy believed that the external keyboard allowed her to remain 'free' throughout the process:

> L: …you can be 'free' and just do whatever you want. It doesn't stop you from playing the [external] piano, whereas some apps would.

Nora found the range of timbres or 'sounds' enhanced her creative potential:

> N: There are so many different sounds on GarageBand, so it's creativity again because you choose which sounds you want to go with your piece, so it's giving you that freedom.

In addition to the creative possibilities participants have identified, they also developed as composers during their tablet partnership. Mia, Piper, Lucy, Hazel and Emily found that when they partnered with GBIOS, they learnt how songs are made:

> M: Yeah it was like a new way to discover music. Well, not really discover but see how the music I've been listening to for like five years now, is made, how it's made.
>
> P: It's made me think about how you can compose your own music and like [how] to make up your own melodies and stuff and I can use my guitar as well.
>
> L: I thought that you made a song by sitting around a piano or someone playing a guitar and then writing the song on a piece of paper but…
>
> H: Yeah. I don't think people realise how hard it is, until they try it out because it's not easy putting stuff together.
>
> INT: Even when it's automated?
>
> H: Yeah. You have so much freedom, I don't think people realise that as well.

Tablet partnerships appeared to reach their zenith when GBIOS provided opportunities for creative freedoms within the security of its imposed musical and technological framework. Nora and Aria carefully selected automated content to accompany their own chords. This blend of student and tablet-owned content helped the pair achieve an outcome whilst they simultaneously maintained a sense of ownership over their work:

> N: Yeah because we've done most of it but we just used a bit of the automatic to help us but obviously, we have picked the automatic out but there are loads of different automatic ones. So, we still had a choice for that to be in our song, it's kind of still ours.

Findings presented here explain how the tablet computer mediated students as they set out to find their musical ideas. 7.3.3 will now present an account of how the teacher worked alongside the tablet and student partners to ensure new creative ideas could be found.

7.3.3 The Teacher

The teacher devised support strategies which responded to students' situated musical trends and interests. The teacher also influenced the broad musical direction of students' compositions and managed the Activity's pedagogical discourse. A more detailed account of these behaviours will now be presented.

7.3.3.1 Connected learning to students' musical cultures

When fieldwork began, the head of music provided me, the fieldwork music teacher, with brief anecdotal accounts of participants' musical abilities and interests. This enabled me-as-teacher to better connect the tablet project to participants' musical worlds. During the first ten minutes of session one, Piper was convinced to bring her guitar to school:

T: Maybe bring your guitar in, sing over that and then maybe some piano and bass? You can do anything you want really, that's the whole idea.

Emily spontaneously played chords for an Adele song at the EK. The teacher attempted to connect this performance with tablet creativity:

T: Could you use those in your song, or something?

Emily and Zoe summed up their teacher as someone who provided technological (e.g. app features) and musical support (e.g. chords). Importantly, the teacher also remained unanimously enthusiastic about *their* musical journey:

E: Yeah because I think you helped us quite a lot with some chords and stuff. You showed us how to work the app and find drum kits and stuff.

Z: I liked how you were enthusiastic about what we had created but also gave us help and inspiration. That's what I enjoyed about having a teacher here.

Beyond these musical, technological and social influences, the teacher was also required to manage the system's pedagogy. An account of this requirement will now be presented.

7.3.3.2 Managed pedagogical discourse

The primary issue for the music teacher-researcher became how to balance the necessity for imposed structure with opportunities for creative freedom and/or collaboration. Structuring creative action was found both a necessity and unhelpful in equal measure and accounts of this symbiotic tension will now be presented. Hazel and Cora believed that teachers *should* set goals for students and introduce new technology to them:

C: Maybe they could set a goal but that's about it. I don't think they could do anything else.
H: I think they could set a goal but maybe teach you like a few bits about the app. That's pretty much it.

Mia believed that these interventions were especially important when students were unsure of how to proceed:

M: If you have no idea what to do, if nothing is going on in your mind, you should ask, tell them about it and maybe they could give you more advice on that.

Students also spoke out when they struggled to find ideas. Zoe found a gap in her composition and asked the music teacher for ideas. Piper struggled to invent lyrics and her teacher offered advice:

P: I don't know what lyrics to do.
T: It can be anything. Would you like a pen and paper?
P: Yes.

Teacher intervention was welcomed here but participants also found goals restrictive, sought out opportunities for independent thought and believed too much structure damaged their morale. Mia, Piper and Lucy explained that a fixed brief (or goal) was not creative and might not 'work out well':

INT: Would having a brief restrict your creativity?
M: Yeah, I can see that happening because you may not be interested in that type of music and you may not know a lot about it and if you're not interested in something, not too happy in doing it, it just doesn't work out well.

INT: Would you like to be given a brief? Say, 'compose me a piece on…'?

P: No because then I'd feel like we weren't doing it ourselves, like not being creative.

L: If it was a lesson, then maybe but not all the time.

For Lucy, structure was associated with institutional settings and its use had to be appropriately timed. Meanwhile, Nora's sense of achievement originated from a belief that her pair created music 'on their own':

N: Overall, I'm really happy with what we've accomplished. I think it's quite cool and I like the idea of how we did it on our own.

Participants explained that there was a balance to be found. Nora, Hazel and Cora welcomed teacher intervention but believed that the decision to act on teacher support should be theirs:

N: I think you should give some idea but not do it for them. They give ideas but you don't have to do what they say.

INT: Do you think teachers should give you short musical phrases, for you to use?

C: You can always do that but if you don't agree with it, you can always just carry on anyway.

H: Like they can offer their advice but you don't necessarily have to take it.

Lucy and Piper also forwarded the issue of student choice. They explained that the teacher should 'show and help' only when needed:

L: If we ask…I think it might be a bit too far but we should have the choice of asking. Maybe they could help us fine tune a melody but if they [the students] don't ask, I wouldn't because they want to be free and do what they want.

P: It was good that you weren't being really into it with us. You weren't really helping us, if you know what I mean because we wanted to do it ourselves but you were there if we needed. You would show us and help us and how to learn.

L: We asked you for ideas, you need someone to ask for ideas, if you're stuck.

P: But you weren't helping us so much, that it wasn't us anymore who was doing it.

Participants clearly expected to retain some creative autonomy. This required well-timed, community-situated musical and technological interventions, which responded to and did not determine student behaviour.

7.3.3.3 Shaped the broad musical direction

Observational data suggests that early musical intervention from the teacher could influence the broad musical direction of students' work. The teacher might have suggested an idea which had the potential to set a creative musical Activity in motion. These types of musical interventions typically took place at the start of tablet sessions.

T: How about a rap then?

T: OK let's have a bass melody today?

T: You could have that at the end of a section?

T: Where are we at then? Are we going to add more parts?

A more student-centred approach was soon devised and it achieved a similar purpose. The approach involved probing for ideas:

T: Any ideas?

T: So, what are you thinking now?

J: I'm kind of thinking spooky now.

T: So, what are we doing then?

7.3 has presented findings which suggest that students' creative ideas were a response to local influences, such as those mediated by their music teacher or tablet computer. Simultaneously, ideas also responded to personal, cultural influences, which included students' listening habits and their broader assemblage of formal and/or informal musical activities. 7.4 will now report on how community one developed their creative ideas during tablet-mediated creative musical Activity.

7.4 Community one develops their creative ideas

An account for how community one students found their creative ideas has now been presented. But how does this community develop those creative ideas to ensure that musical products are produced? 7.4 will now suggest that a plethora of musical and technological influences, from the student partner, teacher and tablet, influenced the development of this community's creative ideas.

7.4.1 The Peer

The necessity to develop creative ideas awakened student partners and they became influential mediating forces. In this community, peers largely became more influential only once a broad musical direction had been established. That is, once a goal was accepted and key creative ideas found (see 7.3).

7.4.1.1 Musically collaborated

As creative ideas were developed, peers developed their role as musical collaborator. They collaborated with the student to input musical material via the tablet touch-screen and the EK. They also conducted the beat, differentiated difficult music, made musical suggestions, provided feedback and verbally instructed musical content.

Observing a student and peer alternatively or simultaneously inputting musical material via the touch-screen was a new experience for me, as teacher-observer. Cora found it difficult to 'tap in' the bass drum and the clap pad because it was challenging to reach across the screen with one hand. Figure 7-6 captures the moment when the pair alternatively input these parts to share workload:

Figure 7-6 Hazel plays bass drum (left) and her partner Cora (right) inputs synthesized claps on the off-beats.

The tablet computer also accepted multiple, simultaneous touch inputs. Consequently, Lucy and Piper were able to equally participate. They dragged drums onto the drum matrix at the same time. During their fourth session, Hazel and Cora collaborated to simultaneously strum chords via the smart acoustic guitar interface.

Hazel and Cora also collaboratively input material via the external keyboard. They manually input a new hook for the whole duration of their music (track 29). Figure 7-7 depicts Cora confidently playing the main melodic pattern and Hazel doubling the part, using the keyboard's bass register.

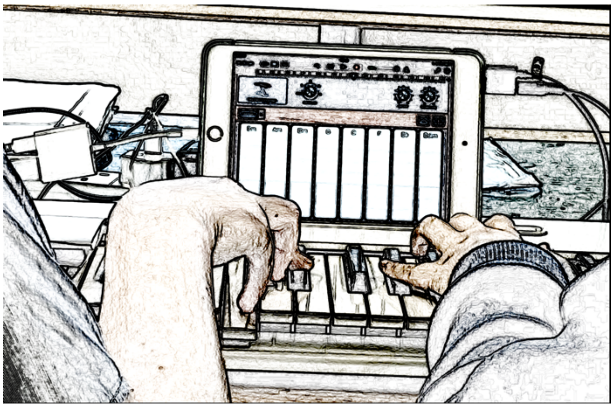


Figure 7-7 Cora plays in the main hook (right) and Hazel doubles up the part in the bass register (left).

Peers musically collaborated in other ways too. Jackie waved her finger to maintain the beat and counted '1 2 3, Go!' for partner Mia. Lucy also conducted Piper's acoustic guitar performance to help maintain timing. She additionally directed when Piper should, and should not play. This moment is captured by Figure 7-8:

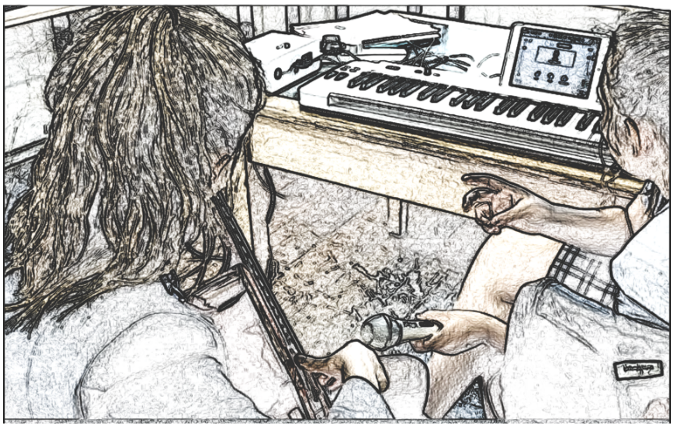


Figure 7-8 Lucy conducts Piper's acoustic guitar performance while holding the recording microphone. She helps Piper keep time and directs when she should play.

Comparatively, Aria held back Nora's finger from the tablet screen whenever she was tempted to trigger a chosen sample too early.

Peers also differentiated parts for their partner and students learnt music from them. They offered musical suggestions and even verbally instructed in ways comparable to a classroom teacher. These range of musical influences are reviewed by Table 7-5:

Table 7-5 A summary of the peer's musical suggestions and their ability to invent, differentiate and teach musical content.

Community: One			**Dimension:** Peer **Finding:** Peers invent, differentiate and teach musical content and make musical suggestions.	
The peer…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…invents content	2	B;C	INT: What role did your partner have in the process, each of you? Aria: For trying new instruments and she came up with the first piano part. Lucy invents a rhythm which Piper likes.	INT 4
…differentiates part	4	A;B;D;E	The participants decide to split up the duties with the chords. Lucy plays A minor and Piper G major. Zoe and Emily now discuss splitting up the chords, to share the burden. Hazel will play the second half of the hook, with Cora starting.	1 1 2
…is someone to learn music from.	3	B;D;E	Zoe is now playing chords in time. (A minor – C major) Emily is imitating Zoe in a lower keyboard register. Hazel begins to experiment and Cora follows. INT: Did you learn anything from your partner? L: I learnt a bit of guitar, 'Twinkle Twinkle Little Star'. I know two notes of it now.	1 3 INT
…makes a musical suggestion	2	C;E	N: What could go over that [piano] bit then? Hazel says to Cora 'You need to go a bit quicker'.	1 3
…verbally instructs musical content	3	A;C	This time, Nora teaches Aria the chords. She keeps the beat and calls out when to switch. Jackie hits on a scale-based idea, teaches her partner and instantly records it. N: If she couldn't do the piano bit, I'd help her with the chords and stuff.	2 2 INT

Peers additionally supported musical progress by developing a feedback role, albeit not in the conventional, corrective sense. Feeding back tacitly took place through a mutually agreed and supportive discourse, which promoted the shared ownership of creative products. This was the case for Piper and Lucy:

> P: When I was on my guitar, I was like Lucy, 'Is this good or shall we do it again?' and she said, 'Maybe we should do it again' because we couldn't hear it and then we did it again and she went, 'Oh that's good' and then Lucy added something.
>
> L: We had to do the voice for quite a while, didn't we?
>
> P: But we both agreed on it.

Shared ownership was apparent in Hazel and Cora's later work too. By session five, Cora actively sought out Hazel's approval:

> As she performs this new pattern, she glances to Hazel for her approval. Hazel is watching Cora's hands closely and 'vetting' everything that she does. Hazel only appears to speak out when something happens which she doesn't like. In this case, she seems to approve, by not passing verbal comment.

Evidently Hazel could identify when mistakes were made. Hazel, Cora, Zoe and Emily also explained that their partners offered subtly corrective feedback:

> H: I put more musical input into it and then she puts more like 'Oh I don't think that sounds right'.

Z: I think it's nice to have a partner to say 'I like this but here's how you could make it better'.

E: They give you feedback, improvement advice.

C: Because we'd be just playing along and then 'No, that won't go with this'.

H: Yeah sort of 'That doesn't sound quite right'.

Lucy found that she could only spot Piper's mistakes after 'coming to know' her musical intentions over time:

P: Lucy wouldn't know I'd made a mistake because it would be the first time that I'd done it. Like if I'd done it right and played it a couple of times, then she'd know.

Despite the corrective nature of some feedback, the feedback process contributed to a 'team effort':

L: I don't think I would have done it without Piper.

P: Yeah same [laugher]. Like together, we fused ideas.

L: Yeah ideas together was like really good.

N: Yeah. Like I say, 'It's good' and give compliments. We are working as a team, so, it's like more positive.

The 'team' worked when each student supported the other when they make decisions:

Nora asks her peer every time she finds a bass drop which she likes. 'This one?'. Aria nods.

Cora finds a 'closing down' sound.

C: We could have that at the end?

H: Yeah at the end.

The findings presented here suggest that peers provided musical feedback through a process of negotiated agreement and by suggesting areas for improvement. Peers also invented, differentiated, collaboratively performed, verbally instructed and supported the development of creative ideas.

7.4.1.2 Technologically collaborated

During tablet composing activity, peers were not just music collaborators. They also collaborated to harness the available technology too. For instance, Lucy deleted an automated drum track for her partner:

P: How do you delete that?

Lucy deletes the drum track on her behalf.

Peers also directed technological action. Hazel was a case in point. Although her partner Cora came to the tablet project an experienced GBIOS user, Hazel learnt from her and subsequently, Hazel began to direct how the tablet computer was manipulated:

Focussed listening. Hazel is not happy with its position.

H: That way, no that way!

Hazel's verbal cues do not work, so she guides Cora's hand/finger as she drags the bass 'wah' sample across the screen.

This moment is captured at Figure 7-9:

Figure 7-9 Hazel (left) directs Cora's technologically-mediated action by guiding her finger across the tablet screen.

Lucy operated the digital technology to support her partner's acoustic musical performances. She held the microphone for her partner Piper, as illustrated by Figure 7-8. Lucy also configured the tablet to record Piper's performance:

> L: I'll try and get this up.

This enabled Piper to remain focussed upon her four-note acoustic guitar riff. Peers could also impede learning by dominating creative musical activity and this behaviour will now be explored.

7.4.1.3 Dominated

Musical and technological influences aside, uneasy tensions arose when peers dominated discourse:

> Hazel curiously taps the screen.
> C: No, no! Don't touch.

> Zoe is dominant. When Emily begins to click something, Zoe uses her arm to push Emily away the screen.

When Hazel interacted with drum matrix interface, she began to drag parts onto the matrix but Cora did not approve. A quick 'finger-fight' ensued and Cora said 'go away' in a high-pitched voice.

Musical ideas also clashed and this led to tension. For instance, Jackie's musical ambitions dominated the first half of her group's tablet sessions. Only once a considerable period of panic, frustration and teacher intervention ensued did Mia's wholly different musical opinions and desires get heard.

During Nora and Aria's third session, Aria dominated the tablet screen but Nora continued to 'push in' and insert a sample. Aria exclaimed 'No!' by shaking her head and her index finger. This interactional sequence repeated three times. Aria's finger gesture is captured by Figure 7-10:

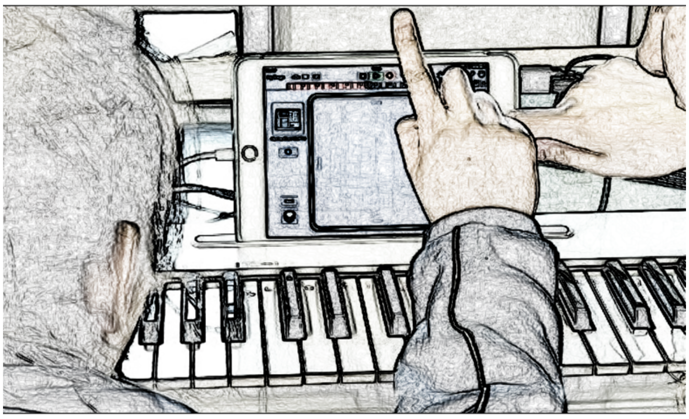


Figure 7-10 Nora (right) tries to insert a sample but partner Aria (left) exclaims 'No!' and shakes her finger.

A musically gifted peer could also negatively impact the system. Emily spent nearly ten minutes learning a bass line but at the moment of success, her partner Zoe quickly learnt the same part and performed it more fluently. Emily received 'rapturous praise' from Zoe for her contribution and this was interpreted as condescending and unhelpful for Emily's confidence.

7.4.1 has suggested that peers musically and technologically influence the development of creative ideas. 7.4.2 will now present findings which describe the music teacher's role in that process.

7.4.2 The Teacher

As students embarked upon the development of their creative ideas, their music teacher's work began in earnest. The goal 'found' earlier now has to be sonorously realised in ways which meet student expectations. To support community one in this quest, the teacher modelled (demonstrated) musical behaviour and provided musical and technological support. An account of these processes will now be presented.

7.4.2.1 Modelled musical ideas

Students quickly conceived of a broad musical idea (e.g. 'we want chords') but typically struggled to sonorously imagine and then play that music. Consequently, the teacher modelled chords, bass lines and melodic content for students. The teacher also performed music alongside student compositions to model how new parts might fit with existing work. Occasionally, a teacher's musical idea was recorded into students' work. This intervention enabled students to add additional layers or to technologically manipulate that idea to suit their needs. A review of these teacher behaviours is included below as Table 7-6:

Table 7-6 The teacher as musical modeller.

Community: One			**Dimension:** Teacher **Finding:** The teacher models musical ideas	
The teacher…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…models basslines	3	B;D	The teacher models a stepwise bassline for Piper and Lucy, based on A minor. The teacher creates a bass-line over Zoe and Emily's work. The moment after the teacher improvises a bass part Zoe states, 'I like that'. Emily isn't that keen on it and explains that she 'doesn't mind it'.	3 3
…models chords	9	A;B;D;E	The teacher also talks Hazel and Cora through the chords and models them on the keyboard. The teacher reminds Piper and Lucy of their chords, by modelling them on the external keyboard. He also suggests they break them up, to create new material.	3 3
…models melodies or riffs	8	B;C;D;E	Now thoughts turn to Nora and Aria's second melodic idea. The teacher advises the notes A, B, C, D, E and demos these notes on the external keyboard. T: [To Hazel and Cora] If that's your riff [plays riff], what chords would go with that? You're basing it around C aren't you. How about this [riff played over C minor, Bb major and Ab major chords]?	3 3
…models with backing track	11	A;B;C;D;E	The teacher then sings a melody over the top [of Jackie and Mia's composition], using fashionable lyrics. Teacher improvises his own rap over the top of the Piper and Lucy's composition, using the words 'When you cool down'. T: So, next time a bit of Cornet, Lucy? The teacher sings some Cornet ideas while the participants are listening back to their work. Lucy seems pleased with the options.	2 2 4
….records part into students' work	2	B;D	The teacher records a piano melody for Piper and Lucy and leaves it in the mix (for now). Now teacher even records in the part! Zoe and Emily twice listen to their composition with the new teacher-added part.	3 3

Live musical demonstrations suggests a differentiated approach, personalised to meet student need. Critically, the teacher's musical models remained optional and in any case, students adapted and experimented with that content or rejected the models as required.

7.4.2.2 Provided close musical support

The teacher provided a broad range of close musical support to mediate students as they developed creative ideas. The teacher answered musical questions, contributed musical knowledge, issued musical instructions or suggestions and located the tonal centre of students' work. Nora found that the teacher brought with them a bank of knowledge, not otherwise available:

> INT: You value having a teacher bringing learning to you as well?
> N: All the history behind music and stuff; you don't really learn it off GarageBand.

This 'extra musical information' often found its way into tablet-mediated musical discourse:

> T: That's called a 'drop' in dance music,
> T: Each chord is play-miss-play…If it has a flat sign written by it [pointing to the 'b' symbol], that means it is a flat or black note.

The teacher also made musical suggestions or musically directed students as they worked with the tablet computer. Table 7-7 summarises those interventions. They related to the chords, loops, musical strategies and raps which students developed.

Table 7-7 The teacher's musical instructions and suggestions.

Community: One			**Dimension:** Teacher **Finding:** The teacher provides musical instructions or suggestions	
The teacher instructs or suggests…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…chords	10	A;B;C;D;E	Nora is struggling to play the chords in time with the beat. T: Really make it as robotic as you can, it's hard to do. H: We need to put something else in, otherwise it will get a bit repetitive. T: You could put some chords in? Emily asks the teacher if it is a good idea to extend the progression. The teacher recommends adding a D minor chord.	3 3 1
…loops	2	B;C	T: What about a loop, or a bass drop? [Teacher imitates a bass drop as heard in dance music.] N: How do you do that? T: If you tap the square button – input select – and then select live loops…	3
…musical strategies	6	B;C;D;E	Teacher advises Piper and Lucy add another section. T: You can either add more layers to what you've got, or make it longer. The teacher advises that Nora and Aria can fade parts 'in and out' of their music.	2 3
…rapping	2	A;B	T: Right, are you listening? Your challenge is to put one part of your own on this, at least. It sounds amazing but it would be quite easy to rap some words over the top of it.	3

The teacher was also required to compensate for the tablet's lack of musical intelligence. When students inserted loops into their work, there was no immediate way to ascertain their musical key. Harmonic chaos quickly ensued, especially when students attempted to add their own musical layers over loops. The teacher was quickly required, by any method possible, to make musical sense of the situation:

> As Cora attempts to play the melody over the rest of the track, it doesn't fit because the loops are in a different key. This isn't made clear on screen.
>
> T: Hang on, while I listen to it…the loops are in C [teacher uses relative pitch to ascertain this].
>
> Cora then tries out her melodic pattern using a C and G pitch and the teacher encourages her to practice with track backing to see if it fits. It works.
>
> The teacher explains to Jackie and Mia that many of the loops are based around note G and he marks the notes G A Bb on the keyboard and triggers a synth.

Determining the key and tonality of students' work using relative pitch and a piano was a challenging proposition. This strand of close musical support required the teacher to make speedy musical judgements based upon his inner musical ear.

7.4.2.3 Provided close technological support

The teacher was obviously a musician but he was also a digital music technologist. In relation to the latter, he provided close technological support as students' musical ideas developed. Early on in that process, the key features of GBIOS were introduced and this support was welcomed:

> A: …you showed us how to use the app because maybe we would have run out of time because we didn't have that much time to make the sounds along with seeing how the app works.

Nora explained that a 'tour of the app' helped her to understand what the buttons mean:

> N: First, we opened GarageBand and then you [the teacher] helped us sort out which buttons mean what.

Tablet induction aside, close technological support was provided in two different ways. The teacher either suggested/directed technological action or responded to questions about that digital technology, as they arose. In relation to the latter, a review of the questions students posed about the tablet computer and GBIOS are presented as Table 7-8:

Table 7-8 A summary of the questions students addressed to their teacher concerning the tablet computer.

Community: One			**Dimension:** Teacher **Finding:** The teacher answers technological questions	
The teacher answers questions relating to…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…how to adjust volume	2	B	P: [To teacher.] How do I make this bass thing quieter? T: Tap track, now track volume. P: OK. Let's try this and see if it works.	3
…how to copy and paste	1	D	Zoe asks whether she can copy the melody, paste it at the end and add a middle section: to be played by Emily.	2
…how to delete	3	A;B	Piper asks how to remove the recorded vocal. The teacher navigates her back to track-view, tap track, tap delete.	1
…how to find loops	1	C	T: What about a loop, or a bass drop? [Teacher imitates a bass drop as heard in dance music.] N: How do you do that? T: If you tap the square button – input select – and then select live loops…	3
…how to listen	2	A;B	L: Can we hear it now? T: Yes, you need to rewind [pointing at the rewind button] and press play. These are the buttons, PLAY, REWIND, RECORD [teacher points at each button, while speaking their name].	1
…how to record	4	A;B;C	J: [To teacher] How do you record? T: So, you want to record that now, yes? L: Yeah, do you press that? T: Yes. It's the red circle button there.	2 1
…how to rewind	1	A	Jackie has not yet found a way to use the transport bar. J: How do you get back to the beginning? T: See that little rewind button?	3
…how to save	1	A	J: How do we save it, I don't want to delete it [said in a slightly panicked voice]	2
…how to record real audio	3	A;B;E	H: Can you add voices? P: [To teacher.] Excuse me, how do we connect the thingy [microphone]? The teacher shows students how to set the level and how to turn 'monitor' on, so they can hear themselves.	6 1

Table 7-8 evidences that the teacher removed barriers to effective use of the tablet computer, as and when they arose. The table also indicates that students' creative progress was correlated to their ability to manipulate the tablet in technological ways. For example, if students cannot record, listen to or copy and paste their ideas, creative development likely stagnates. Conscious of this realisation, the teacher suggested, or even directed students' use of the tablet computer, where necessary. Table 7-9 reviews instances where the teacher makes those interventions:

Table 7-9 How the teacher suggests or directs students' technological action.

Community: One			**Dimension:** Teacher **Finding:** The teacher suggests or directs technical action	
The teacher instructs or suggests…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…bars	1	D	Zoe and Emily are reminded how to add extra bars.	1
…instrument, sound, synth or loop	4	C;D;E	The teacher encourages Zoe and Emily to 'find the sound they want' and demonstrates the bass synths but the students return back to the 'Liverpool' bass. Nora and Aria begin tapping loops and the teacher picks out a bass drop.	3 3
…the configuration of smart instruments	4	B	The teacher advises that smart instruments can be switched between chords and notes. L: Sorry, just trying it out! T: That's the whole point, take your time.	1
…looping	2	C	For some reason, Nora isn't happy – the timing is not quite right. The teacher once again recommends looping the track, which Nora carries out with the teacher's guidance. This is successful.	1
…saving	1	C	Nora and Aria are encouraged by the teacher to save their song.	1
…a change of tempo	1	D	The tempo is too quick and the teacher reminds Zoe and Emily how to adjust it. Emily thinks 90 bpm.	1
…metronome use	3	A	T: Think about recording it in time, with the metronome. Teacher turns metronome on.	2
….muting or soloing tracks	2	B	The teacher shows Piper and Lucy how to solo a track, in order to find out which track is which. The teacher reminds Piper to turn off soloing (headphone button for each track).	2 2
…track-editing	5	A;B;C;D	The piano-roll/edit screen appears. T: Wherever your mistakes are, you can just tap and delete them. Zoe: Oh, OK. The teacher advises Lucy about how to record the guitar, by explaining what the levels should look like in the audio recorder on screen [lots of green, no red].	2 4
….mastering	5	A;B;C	The teacher encourages Lucy and Piper to blend the rap vocal with the rest of the mix. The advice is taken and the vocal volume is adjusted. The teacher recommends turning the layer down in the mix and instructs Nora to the volume button. Aria turns down the volume a number of times, until it is 'just right'.	2 1
…how to use the transport bar	10	A;B;C;D	Teacher presses record button (another case of Jackie and Mia not understanding the app's symbolic representations). J Right, let's listen to it now. How do we listen to it? T: Right. Press 'rewind' (teacher points to rewind button) and then 'play'. T: So, you want to record that now, yes? L: Yeah, do you press that? T: Yes. It's the red circle button there. The participants seem hesitant to use the transport toolbar. T: Press stop and go back to the other screen. L: Which, that? [Points to wrong button]. T: It's that one there look [teacher points to the stop button]. L: Can we hear it now? T: Yes, you need to rewind [pointing at the rewind button].	2 2 1 1

Editing tracks, mastering, looping and smart instrument configuration perhaps represented those more advanced ways to make use of the digital technology. Yet surprisingly, the transport bar remained a persistent barrier for students. Their music teacher grew up in an age of tape players and VCRs, all of which were emblazoned with the words and/or symbols for PLAY; STOP; REWIND. Participants grappled to understand the symbolic representations for these commands and consequently, the teacher routinely supported the efficient and correct use of that bar.

Part 7.4.2 has found the teacher to be both an influential musician and digital music technologist. As a musician, the teacher modelled musical ideas and provided close musical support. As a digital music technologist, he introduced new app features, answered questions about the digital technology and suggested or directed how students manipulated the tablet device.

7.4.3 The Tablet

Community participants have explained that the tablet computer promised a potential to initiate creative ideas during the ‘find’ stages of their compositional journey (see 7.3.2.1). An account will now be presented for how the tablet computer supported community one students as they focussed and ultimately fixed their creative ideas.

7.4.3.1 Facilitated musically driven recording strategies

Once participants found ideas and developed their goals, they discovered a musical problem. That is, how to translate a goal into a concrete, performable product. To navigate the transition, students developed intensive practice strategies and then made a recording attempt. A range of broad and focussed listening strategies were ultimately developed to ascertain the musical quality of newly recorded parts. This cyclical, tablet-led strategy is described here as Rehearse-Record-Listen. The strategy was thought music-centric for its emphasis on the rehearsal and critique of musical material, which was primarily created by the human participants (and not the tablet). Table 7-10 sequentially reviews those findings which evidence the Rehearse-Record-Listen cycle:

Table 7-10 A sequential review of musical tablet-mediated interactions defined as 'Rehearse-Record-Listen'.

Community: One	**Dimension:** Tablet			**Finding:** The tablet facilitates 'Rehearse-Record-Listen'	
The tablet facilities…	**Sub-theme**	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…practice with the backing track	N/A	21	A;B;E	Practice rap with backing track. It's now in time with the beat and Lucy and Piper's rap takes advantages of spaces in the music between the piano part. Cora instantly plays a syncopated rhythmic pattern with the backing track.	2 4
… solo practice	N/A	10	A;B;D;E	Piper and Lucy practise chords on the external keyboard, without their backing track.	1
…recording of part	*Acoustic*	2	B	Recording attempt. It was certainly worth the extra recording. The sound of the guitar is far more confident and each note is plucked at an equal forte dynamic.	4
	Drums or percussion	2	C;E	Nora records a drum part via the drum pads but without using the metronome.	1
	Loop-based	8	A;B;C;E	Cora records just one playing of the motif, returns to track-view and then loops that playing using the app's loop function. It is beautifully in time and a special moment in the development of the piece.	3
	Melody or riff	5	A;B;C;D	Zoe makes a successful recording attempt. For each attempt, the melody becomes more crystalized. Now, it is a catchy melody, one developed through repetition and trial and error.	2
	Vocal	1	B	Recording – vocal quality improves and the 'drop the mic' sound effect is more confidently recorded.	2
…failed recordings	*Clashes or doesn't fit*	3	A;E	Nevertheless, Jackie hits on a scale-based idea, teaches her partner and instantly records it. It's out of time and bares no relation to the dance music loop, which the group have recorded.	4
	Mistake	6	B;D;E	Zoe and Emily's first recording attempt. Block chords in time, repeated broken versions are not as secure. Slightly out of time overall.	1
…focussed listening	*Listen to specific issue*	10	D;E	Cora edits the notes in the piano-roll view to improve the timing but one or two of the pitches still do not work. This becomes clear when the participants listen to the track again. Zoe and Emily watch the track-view screen while undertaking focussed listening. They discover a smudged last note.	3 2
	Fit new part to track	2	D	Emily listens to the track and attempts to 'play along' during the blank central section. She plays chords.	2
	Follow notation	4	D;E	Cora loads piano-roll and listens back to the newly recorded part while studying the notation because each block can be edited, or removed, if needed.	6
	Suggests mastering	1	B	Focussed listening. Volume of audio guitar is too low and with the teacher's help, the volume is adjusted in track-view.	4
	Suggest structure	1	E	Listen to track. While listening, Hazel is thinking about the structure. At the start of the trance rhythm, she says 'right this is the chorus' and while the track is playing she says 'right stop the chorus there'.	4
…broad listening	*At start or end of session*	4	C;D;E	Broad listening at moment of 'completion'. Zoe and Emily listen to the whole track and it works. Nora and Aria's session begins by listening to the whole piece but it sounds largely complete. It will be tough to extend it further.	3 3
	Identify problems	2	C;E	Cora broadly listens to the work. She remains unhappy, so returns to dragging the bass 'wah' sounds to the exact points in the bars, where she wants them to be.	2
	Initiates next step	1	A;B;E	Then, Jackie and Mia listen to the rest of the track and Jackie identifies somewhere else where she could add a synth part. Listening. P: I feel like it needs to be a bit louder. Piper then adjusts the volume, over two or three listening cycles.	4 3
	Reaction to their work	6	A;B;C	Piper and Lucy listen to their piece and dance along. Nora is pleased when she listens back – head bopping.	2 4
	Unfocussed	2	A	Is this just a 'mess around'? Much time passes with the music constantly looping. In fairness, the structure is built up and thinned out with a great deal of skill from Jackie. Almost ten minutes of continuous loops has ended.	3

Table 7-10 describes students' two methods of practice, their performances for recording purposes and their focussed listening behaviours. While Rehearse-Record-Listen was welcomed by the teacher for its reliance on humanistic musical ability, this form of tablet use predominantly replicated existing classroom practices, namely the perform/record/assess routine. Part 7.4.3.2 will now present evidence that community one students combined Rehearse-Record-Listen with other strategies which more heavily relied upon the transformative nature of the digital technology.

7.4.3.2 Facilitated technologically driven recording strategies

Part 7.4.3.1 has suggested that students manipulated track-view to correct timing, delete notes and inform decisions about the structure of their music. Hazel and Cora made more extensive use of track-view. In fact, they depended on it to realise their creative ambitions. Cora routinely actioned copy and paste to extend the duration of existing ideas and/or to create new sections of musical material. Figure 7-11 depicts Cora copying and pasting guitar chords (track 27):

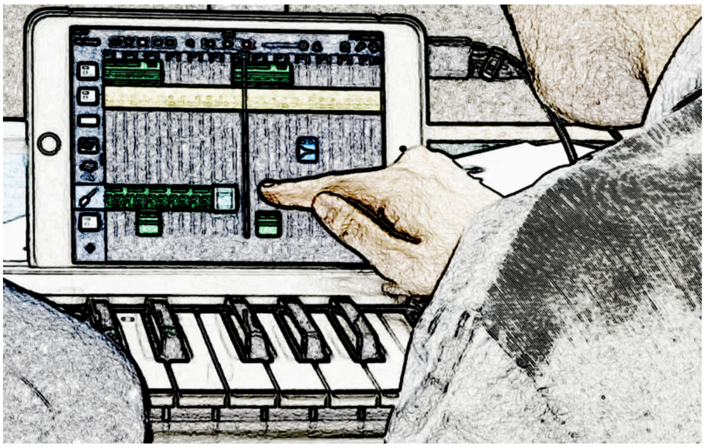


Figure 7-11 Cora (right) copies and pastes her guitar chord pattern in track-view.

Hazel and Cora also used the external keyboard to input a new hook. Cora zoomed in to reveal the hook's graphic notation. Each note was represented as a small block. They varied in length and vertical placement to represent duration and pitch. Cora checked these blocks to assess timing and note accuracy.

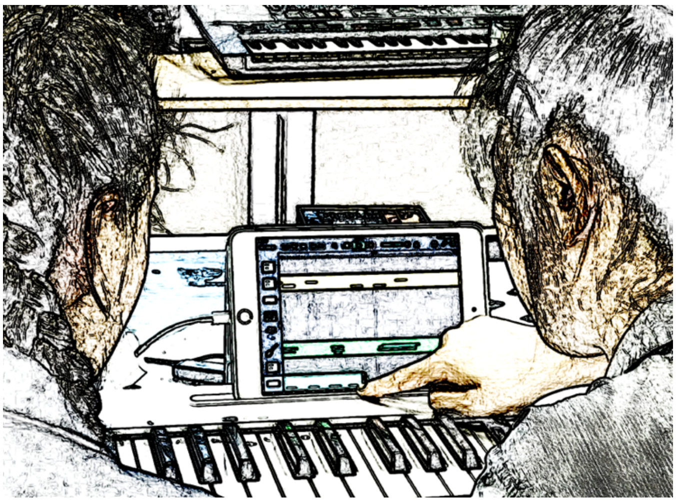


Figure 7-12 Cora (right) zooms in to review her group's eighth creative idea, a new bass hook.

Table 7-11 suggests that in addition to copy, paste and zoom, participants also worked the track-view to crop, delete, drag, zoom, loop and master their work:

Table 7-11 How students use track-view functionality to enhance their creative products.

Community: One			**Dimension:** Tablet **Finding:** Tablet facilitates track-view editing	
The Tablet facilitates…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
Copy and paste	16	C;D;E	Nora now copies and pastes an existing drum part under her new piano part. Z: So, we could have another little instrumental, maybe. But then, Zoe identifies another part which she can copy to save time. She successfully copies and pastes another component. Cora now copies and pastes the bass 'wah' sample, so it triggers every couple of bars.	2 3 2
Crop	11	D;E	There is a smudged last note. Z: We can just crop it down. Emily undertakes the crop by dragging the track to the left. It works. More cropping. Now Cora has completely removed the first hook, only to leave the musically better second attempt.	3 2
Delete	16	B;C;D;E	Piper taps and deletes drummer Kyle. Cora deletes the whole track and opts for another recording attempt.	2 4
Drag	16	C;D;E	Instead of re-recording the loop, Nora explains that she can just drag the new track to wherever they need it. This is a more complex operation than simply re-recording. The first drag attempt is too late. The second attempt remains in-line with the piano's last note and this works well.	3
Zoom	6	E	Cora pinches the screen to zoom in/out, in order to look at the new track in detail	2
Loop	7	E	Cora selects the track in track-view and taps loop.	4
Track mastering	5	B;C;D	Piper and Lucy move sliders in track settings to find the timbre they require. These include a compressor, volume, treble and bass. Piper makes lots of adjustments. Then, Piper finds an echo slider (excited facial expression). This echo effect works really well and makes the vocal rap sound very professional.	2

The range of tablet computer/GBIOS influences, as summarised by Table 7-11, ensured that students could develop a second cyclic use strategy: Record-Edit-Loop. Pairs B,C,D,E used aspects of it (e.g. editing and looping) to enhance their work (see table 7-11). However, Hazel and Cora remained the only pair to solely rely upon Record-Edit-Loop to realise their compositional intentions. For Hazel and Cora, their approach was a reaction against the Rehearse-Record-Listen strategy. For them, 'getting in perfect first' was not the way creative goals should be achieved:

> C: I think we were just going for it sometimes and seeing how it worked. Then, you can always go back but I think you do a lot of things on the spot. I can't [perfect first]…I have to draft it.
>
> INT: So, get it perfect and then input the information?
>
> H: We put it in quickly to see what it sounded like and then maybe perfected it after just to see if it went with it and then we'd go back…
>
> C: …and added more things after.
>
> INT: Why do that then? So you don't waste time?
>
> H: Yeah, so we don't waste time perfecting something and then putting it in and not liking the overall things at all.
>
> C: I like…the perfectionist afterwards. I don't mind doing it and going back, reviewing it and perfecting it after; that doesn't bother me.
>
> H: You get more done…instead of perfecting something, putting it in and then deciding you didn't like it after you've spent a whole hour just perfecting that one thing.

While Hazel and Cora's musical ideas were predominantly inputted manually, just one short playing of the idea was recorded in the knowledge that it could be looped after the event. Cora repeated this behaviour during her second, third, fourth and fifth tablet session. During Cora's second tablet session, she edited a short melodic hook:

> Instead of manually recording every recurrence of the new hook, Cora has just recorded one cycle, which is two playings of the hook. The second hook is more successful that the first. Now Cora pinches the screen to zoom in on the new hook, to the extent that she can see every note as a line within the track view. She is scanning for the weak areas.

While this strategy was primarily reliant on the digital technology, the pair's creative musical desires appeared to necessitate musical and technological behaviours.

Part 7.4.3 has presented findings which describe the tablet as a device which mediates the development of creative ideas through its facilitation of both human initiated (musical) and tablet initiated (technological) recording strategies.

Community one's account of their creative musical activity has now been presented. Findings have described how the student, peer, tablet and teacher influenced the initiation and development of creative ideas during community one's table-mediated, creative musical Activity. Using a secondary and tertiary analysis of observation data and a newly developed method to visualise creative development, the lifecycle of individual creative ideas will now be mapped overtime. This micro analysis of credibly selected community ideas aims to provide new understandings about the inner workings of creative musical development.

7.5 How community one initiated and developed their creative ideas over time

This community one case report has explained how each Activity System dimension (i.e. tablet, teacher, peer, student) influenced the initiation and development of creative ideas. Those findings which emerged from a secondary and tertiary analysis of observation data will now be presented. A secondary analysis grouped findings by 'creative idea' and not by 'Activity dimension'. This approach promises simultaneous consideration of the relationships *between* Activity dimensions during the lifecycle of any creative musical idea. To better observe these relationships, visual charts will be presented which map the lifecycle of individual creative ideas over time. These charts colour-code activity dimensions and visually arrange them to replicate events as they emerged in the field. By studying these horizonal flows over time, new trends can be observed, for example when different dimensions 'dropped out' or became more fundamental. Further, by studying the numbered dimensional coding, it will be possible to discern the extent to which any creative idea was primarily musical (e.g. manually input musical material) or technological (e.g. produced with track-view editing).

Following this secondary analysis by creative idea, a third stage analysis will be presented which responds to Burnard and Younker's model of composition pathways (2004). This model is used to inform understanding of how the whole Activity System behaved as community one students found and/or focussed and/or fixed their creative musical ideas. This analysis is colour-coded pink in the forthcoming charts. Additionally, Kirkman's conceptual spaces of learning

(2016) informs an understanding of how a system's creative musical development remained either rooted in or shifted between institutionalised (e.g. structured, prescribed or teacher-directed), open (e.g. student-centred), or shared (e.g. collaborative) learning spaces. Chapter Four explained that open, institutional and shared spaces are characterised by emancipatory, dialectic and dialogic pedagogical approaches, respectively.

Community one developed twenty-eight creative ideas for their tablet-mediated compositions and each idea was visually charted as part of the secondary analysis process. A data reduction strategy ensured that the charts presented here credibly represent the broad range of interactional trends observed in community one. For a review of the data reduction strategy, see 6.6.6.

7.5.1 Jackie and Mia (Community One)

Jackie and Mia began to compose tablet-mediated music as a response to Jackie's vividly imagined narratives. This method of finding ideas was subsequently abandoned in favour of a loop-based approach, which better aligned with Mia's dubstep tastes. Jackie and Mia's first idea was ultimately a failure but the insightful nature of the creative processes will now be presented. This will be followed by a presentation of their fifth, loop-based idea, which the pair submitted at the end of their tablet project (see track 1).

7.5.1.1 Idea 1: Soundscapes

From the first moment, it became obvious that Jackie was a confident young person who invented creative scenarios with notable fluidity. Throughout the nine-minute lifecycle of the soundscape phase, Jackie invented detailed narratives, associated musical ideas and made copious false starts. Jackie's somewhat frantic creative process increasingly frustrated her peer, Mia. This is understandable, given that ideas were seldom 'focussed' and never became 'fixed' over many weeks. The green bars visualised at Figure 7-13 represent these instances of Jackie's creative behaviour:

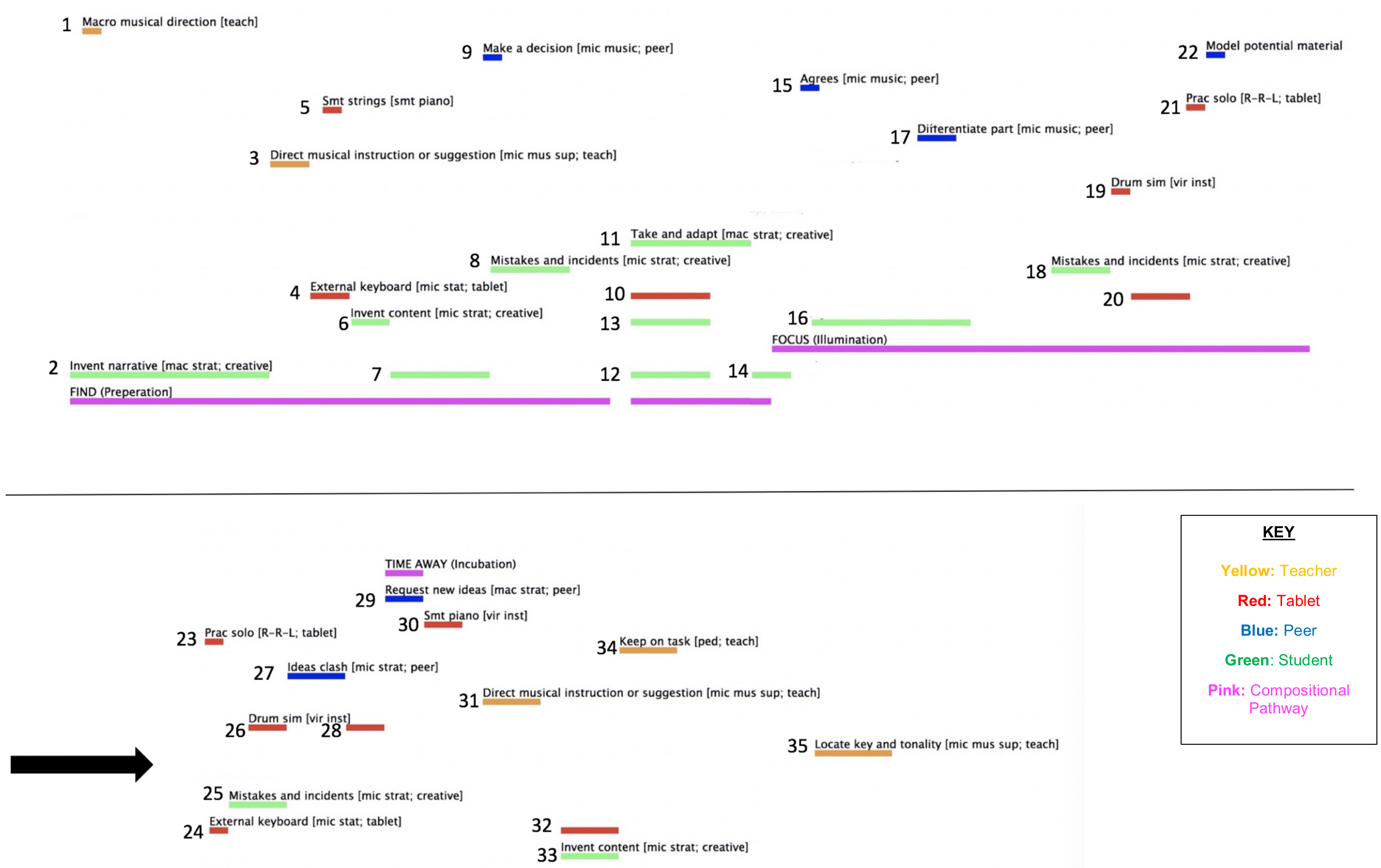


Figure 7-13 A chart mapping Jackie and Mia's aborted attempt to create soundscapes based around Jackie's imaginary narratives (creative idea 1). Duration circa 9 minutes.

Figure 7-13 helps to visually review how Jackie and Mia attempted to develop a soundscape for imagined narratives. The teacher probed for ideas (1) and straight away Jackie began to invent ideas about wolves (2). The teacher responded to this by suggesting how to transform these ideas into music (3). Mia then began to musically experiment on-screen and at the keyboard (4). Jackie selected the violin on-screen and experimented with scalic and chromatic patterns to represent running (5,6). Jackie soon invented a new narrative based upon ‘a park full of children’ and Mia became frustrated (7,8,9). Jackie switched back to a wolves theme and then peer taught Mia a chromatic pattern (10,12,13). The pattern was an adaption of John Williams’ Jaws theme (11). This idea was dropped and a new narrative invented: ‘a deer who is running’. For this theme, Jackie played a bass line and then asked Mia to play that part while Jackie invented a similar pattern intended for a higher keyboard register (16,17). However, the idea was again dropped (18) and Jackie tapped the GBIOS drum simulator (19). This was also dropped and Jackie recalled the pair’s earlier stepwise patterns developed on the external keyboard. Jackie taught the patterns to Mia (20,21,22,23,24). However, the music lacked rhythm and relied upon a simplistic melodic contour and this frustrated Mia (24,26,27). The drum simulator was reloaded (28) and even Jackie now admitted that things were not going well (29). Another fresh start is attempted when Jackie loaded the smart piano because she had yet another new idea (30). At this point, the teacher suggested the pair layer up a drum beat (to improve their timing) (31). This advice was ignored and Jackie performed an octave pattern at the external keyboard (32,33). The teacher became increasingly concerned so he prompted the pair to work towards a recording (34). As both Jackie and Mia experimented at the external keyboard, the teacher was required to ensure that their different parts worked harmonically (35). Finally Jackie abandoned this also and invented a new narrative based upon a haunted house theme. No musical material became fixed and the whole phase is abandoned.

Table 7-12 accompanies Figure 7-13 and it uses fieldnote data to provide a more detailed account of how Jackie and Mia found and begin to focus narrative and musical content for a soundscape.

Table 7-12 How Jackie and Mia's tablet-mediated activity musically, technologically and pedagogically influenced the initiation and development of their soundscape phase (creative idea 1).

	Community: One	**Participants:** Jackie and Mia **Creative Idea:** One				
ID	**Code**	**Data**	**DIMENSION**	**INFLUENCE**	**PEDAGOGY**	**FIND/ FOCUS /FIX**
1	**Macro musical direction**	T: Any ideas?	TEACHER	MUSICAL	EMANCIPATORY	FIND
2	**Invent narrative**	J: Well we both like wolves. If we did wolves running and they kept on running to get to a place and then they get to that place. T: How did you just come up with that? J: I'm very creative [laughter]. T: Do you get ideas all the time? J: Yeah, they just pop into my head. Well I think of what do I like and then I think of how I can add onto that. We could also do when it [the wolf] is trying to get its prey, or something. M: That's so good!	STUDENT	MUSICAL	EMANCIPATORY	FIND
3	**Musical suggestion**	T: So, what does that mean in terms of instruments, chords and all the rest of it? It might be minor chords.	TEACHER	MUSICAL	EMANCIPATORY	FIND
4	**External keyboard**	Then, Mia quickly takes over the screen and plays a number of notes on the keyboard.	TABLET	MUSICAL	EMANCIPATORY	FIND
5	**Smart strings**	Jackie loads the smart violin and experiments with a few notes to represent 'running'.	TABLET	MUSICAL	EMANCIPATORY	FIND
6	**Invent content**	However, it is Jackie who develops a chromatic pattern using the pitches C and C sharp. The tempo of this pattern increases to imitate running.	STUDENT	MUSICAL	EMANCIPATORY	FIND
7	**Invent narrative**	J: I don't think that's gonna…we need it to be like running. I've got an idea. It's going to change everything. It's based on a park with lots of children, so it's nice and peaceful and quiet and loads of kids just come screaming in at playtime, when you're reading a book, or something. I've got so many ideas in my head. M: Just choose one!	STUDENT	MUSICAL	EMANCIPATORY	FIND
8	**Mistakes and incidents**	Jackie is talking through lots of different scenarios. She is animated, excited and her behaviour is somewhat surprising to everyone. Yet the copious indecision and inability to translate creative narrative into musical material ensures that what appears to be a quantum start has degenerated into chaos.	STUDENT	MUSICAL	EMANCIPATORY	FIND
9	**Make a decision**	M: Just choose one!	PEER	MUSICAL	DIALECTIC	FIND
10 **12** **13**	**External keyboard; Invent narrative; Invent content**	J: We could put it from the wolf's prey point of view, so it will be nice and peaceful for the deer's point of view. Nothing is wrong and then suddenly he [the wolf] hears something like [plays two low notes on the keyboard at random] and then 'What's that?'. And then you [Mia] can go [plays chromatic high notes].	TABLET STUDENT	MUSICAL	EMANCIPATORY	FIND
11	**Take and adapt**	J: We can't do that, it's stealing JAWS [the theme by John Williams]. T: You can steal ideas, if you adapt them.	STUDENT	MUSICAL	EMANCIPATORY	FIND
14	**Invent narrative**	J: We are going to base it on the deer who is running. Shall we write this down?	STUDENT	MUSICAL	EMANCIPATORY	FIND
15	**Agrees**	M: Yes sure.	PEER	MUSICAL	DIALOGIC	FOCUS
16 **17**	**Invent Content; Differentiate part**	Jackie then plays a bass line in a major key. The tonality, tempo and dynamics suggest it's calm nature. Jackie asks Mia to play the bass notes and she adds a high melody in approximately the same tonality. Now Jackie moves to a chromatic pattern using the black notes in the centre of the piano.	STUDENT PEER	MUSICAL	EMANCIPATORY DIALECTIC DIALOGIC	FOCUS
18	**Mistakes and incidents**	A goal seems elusive. Teacher and peer are not sure how to react at this stage. The ideas appear both fantastic and useless at the same time, for they seldom lead to good quality musical material.	STUDENT	MUSICAL	EMANCIPATORY	FOCUS
19	**Drum sim**	Jackie loads a number of virtual instruments and settles on the drum kit.	TABLET	TECHNOLOGICAL	EMANCIPATORY	FOCUS
20	**External keyboard**	At that moment, she recalls the stepwise pattern which she created. Both students play this at different ranges on the keyboard. Jackie counts in.	TABLET	MUSICAL	DIALOGIC	FOCUS
21	**Solo practice**	Practice attempt (just using keyboard).	TABLET	MUSICAL	DIALOGIC	FOCUS
22	**Model potential material**	Jackie attempts to show Mia what to play. Mia struggles to copy the pattern.	PEER	MUSICAL	DIALECTIC	FOCUS
23 **24**	**Solo practice; External keyboard**	Another practice session (no backing).	TABLET	MUSICAL	EMANCIPATORY	FIND
25 **26** **27**	**Mistakes and incidents; Drum sim; Ideas clash**	The music lacks any structure or rhythm and the melodic contour is simple. Mia sums things up well, while Jackie is using the on-screen drum kit. M: You are just playing with it.	STUDENT TABLET PEER	MUSICAL	EMANCIPATORY DIALECTIC	FIND
28	**Drum sim**	Both students are now tapping the drum kit at once but then Jackie plays a four-to-the-floor drum kit in time. She is using the bass and snare.	TABLET	MUSICAL	DIALOGIC	FIND
29	**Request new ideas**	J: I think we need to change this because it's a bit bad to be honest.	PEER	MUSICAL	DIALOGIC	TIME AWAY
30	**Smart piano**	Jackie launches the smart piano because she has another idea, which she claims is going to change everything.	TABLET	TECHNOLOGICAL	EMANCIPATORY	FIND
31	**Musical instruction or suggestion**	J: We want it more upbeat, more 'dancey'. T: Why don't you think about putting a beat in first? Start with the drums. J: No listen to this, it's way more peaceful.	TEACHER	MUSICAL	DIALECTIC	FIND
32 **33**	**External keyboard; Invent content**	Jackie plays two C pitches an octave apart and then enlists her partner to add extra unplanned notes in the bass part. J: That actually sounds quite good!	TABLET STUDENT	MUSICAL	EMANCIPATORY	FIND
34	**Keep on task**	T: Yeah? Have we recorded anything yet girls? J: No! T: Well, perhaps before we finish in five minutes, I think we should at least record one part.	TEACHER	TECHNOLOGICAL	DIALECTIC	FIND
35	**Locate key and tonality**	Jackie summons Mia to play a chord in the bass of the piano. This sounds OK on its own but then, Jackie plays some material in a high register, which is not harmonically related. This triggers a response from the teacher: T: You need to think about what notes you're using, so that they actually go together.	TEACHER	MUSICAL	DIALECTIC	FIND
36	**Invent narrative**	J: We could have a haunted house and one person walking through the haunted house. It's like this girl, who is in a house and she doesn't realise it's haunted. Then, all of a sudden, she sees this weird creature walking by and she just gets petrified.	STUDENT	MUSICAL	EMANCIPATORY	FIND

It becomes clear from table 7-12 that the trajectory of the Activity was influenced by Jackie and the remaining human participants adopted comparatively minor roles. It was interesting to observe an authentically student-centred approach, typical of the classroom dynamics found in community one. Some might celebrate Jackie's unbridled creative brilliance, while others could point to a lack of creative development and the absence of measurable outcomes.

Jackie and Mia failed to fix any creative idea throughout their tablet-mediated Activity. For their fifth idea, Jackie's ambitions were dropped in favour of Mia's musical interests. Consequently, the pair create a dubstep inspired, loop-based idea. This idea's multi-dimensional, developmental sequence will now be presented.

7.5.1.2 Idea 5: Loop-based phase

7.5.1.1 established that Jackie and Mia took time finding creative ideas but when the challenge of focussing them became too great, they lost heart and switched back to finding new ideas. Jackie and Mia's loop-based phase was no exception. The idea made use of the 'Live Loops' GBIOS interface. Jackie and Mia spent ten minutes finding their ideas and they began to focus them. Just fourteen pieces of data are coded to this phase, which is indictive of the increasingly automated nature of their creative processes. This data is temporally arranged, colour-coded and charted at Figure 7-14:

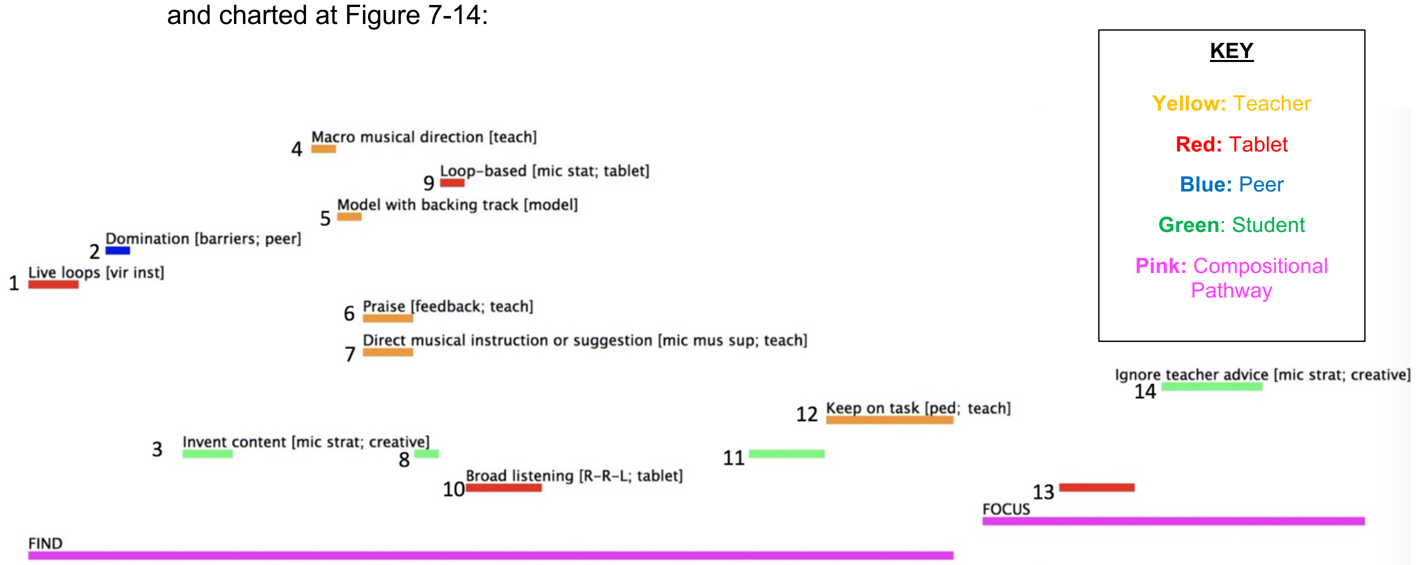


Figure 7-14 A chart mapping those Activity dimensions active when Jackie and Mia found and focussed their second loop-based idea (creative idea 5). Duration circa ten minutes.

The phase began when Mia triggered beat samples in the 'Live Loops' interface (1). Although dubstep was not Jackie's primary musical interest, she began to dominate the tablet screen (2). Jackie independently made loop selections and justified her choices (3). Additionally, she chose to find lyrics after a teacher prompt (8), invented potential themes and considered structure (11). However, the teacher developed a different agenda to Jackie and these two approaches remained unreconciled throughout. The teacher was keen to musically influence development. A rap was suggested (4), then modelled (5) and the students were praised (6). The teacher then challenged Jackie and Mia to include just one layer of their own music (7). The pair chose to largely ignore the teacher's interventions and instead, they perpetually listened to the Live Loop content in an unfocussed way (10,13). This idea was submitted ‘as is’ with no final editing or further development.

Table 7-13 below accompanies Figure 7-14 because it presents fieldnote data which corresponds to the chart numbers. Please note that although the table also highlights musical or technological influence, compositional pathway and prevailing pedagogy, these will be properly addressed in chapters nine and ten.

Table 7-13 How Jackie and Mia’s tablet-mediated Activity musically, technologically and pedagogically influenced the initiation and development of their second loop-based idea (creative idea 5).

	Community: One	**Participants:** Jackie and Mia **Creative Idea:** Five (Loop-based)				
ID	**Code**	**Data**	**DIMENSION**	**INFLUENCE**	**PEDAGOGY**	**FIND/ FOCUS/ FIX**
1	**Live loops**	The students begin a new song project using Live Loops. Mia triggers a number of beat samples.	TABLET	TECHNOLOGICAL	DIALECTIC	FIND
2	**Domination**	Experimentation from both students but Jackie takes the primary role, once again.	PEER	MUSICAL	DIALECTIC	FIND
3	**Invent Content**	J: I think we should start off with more this, because it’s got more of a beat. The students find a ‘wa wa’ bass line (classic dubstep).	STUDENT	MUSICAL	EMANCIPATORY	FIND
4	**Macro musical direction**	T: How about a rap then?	TEACHER	MUSICAL	DIALECTIC	FIND
5	**Model with backing track**	The teacher performs a rap, using made up lyrics, over the top of the students’ work.	TEACHER	MUSICAL	DIALECTIC	FIND
6 **7**	**Praise; Direct musical instruction or suggestions**	T: Right, are you listening? Your challenge is to put one part of your own on this, at least. It sounds amazing but it would be quite easy to rap some words over the top of it.	TEACHER	MUSICAL	DIALECTIC	FIND
8	**Invent content**	J: [To Mia] OK. Shall we play the song and then keep thinking words to it and write them down?	STUDENT	MUSICAL	DIALOGIC	FIND
9	**Loop-based**	This second, loop-based work, is much ‘harsher’ i.e. more dance/dubstep.	TABLET	TECHNOLOGICAL	DIALECTIC	FIND
10	**Broad listening (unfocussed)**	There is little word planning going on. Students are just listening and listening.	TABLET	MUSICAL	EMANCIPATORY	FIND
11	**Invent content**	J: Right, so. We need a theme. M: Futuristic? Robotic? J: What about something quiet, then BOOM, then quiet, then BOOM!	STUDENT	MUSICAL	EMANCIPATORY	FIND
12	**Keep on task**	T: So, what are you thinking now? J: I’m kind of thinking spooky now. This group finds it extremely difficult to set a goal and ascertain the key steps required to achieve it. Surely the teacher should now insist on a fixed activity, that is created in a certain way?	TEACHER	MUSICAL	DIALECTIC	FIND
13	**Broad listening (unfocussed)**	Is this just a ‘mess around’? Much time passes with the music constantly looping. In fairness, the structure is built up and thinned out with a great deal of skill from Jackie. Almost ten minutes of continuous loops has ended.	TABLET	MUSICAL	EMANCIPATORY	FOCUS
14	**Ignore teacher advice**	The students get bolder and begin triggering all the loops at once. T: These are included, aren’t they? How could you make your own samples? Banging on a desk say and recording it in. Jackie cleverly avoids difficult questions. She returns to the app. They are mesmerized by the sounds.	STUDENT	TECHNOLOGICAL	EMANCIPATORY	FOCUS

Jackie and Mia’s creative ideas might be perceived as negative cases. That is, instances where tablet composing failed to lead to convincing outcomes. An alternate perspective is that Jackie and Mia did consider musical structure, develop further understandings about dubstep music and liberally applied their creative thinking.

The creative ideas charted from 7.5 have visually and tabularly evidenced the extent to which tablet-mediated Activity Systems change form over time to meet the personal goals and local agendas of their situated communities.

An account of community one’s tablet-mediated, creative musical development has now been presented. This account has described how the student, peer, tablet and teacher influenced the initiation and development of creative ideas. Chapter eight will now introduce a second community of tablet composers and provide an account of how their creative musical outcomes were developed.

Chapter 8:
Case report two

This chapter will begin by introducing community two. An account of its ten participant composers and their broader educational and cultural context will be presented. Participants' formal and informal relationship with music (8.2); school values (8.1) and classroom music curriculum (8.1.2) will also be reviewed and proposed as influential cultural forces. These forces influenced how fieldwork was designed and conducted (8.1.3) and the nature of participants' creative musical products (8.2). Once this situated context is established, findings are presented which develop understanding about how this community found and developed its creative ideas (8.3 and 8.4). This narrative is developed further at 8.5 when charts are introduced to reveal how this community's systems of action worked together to develop individual creative ideas over time.

8.1 A 'Flagship' Academy in West Yorkshire

Community two was bound together by its membership of a secondary academy in West Yorkshire. The academy was co-educational with 1094 students enrolled, aged between 11-18. The school enjoyed a strong history of musical achievement. This was epitomised by a concert series wherein a diverse student body developed their musical prowess. Singer Gareth Gates was a former student. Unsurprisingly, a recent Ofsted report found the school to be popular and heavily over-subscribed. It attracted ambitious young people from a diverse range of social and economic backgrounds. Ofsted reported that many students belong to minority ethnic groups, primarily of Indian or Pakistani origin.

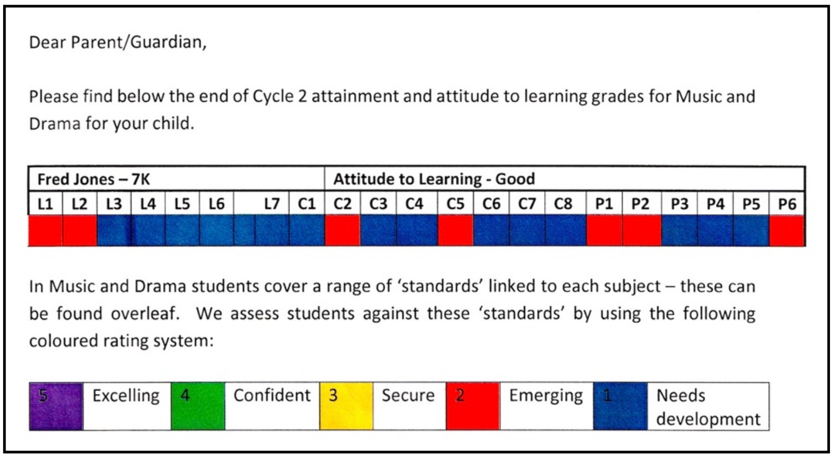
The academy required students to adhere to a set of expectations known as 'pride values'. These values expected students to show <u>P</u>urpose, <u>R</u>espect, <u>I</u>ntegrity, <u>D</u>etermination and <u>E</u>xcellence. Staff repeatedly reinforced these words when talking to students about their learning and consequently, the terms were internalised from year seven. PRIDE was the social convention through which all learning and school discourse took place.

8.1.1 Head of Music

The Head of Music (HOM) was an experienced classroom teacher who had taught at the academy for many years. During each classroom lesson, the HOM issued students with personalised targets to meet. Every student stored their targets alongside self-assessments to create a record of progress over time. The HOM's perpetual search for innovative practice led to her interest in this research project.

8.1.2 Classroom curriculum

Classroom learning was target driven and routinely assessed by teacher and student, in order to catalyse new learning. At KS3, the HOM developed assessable standards for those listening (L), composing (C) and performance (P) tasks which comprised a unit of work. The HOM then applied a colour-rating system to reward achievement and highlight those areas which required further development. In Year 7, this assessment system was introduced to parents and the figure below describes a fictional student's progress using the colour rating system. A colour key is also included:



Dear Parent/Guardian,

Please find below the end of Cycle 2 attainment and attitude to learning grades for Music and Drama for your child.

Fred Jones – 7K								Attitude to Learning - Good													
L1	L2	L3	L4	L5	L6	L7	C1	C2	C3	C4	C5	C6	C7	C8	P1	P2	P3	P4	P5	P6	

In Music and Drama students cover a range of 'standards' linked to each subject – these can be found overleaf. We assess students against these 'standards' by using the following coloured rating system:

5	Excelling	4	Confident	3	Secure	2	Emerging	1	Needs development

Figure 8-1 The coloured rating system, as introduced to newly enrolled students and their families.

Descriptors of the numerical listening, performance and composition standards listed in Figure 8-1 can be found at Appendix F.

During my time at the academy, I assisted the HOM during KS3 and KS4 classroom lessons. From the outset, year eight were identified as a year group who might benefit from the tablet research project because they had already undertaken a music technology unit of work.

8.1.3 Fieldwork activity

The HOM explained that when students left their regular music lesson to compose with the tablet, their learning was expected to connect with the department's current unit of work, 'Blues and Ragtime'. A scheme of work summary is attached as Appendix G. To meet this expectation, a classroom worksheet of blues stimuli was made available to students during fieldwork. This worksheet included charts for a 12 bar blues structure, C blues chords and C blues scale (included as Appendix H).

This tablet research concerns itself with composing activity and therefore, only composing standards were assessed in the field. A laminated task card was created to share the composing standards for the tablet project. These standards were adapted from the department's own assessment criteria (included as Appendix I). The card also contained the fieldwork brief, which comprised two parts. Firstly, participants were invited to link their work to 'Blues and Ragtime' using the standards provided. Secondly, participants were also invited to portray something of their personal musical interests.

Rather than expecting every student to respond to every standard, the HOM and I decided which standards each student pair should focus upon. Each participant's current colour ratings for the C1-C8 standards informed our decisions. Once each participant pair was allocated specific standards to achieve, I agreed to provide students with WWW (What Went Well) and

EBI (Even Better If) feedback to be presented at the start of each tablet session. Each participant read their WWW and EBI targets to devise their MAP (Map Action Plan). This range of information was compiled into a 'progress tracker', which the researcher created for every tablet session and a sample is included as Appendix J.

8.2 The participants and their music

A situated context for this second fieldwork cycle has now been established and a summary of participants' musical experience, interests and their creative products will now be presented.

8.2.1 John and Botan (Pairing F)

Year eight student John played the cornet, took voice lessons in music theatre and learnt to dance out-of-school. In school, John took part in school performing arts concerts and he was also a concert band member.

Year eight student Botan didn't take music lessons but remembered his class getting taught the violin at primary school. Botan explained that his Muslim culture introduced him to 'very different' styles of music, especially when his family celebrated Eid and attended weddings. Botan also listened to Ed. Sheeran and Clean Bandit via the internet when he 'got bored'. Botan's future musical ambitions were to attend a concert, write a 'good' song and to take part in a large musical event.

The starting point for John and Botan's composition (track 30) was a riff, which the pair developed from the C blues scale (track 31). From there, John created a drum beat in partnership with the matrix interface (track 32) and the students duetted to record a chord progression (track 33). For a new section, John led the creation of a more complex blues scale riff (track 34). To complete the composition, a drum fill loop was edited and then inserted. A syncopated bass part using the notes C and G was added for textural variety (track 35).

8.2.2 Sada and Nayan (Pairing G)

Year eight student Sada was a school trendsetter with little formal musical experience. Her relationship with music was influenced by friends, family and the classroom, to the extent that she had informally learnt to play the violin, guitar, piano and drums by imitating others. Sada was a competent technology user and she was completely familiar with touch-screen devices. Sada also listened to a broad range of pop music, which included artists such as Charlie Puth, Taylor Swift, Selena Gomez, Ariana Grande, Justin Bieber and Logan Paul.

Year eight student Nayan occasionally composed music with friends and family but possessed no formal musical training. Her primary musical experience was classroom-based and she seldom used digital technology. Nayan aspired to win school-level auditions to perform in a concert.

Sada and Nayan's final composition (track 37) developed from a four-to-the-floor drum-pad beat (track 38) and an Amin-Gmaj chord progression (track 39). From there, the pair deleted a riff (idea 4) and recorded a new high-pitched riff, based on the pitches ABCDE (track 40). As the music built up, a sustained, broken-chord pattern (track 41), a syncopated one-note bass part (track 43) and an adaptation of earlier riff material (track 44) helped the composition to achieve its ethereal, mysterious intentions.

8.2.3 Liam and James (Pairing H)

Year eight student Liam took lessons on guitar in school and his guitar teacher explained that he was making rapid progress. Liam chose to perform music which imitated the bands and artists he watched live online and these included Blink 182, Korn, Nirvana, Mac Demarco, Eric Code and Slipknot. These artists released indie, psychedelic rock, electronic dance, industrial metal, punk and alternative music. Liam's musical ambitions were to play 'superfast' solos, sign to a record label and become a famous guitarist.

James was a committed young musician. He formally learnt the violin (grade three standard) and drum kit (grade one standard) and he owned his own electronic drum kit. James had previously composed music on tablet computers and he was a competent GBIOS user. In school, James was a member of concert band, rhythm & blues group and samba band. He also attended a Suzuki violin group and typically performed violin at six concerts per year, four of which were in school.

Liam and James' composition (track 45) began with a drum beat and this was input by hand and revised three times by drummer, James (track 46). Liam acoustically recorded a riff using his electric guitar (track 47) and James responded with a high-pitched keyboard riff (track 48). Liam imitated James' voice to create a bass riff with his electric guitar (track 49) and again, James responded with a jazzy, high-pitched piano riff (track 50). Liam created a final, more improvisatory blues riff (track 52) and the composition ended with a crash cymbal (track 51).

8.2.4 Owen and Kasar (Pairing I)

Year eight student Owen found any classroom environment an acute challenge. The HOM decided that a digital technology project might better engage Owen with school music. Owen was an expert Xbox gamer and spoke with authority on this subject. He also had experience of touch-screen music apps. Owen's local social club ran a project using the app 'Junior Jam', an experience which Owen remembered fondly. In terms of Owen's music listening, rap artists such as Stormzy, Chipmunk, Eminem and Big Shark were influential.

Year eight student Kasar had developed a reasonable proficiency for the music keyboard during his classroom lessons. Kasar had little to say about his musical interests but he listened to chart pop while he is writing up homework. Kasar received no formal musical training nor did he extensively pursue musical experiences out-of-school.

Owen and Kasar's composition developed into many sections, each containing a range of creative ideas. Composing began when the pair jointly inputted a Cmaj-Fmaj chord progression (track 54) and then found a drum beat (track 55). After learning the blues scale, Owen developed a syncopated riff (track 56) and a bass part (track 57). Two more drum parts (tracks 58 and 60), a second bass part (track 59) and two complex electric guitar riffs (tracks 61 and

63) filled out the texture. Owen also developed a rap and his lyrics were adapted to reflect the story of the blues in South America (track 62).

8.2.5 Jenny and Inder (Pairing J)

Year eight student Jenny was a keen school musician who attended choir on a weekly basis. She was also beginning to learn the flute and read stave notation. Out-of-school, Jenny was a fan of the group Seventeen and she listed their albums. Jenny admitted that ‘most of her life is made of music’ and she aimed to see K-POP, ATL and ‘Pierce The Veil’ live in concert.

Year eight student Inder enjoyed some informally-acquired experience of the guitar, drums and keyboard but no grades had been taken. Inder used the app ‘Yousician’ and its sheet music or tab-based, real-time visualisations to teach himself to play instruments. Inder listened to rap artists such as Stormzy and Drake, via Spotify, YouTube and Deezer.

Jenny and Inder’s tablet composing (track 65) began with a drum track (track 66) and a syncopated Cmin-Fmaj-Gmaj chord progression (track 67). A three-bar keyboard riff (track 68), some keyboard improvisation (track 70), a further bass keyboard riff (track 71) and a C-F-G riff recorded by Jenny on her own flute provided the melodic material (track 73). The chords (track 67) were later adapted to create a new chord pattern which filled a gap in the music (track 72).

8.3 Community two searches for their creative ideas

Participants’ musical interests and creative ideas, as presented at 8.2, will now situate an account for how students, teacher and tablet computer influenced community two’s search for creative ideas.

8.3.1 The Student

The student copied, adapted and on occasion, invented musical content. They also found ideas by linking fieldwork to their own musical interests and beliefs about the composing process. Some students also developed their own goal, which additionally informed creative ideas.

8.3.1.1 Built upon their musical interests

Inder and James had previous experience of using GBIOS. Inder directed Jenny to the drum matrix during their first session. James owned an electronic drum kit and listened to Clean Bandit and these interests helped James and his teacher to begin compositional work:

> INT: That was the first part you put down, wasn’t it – you play drums, don’t you?
>
> J: Yeah, I have an electronic drum kit…I like Clean Bandit, they use an electronic drum kit most of the time and they can change the sounds that they want to use. So that was really easy.

During fieldwork, James became fixated with creating and refining drum parts. Observation notes also recorded that Owen recited a favourite rap:

> Owen now breaks into a rapping routine. He recites a rap that he has learnt from other artists.

Subsequently, Owen decided to compose and record his own rap (track 62). Liam found the project no different from what he ‘normally does’ because he was able to use his own guitar throughout:

> L: Nothing really changed, it was easy for me because I'm already doing blues in my guitar lessons, so this just helped me to bring those scales to good use.

When Jenny was creating ideas, she drew upon that theoretical knowledge she acquired from flute lessons:

> J: I've got used to in flute [lessons], holding things on for 4 beats.
>
> T: You could do that.

From session three onwards, Jenny retrieved her flute and a how-to book to create a flute riff:

> Jenny laughs.
>
> J: I have my flute book and my flute is in the locker…
>
> T: Go and get it!
>
> Jenny reaches for her flute book to research how to play an Eb and an A.

John and Botan chose not to use additional instruments but their informal music listening habits immediately furnished them with ideas:

> INT: You both listen to a lot of music at home or wherever. Does that shape what you do?
>
> J: It does quite a lot because it means you have something to go off the bat and you know it will sound good, if you add it to your piece. Obviously, you don't just copy it straight up but you change it a little bit…
>
> B: You tweak it just a little bit, so you know it's still your own but really, it's based on someone else's.

Sada and Nayan agreed, explaining that they would prefer to listen to more of their 'own music' during their tablet sessions to 'take ideas':

> S: It would help us even more, if we got to listen to the [our] music [in the session] and then we got to pick out stuff and try to make it [our piece] more…
>
> S: Listening to a song while we are doing it and trying to like take the idea and put it into ours, like if it is high or low.

Participants were evidently keen to develop and apply their own musical interests when they used the tablet computer. These personally-held musical interests influenced acoustic instrumental, voice performances and touch-screen inputs.

8.3.1.2 Developed opinions about the composing process

Community two students brought with them diverse opinions about the composing process and these influenced tablet composing discourse. Jenny explained that for her, creating music was about making something new, something not found anywhere else:

> J: Creativity is being able to come up with something and making it different from everything else and making it your own.

John shared a very different viewpoint. He believed that 'new' music is routinely 'remixed' from older music:

> J: Well a lot at the moment is like remixes. That is, when someone's written something and the other person has written something and then they will have merged it together and it will start off with one part of the music and finish up on the other piece and they will mix it together.

John and Botan built upon this 'remixing' perspective to suggest that composing is a fundamentally collaborative activity:

> INT: People say that Mozart is a genius, that he created everything in his head…

J: …he probably had like some help. So, he'd have probably have gone to his park or something and asked his mate 'What do you think I can add to this?' or 'Could I do this?' and then it all came together.

B: Sometimes he might have heard a song. He might have been where it's uptown or something and might have heard a song that he liked and adapted it, the tune and then put it into his song.

Kasar explained that composers might begin a project alone but soon look to others for developmental input:

INT: So, you know these old classical composers, do you think they worked alone?

K: The thing is, they probably started alone and then developed it with other people.

Participants have defined composing as both an individualistic, imagination-driven activity and a collaborative process, one which shares and adapts creative ideas. Sub-sections 8.3.1.3 to 8.3.1.5 will now present findings which suggest that students' ideas were in part influenced by their compositional beliefs.

8.3.1.3 Copied existing ideas

At 8.3.1.2, participants explained that for them, composing is a process defined by situated others, existing materials and other environmental influences. During tablet fieldwork, table 8-1 evidences that students were indeed influenced by situated others (teacher and peer) and/or existing materials (worksheet) to replicate chords, riffs and the blues scale:

Table 8-1 A review of those community two student ideas which were copied from the teacher, worksheet or each other.

Community: Two			**Dimension:** Student **Finding:** The student copies existing ideas	
The student…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…copies chords	4	F;I	Botan now attempts to copy the C and F chord pattern [from worksheet and teacher]. John helps him find the correct notes by moving Botan's hand/fingers.	1
			Next, the teacher counts 4 beats and indicates that Owen could play one chord per bar. This is achieved by the teacher playing the same chord in a lower octave on the keyboard. Owen copies the teacher.	1
…copies riffs	5	F;G;H	John practises the bass riff, as shown by the teacher. It works well and is beautifully in time.	1
			Now Sada and Nayan begin to play the A B C D E pattern, as modelled by the teacher. Although this was shown as a starting point, the students seem to have accepted it and used it without 'getting creative' with the pattern.	3
			Now James sings the pattern on a D pitch also. A A C A then D D F D. Liam appears to have a good musical ear and replicates this on his guitar.	3
…copies scales	2	F;I	John plays the blues scale in its entirety [learnt from worksheet].	2
			Now Owen and Kasar play the external keyboard but their patterns remain very similar to the blues scale itself.	2

Replicating ideas in this way could be compared to John's definition of remixing, which argues that the composer does not necessarily have to 'write the song' but instead, copies parts and arranges them in a new way.

8.3.1.4 Adapted existing ideas

Students did not just copy musical ideas, they adapted them to suit their own needs. Sada and Nayan explain this strategy:

INT: Right yes because I gave you a few musical ideas, didn't I?

S: It's like taking something and changing it. It's not taking it. It's changing it…

INT: …and making it your own. You did that, didn't you? You took things and then you did change…

N: …and then we made it into our own.

A number of students adopted Sada and Nayan's approach. They worked to adapt existing basslines, chords, scales, melodies and riffs, in order to 'make them their own'. Examples of this adaption strategy are reviewed by Table 8-2:

Table 8-2 The student adapts existing musical ideas.

Community: Two			**Dimension:** Student **Finding:** The student adapts existing ideas	
The student…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…adapts a bass line	1	F	Botan now tries out the teacher's bass riff but changes it, playing three C pitches and then one G note. C C C G C C C G C C C G. This is an effective extension of the pattern. T: That would work all the way through.	3
…adapts chords	3	H;J	Back to smart piano where James practices the chords as shown by the teacher (but he has adapted the rhythm). Jenny now uses the bottom note from each chord (C, F, G) to create a pattern. She has adapted the worksheet material as forwarded by the teacher.	3 3
…adapts scales, melodies and riffs	8	H;I;J	Liam begins to play a catchy riff (A A C A) he has developed from the blues scale. Owen begins to develop a five-note riff, based on the blues scale. C Eb F Gb G. Jenny now creates a short improvisation using the first four notes of the blues scale. Jenny practises a C F G pattern as found on the worksheet. Soon, it becomes CC FF C G F C. A little creative development has seemingly occurred.	3 1 1 2

8.3.1.5 Invented new ideas

Despite the available worksheet, descriptive targets and teacher input, students chose to place these aside and make their own choices. It was found that students invented new ideas by experimenting with the tablet's digital smart instruments, audio recorder and real, acoustic instruments. In search of new ideas, Sada experimented with chords by tapping on-screen. This phenomenon is illustrated at Figure 8-2:

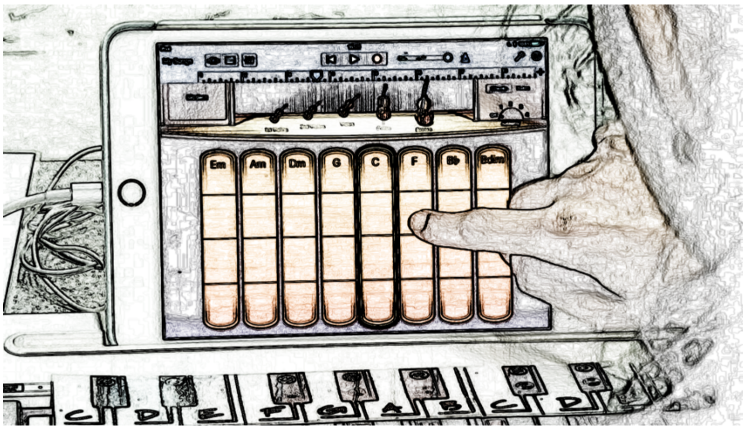


Figure 8-2 Sada taps the touch-screen to experiment with chords.

Students also auditioned timbres to find ideas. During session two, Owen selected the audio recorder and began to experiment with the vocal pre-sets and the external microphone:

> Owen starts to say 'Hello', while experimenting with the pre-sets. Some strange sounds are emitted, which cause a number of laughs.
> O: That just felt really creepy, that just sounds so creepy.

Each audio effect was symbolically represented by a cartoon-style icon and Owen and Kasar tapped the icons to find new vocal effects, all while Owen continued to verbalise into the external microphone. This behaviour is captured by Figure 8-3:

Figure 8-3 Owen (right) experiments with the external microphone while tapping vocal effect icons, as displayed by the GBIOS audio recorder interface. Kasar (left) also triggers different effects.

In addition to experimentation, Table 8-3 suggests that students improvised, or used their own musical experience to invent ideas for acoustic instruments, smart drums and smart piano:

Table 8-3 Students invent new ideas for both real acoustic instruments and the tablet's smart instruments.

Community: Two			**Dimension:** Student **Finding:** The students invents new musical ideas	
The student invents musical ideas for…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…an acoustic instrument	2	J;H	Jenny then works out exactly what she is going to play on her flute at the end. She has selected the notes C F G C F G A . Liam begins to improvise over James' tablet-based drum pattern with his electric guitar	2 1
…the smart drums	3	H;J	INT: Did you initiate and develop the drums then James? J: Yeah, I had an original beat and of course, I replaced it with a different drum, which sounded way more blues. Also, I added a different rhythm in. I added a fill a bit more often, instead of having one or two in the whole thing. So, that made it sound way better, so I was happy with that. INT: So, Jenny and Inder, who initiated the ideas? J: It was me and Inder who came up with the ideas. So, like when we first started, we had no idea what we were doing. I: So, we used the beat to get going. J: …and we came up with the idea of creating a drum beat, creating a simple one, which we could follow and add more music to it and that would make it catchy.	INT INT
…the smart piano and external keyboard	9	F;G	Sada develops her own, new less syncopated pattern and plays it. T: Sounds good. Nayan invents some new material at the keyboard. N: That [plays some note clusters], or this [plays some lower note clusters]? John and Botan practise without the auto-play feature. A new riff emerges. J: If you play higher, I'll just play a [single note.]	2 4 4

Part 8.3.1 has suggested that students' informal/formal musical interests and their perceptions of the compositional process influenced creative musical Activity. Students copied and adapted existing ideas but also staked ownership of the Activity, which led to the invention of unforeseen musical ideas. Part 8.3.2 will now consider how the tablet computer influenced community two's creative music-making.

8.3.2 The Tablet

Participant and field accounts record that students made use of GBIOS's exploratory design, range of timbres and track-view screen to find new creative ideas. Participants also explained that the tablet computer and its GBIOS app both impeded and enhanced their ability to be creative in musically and/or technologically driven ways.

8.3.2.1 Initiated ideas

Findings presented at 8.3.1.5 suggested that students invent creative ideas but it is also clear that the tablet tacitly contributed to, or even initiated that process. During sessions two and three, James discovered and experimented with timbre to find creative ideas:

> James tries out more timbres while playing his blues scale.
>
> James now searches through different keyboard timbres.
>
> James is now searching for a new instrument. Lots of tapping around the app, seemingly randomly.

Liam explained that timbres could enhance the quality of new ideas:

> L: We could add effects to our sounds, so when James was playing the keyboard, he didn't have to just play a normal keyboard like this one, he could play like any keyboard…so like the soul organ.

James found that the range of timbres gave him 'so many opportunities' to initiate ideas:

> J: There are so many opportunities. You can go on to the different effects, you can change all of the stuff…If I go onto here, I can choose Live Loops and I can choose EDM, HipHop, DubStep, R&B, House, Chill, Rock, Electronic Funk, Beatmaster, Chinese traditional or Chinese modern. That's a lot of different stuff, of sound samples, which you have there.

During their second session, John and Botan searched through and auditioned keyboard timbres. Fieldnotes recorded the speed at which this sequence took place:

> John searches through a range of keyboard-based timbres while Botan plays the external keyboard. Just a couple of seconds are spent auditioning each timbre. When a timbre/instrument is selected, the whole interface reconfigures extremely quickly to present both a new input interface designed for that instrument and a new timbre.

During interview, John and Botan explained that the GBIOS interface provided a sensible (and not endless) selection of timbres which could be quickly and easily switched at will. Evidently, the accessibility, speed and contained nature of auditioning timbre in GBIOS could make it an initiator of creative ideas.

John and Botan also explained that the external keyboard helped them find ideas because they could 'mess around' and not have to 'guess' when making recordings:

> INT: You say you started with the external piano first, was it useful to have that?
>
> B: Yeah, it was kind of useful.
>
> J: …because you could kind of mess around before you recorded it and then you knew it was easy to play it and you didn't have to guess what you were going to do.
>
> B: It's kind of like we could hear the sounds, so it's kind of like a trial so if you're going to put something in, you kind of know how you're going to do it. So, if you're going to put something into your tune, you can practise it first, instead of putting it in and doing it over and over again.

Additionally, the visual layout of the GBIOS app was found to influence Jenny and Inder's musical ideas and memory recall. In relation to musical ideas, Jenny used track-view to identify gaps for where new musical ideas could be inserted to complement existing layers. The teacher quizzed Jenny about this behaviour during session two:

> T: So, are you looking at the track-view there to see where the gaps are?
>
> J: Yeah.

T: How can you see it then?

J: There is a gap here and a gap there and big gap there. You can see it because there are no lines.

As Jenny was talking, she pointed to gaps between the layers, as indicated by the tablet screen. This behaviour is captured by Figure 8-4:

Figure 8-4 Inder (right) looks on as Jenny (left) uses the visual layout of the track-view screen to identify where new creative ideas might be developed.

Jenny continued to use the strategy during session three:

Jenny scrolls across track-view.

J: We need something to put there…so it's from six to seven…We could put a C chord in?

The visual layout influenced where Jenny and Inder created sections of ideas (musical structures) and how new tracks interacted with each other (texture). John and Botan agreed that the tablet could suggest ideas:

J: [The tablet is] …a bit quicker, but it also shows you what you can do with the piece.

B: It kind of gives a different perspective on how you play it.

J: You probably wouldn't have thought of doing something like this.

T: So hang on, it gives you the ideas in the first place?

J: Yeah.

During session two, Jenny also reviewed her recorded parts in the track-view screen with the intention of re-learning that material:

Jenny now uses the graphic notation view to remember what she played in a previous session.

J: So, does that mean I just played one note at a time?

T: It looks like it, yes.

The tablet's smart instruments also helped Jenny to find notes, chords and even ready-made musical content:

J: If you didn't know where certain notes were, you had it on the screen already and you could see which ones…Yeah, like before, you'd have to think of an instrument and you'd have to know how to play the notes on it. Whereas, with this, you had the notes and it would automatically play a few.

In addition to the automatic provision of new ideas and the display of older ones, findings have suggested that the tablet computer influenced the timbral, structural, textural and musical quality (via external keyboard rehearsal) of students' newly initiated musical ideas.

An account will now be presented which evidences how the tablet computer both impeded and enhanced participants' creative behaviour.

8.3.2.2 Impeded musical creativity

Participants explained that the tablet computer impeded musical and technological aspects of their creative behaviour. In musical terms, Inder found the smart electric guitar restrictive:

> I: So, when we got onto the electric guitar, we could only play some notes.

Similarly, the touch-screen interface could not musically replicate what Liam performed on his electric guitar:

> Liam develops a short, improvised pattern using the touch screen interface. However, Liam cannot match the level of blues improvisation that he can achieve on his 'real' electric guitar.

James also found that he could not create complex, polyrhythmic patterns because of touch-screen limitations:

> J: There is a drum section on here but it's harder because you have to use your fingers because it's not four finger multi-touch.

In addition to these musical impediments, Liam questioned the credibility of music created via virtual means:

> L: …you can play it on the iPad but you want to know how it will sound, if you play it on the guitar.
>
> INT: Right, actually for that instrument, actually try it out. So almost, you don't believe it on there [the tablet], until you've checked it out?
>
> L: Yeah.

Botan found that the GBIOS virtual musical experience did not develop his core musical skills:

> B: It doesn't really prove anything. You don't have to be good at music because it doesn't develop any of the skills.

Botan took this view because for him, much of the app was 'automatic'. He explained that if he wanted to invent his own musical ideas, they might not 'match up' to the bundled, automated content:

> B: Because if you are doing the automatic, then you've got a perfect tune, then there is nothing wrong with it. Then, you've got your own which has something else in it. So when we are playing, it's not as good as the stuff that's already on there.

Botan and Inder are suggesting that GBIOS overly supported by limiting and automating musical processes. Meanwhile, John identified areas where the app could have *done more* to support music-making. During session one, he discovered that the app did not feedback note names when he played the external keyboard:

> J: Does it tell you if you are playing a C?
>
> John then taps a few notes on the keyboard to see if anything happens on screen – it doesn't. The teacher points to the C note instead. Now John begins counting up notes to identify the C, F and G on the keyboard.

John also discovered that the tablet restricted his ability to transpose recorded tracks:

> J: However, there is one problem with having the tablet. When you were on the computer [in class], you could click on the piece of music you had played and move it when you pressed a key…Instead of having to re-record it you could move the keys [notes] and move them up and down into what key you wanted it.

Participants also described a range of software design issues, which impeded their ability to compose music. James identified that looping Liam's guitar audio in track-view was a frustratingly challenging task:

> J: The loops. You couldn't just play something and loop it…That's the one downside with looping audio, it's very hard to do and we practically didn't do it at all.

Additionally, Owen and Kasar found the touch-screen to be inadequate for musical input:

> O: I find it [the touch-screen] quite good.
> K: You might click on the wrong thing.
> O: That's the one disadvantage, isn't it?
> INT: You can accidently…
> O: …delete something by accident and spend half the day just trying to get it back.

The accessibility of the touch-screen also invited student pairs to jostle for control in front of the screen. As Kasar and Owen's confidence increased, the area in front of their touch-screen became a busy place.

8.3.2.3 Enhanced musical creativity

Contrary to the musical and technological impediments participants identified, the tablet was found to enhance musical skills, creative freedoms and musical inclusion. In musical terms, students learnt how industry professionals construct songs. They also developed a sense of timing and learnt to input polyrhythmic parts. John and Botan commented on how their timing and counting improved:

> B: I picked up timing because my timing used to be rubbish.
>
> J: I think I developed the ability to count better.

Fieldnotes recorded how John's ability to input a drum fill rapidly improved:

> After a number of on-screen attempts at a drum fill, John's ability to play one dramatically increases after a few minutes. Almost through a trial and error approach, he has emulated the sound of a typical rock drum fill. John starts by using one hand and as his technique improves, he uses two.

When five participants created music with the tablet, they developed an understanding for how songs are constructed:

> Liam: …when you make your own music like we did, it gives you a simulation of what it's like to be a real musician and working like…
>
> James: …in a recording studio.
>
> Inder: I just played around but now, I know you can edit. There is the track-view and you learn how composers make songs.
>
> Jenny: I think they put it all in [to track-view] so they can see all the layers. If they don't like it…like when they actually put it on CD, they can change it to how they want. Then, they know they definitely like it.
>
> John: It has showed me in a deeper depth how people create music on computer which I had done but for fun. It showed me how hard it must be to create remixes but also [it has] inspired me to mess with music and experiment.

The participants also found the tablet enabled them to experience creative musical freedoms. Botan explained how the app enabled him to become 'master of his own music':

> B: Yeah, I really like it…Because you can choose what you're playing, how you're playing the tune, the sound, how loud it is, how low it is, basically you are the master of your music, you choose everything.

Inder too believed that he was free to 'play around' with the app:

> I: Because in school, you have restrictions and stuff sometimes but you get to play around with it [the app], you are free to do what you want.

In addition to creative musical freedoms, participants explained that the tablet was musically inclusive, regardless of musical background. John explained that automated features could be used as a starting point for any composer:

> INT: Say if you two both used loops in a piece, would that still be your piece?
>
> J: No. However, it does mean that you don't have to be able to play the piano fluently and you don't have to be able to play the guitar to be able to make the piece, you can use a bit of it.
>
> B: Even though I can't play the piano amazingly, I could still put a piece together using this software.

Nayan and Sada agreed, explaining that tablet composing began easily but then ideas could soon be extended through use of the external keyboard:

> INT: Did it make actually writing a piece of music easier, or not?
>
> N: It did!...It was easier because if you were writing it there was like…you take more time but here [on the tablet], it's easier.
>
> S: And then you can develop it from here [pointing to the external keyboard] and then you can write it down proper then [record it].

James explained how the tablet workstation's different input options enabled him to choose a mode most compatible with his habits and experience:

> J: Yeah because I found it easier to be able to make a good melody [on-screen] because the app gave you the scale. It also gave you all of the notes in the scale and all you had to do was use those eight notes. However, with the keyboard, you sort of have to skip notes that are in-between them and you have to find the notes [yourself]. That's more annoying. So, to be able to use an app which gives you the opportunity to use auto-play, use an electronic drum, use guitar auto-play, it's so much easier.

Participants have now reported how GBIOS and the tablet touch-screen influenced their musical and technological creative behaviour. Evidently, some opinions were polarised and contradictory. John and I discussed the issue:

> INT: Do you think it's a difficult balance then, these automatic, automated features and what you're bringing to the table?
>
> J: Yeah, it's really difficult to tell whether it's good or not good and they kind of clash whether it is good or not good or whether you should use it or whether you shouldn't use it.

Sada and Nayan believed that students could not 'just' use automated loop features but then, Nayan conceded that the looping option did enhance her creative potential:

> N: I think you can't only use loops. You need your own piece of work. Because then, you know that it will be your effort and just not copying and stuff.
>
> S: You need to change it over too [Sada's phrase for changing existing ideas].
>
> INT: Are the loops a bit of a negative, maybe?
>
> N: No, I think it does help. If you want more of it, you don't have to do it all over again, you can just loop it.

Critically, Jenny added that even when she chose automated content, she retained responsibility for the ideas and creative decisions taken:

> J: If you just put a bunch of drums together, it won't sound like much. You have to put them in an order, to make a song out of it.
>
> INT: Right, so you are still being creative, do you think?
>
> J: Yeah. You have to think of like a tune [or idea] to do it.

The tablet computer has been found to both enhance and impede creative music-making and participants occasionally found its mediating influence a challenge. Findings will now be presented which describe how the teacher managed pedagogical discourse and influenced the broad musical direction of creative products.

8.3.3 The Teacher

During early tablet composing sessions, the music teacher (my role as participant-observer) was found to manage pedagogical discourse and influence the broad musical direction of students' work. A more detailed account of these behaviours will now be presented.

8.3.3.1 Managed pedagogical discourse

Community two students welcomed a range of structural guidance when they composed with the tablet. During interview, three pairs explained that teacher-imposed structures were welcome. However, John and Botan believed there should be a balance between their own and prescribed ideas:

> J: …it's good to have something you can input as well as you just having your own [ideas]. For example, we were missing a few key parts of the music and then you helped us see what we were missing out.
>
> B: We had to fill that part in and you showed us the blues and improvising and it kind of showed us what to do, like guiding us.
>
> J: We are all children aren't we and we've never really done it massively in like the massive DJ side of things, so it's helpful to have something, some kind of guideline.

Kasar and Owen concurred. They expected the teacher to help only if things 'went wrong' but Owen also acknowledged the potentially positive impact of a teacher's musical intervention:

> K: I think you should have let us do it but then if we went wrong, then you should help us to make it better.
>
> O: I think when you did that improvisation, I think that was actually quite good actually. It sounded a bit more bluesy.

Jenny and Inder made the point that even when the teacher provided structural guidance, it remained their choice whether to act upon that guidance. If guidance *was* acted upon, the pair adapted it to suit individual need:

> I: Yeah, so you [the teacher] can like guide us.
>
> J: Yeah, it will get you started on something and you don't necessarily have to use it. We've got that blue sheet [worksheet] but we didn't have to play it like it was on the sheet. We could just mix up the notes.

In fact, during session three, Jenny voluntarily consulted the blues worksheet and chose to learn the C, F, and G chords. This behaviour is depicted at Figure 8-5:

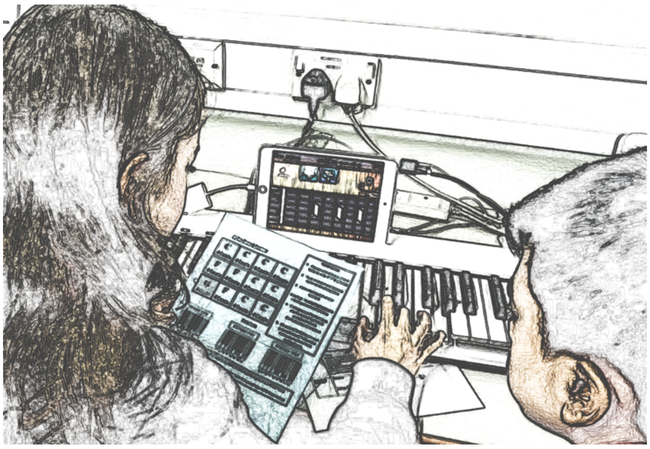


Figure 8-5 Jenny (left) voluntarily picks up the teacher's worksheet to learn the C F G chords. She holds the sheet while playing the chords.

Participants provide additional reasons why their teacher's structural guidance is necessary, especially during the preliminary tablet sessions. They find guidance helps them to improve; receive suggestions and help; overcome confusion and to explain app features. Data for these findings is presented at Table 8-4:

Table 8-4 Why community two believe teacher-led structural guidance is necessary for tablet composing.

Community: Two			**Dimension:** Teacher **Finding:** Structural guidance from the teacher is necessary	
The teacher's structural guidance is necessary…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
….for how to improve	2	G;J	Nayan: So, do you think he should have been here more, or less? Sada: No, stay here, help us and then when we had to start off again, you told us how to improve on that and we did it again on top of that. Jenny: Because even when it's creative, just because you've made it and it's your own, doesn't mean it's good. So, if the teacher gives you a target, or tells you how it could be improved, next time you do it, you could do that.	INT INT
…for suggestions	1	G	Nayan: It is ours if they are just ideas, the teacher doesn't make what we are going to do, they are just ideas. They say 'put chords in' but they don't tell us what chords to put in and we are the ones putting the effort in… Sada: …trying to put it in ourselves.	INT
…to overcome confusion	1	H	James: …most of the time, we may have been a bit confused because the loops weren't working. With a teacher at hand, you can actually set out the structure and a strategy to be able to get to the finishing point.	INT
…to explain app features	2	H	James: Having a teacher there, who would already have all that intelligence and knowledge of this app is important. [For instance] I want to set it so everything can be muted, except for one thing [track] and they can be just like, "You go over here, press on those headphones" [an icon on-screen] and everything else is muted then. Then, they [the students] are like, "How do I just mute one thing though?" and you can be like, "Oh, it's easy, you just go over", say, "Just press that button there".	INT
…because students are willing to learn from a more knowledgeable other	1	G	INT: Do you think I should have left you alone to do it? Do you think you needed more from me? Sada: No, I think it was better that you were here because you know more than us and we have only just started to get used of music and we need that help to start off.	INT

Observation data records that the teacher also prompted students to recall musical skills and knowledge:

James: How may bars should we make it? 16?
T: Ooh, bit more?
Liam: 20?
T: How long is the blues?

Liam: 12 bars.

T: How many times do you want to do that, maybe three? So that's 36 bars!

James: 36 bars?

T: Now, do we know what chords there are in a blues?

Jenny: No.

Inder: C, F and G?

T: Well remembered Inder.

Inder now plays C chords, one per beat, in fact.

T: And then Jenny, we are going to change to an…

Jenny: F.

In addition to musical interventions, the teacher also intervened to sustain development. This pedagogical behaviour was intended to keep students on task. These interventions are reviewed by Table 8-5:

Table 8-5 A review of those teacher interventions devised to ensure students remain on-task.

Community: Two			**Dimension:** Teacher **Finding:** The teacher makes interventions to keep students on-task	
The Teacher…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…monitors behaviour	6	H	T: Come on then chaps, we've got to keep it focussed. Down a little [with the volume] Liam, we just need to get it written now.	2
…encourages participation	7	H;I;J	T: Right James, I'm leaving it to you now. You've got to operate that [the tablet] as well remember. T: Can you direct him Kasar? Kasar: Start on that one [pointing to a C]. T: Come on then Jenny, this is your moment now!	1 2 1
…encourages students to record	4	G;I;J	Let's see if we can get that recorded [Sada and Nayan], so we at least remember it for next time. T: Right [Owen and Kasar], we've got about five minutes left. I would record it, just so we don't forget it.	4 1
…develop the group dynamic	5	H	Liam: Well, for the past weeks, me and James didn't really communicate with each other, we were just doing our own thing, making random beats up. Then, you got us to communicate and we turned out with all this. INT: Right, so you think I helped the group dynamic a bit? L: Yeah. It's better to have someone to keep us under control.	INT
…encourages goal setting	4	H	T: So, what's the plan James. You've got to agree a plan with Liam. J: What we can do is go onto the electronic drums [not the matrix smart drums]. T: Make a plan guys, make a plan.	3
…is time keeper	11	F;G;H;I;J	T: You've literally got twenty seconds haven't you. John: It's nothing really. T: Come on then, we need to get something in [Sada and Nayan]! Let's go back to your track-view and have a look. Play it again both of you. T: twenty minutes left Jenny. Could you play a blues scale on your flute because it's at concert pitch isn't it?	2 2 3

This table evidences that the teacher prompted musical knowledge recall and made interventions to pedagogically manage the activity of creative music-making. In response to music department and broader community practices, the teacher also made explicit links between students' work and their targets:

T: That's good because improvisation is one of your targets. So just mess around with it [the scale] a bit.

John: So, just choose a few notes and that's it?

T: Yeah.

T: [Looking at Sada and Nayan's progress trackers.] Now it says here that a riff can be really short, just three or four notes. We've done the chords, effective use of two blues instruments, we've done that and [we need to develop] a little bit more improvisation.

By session two, Owen was reciting raps that he had memorized from other artists. While the lyrics were not explicit, they were not especially appropriate for a school project. The teacher asked Owen to consider the story of the blues and some lyrics for his rap were suggested:

T: Do you remember the story from class? African slaves we transported by boat to America and then they had to work the cotton plantations. It was a very hard life, they had no freedom, no money. You could say, 'No freedom, no money, long hours'.

During Inder and Jenny’s first session, the teacher shared how minor chords could help meet blues-related targets:

> T: I’ve found that a nice thing to do in blues compositions is to play a minor chord because it sounds a bit more bluesy.

The teacher also prompted students to read their EBI targets and make a MAP at the start of each session:

> T: So, what are we writing for our MAP [Map Action Plan] Inder?
>
> Inder: To write a catchy improvisation.
>
> Jenny: I’ve got that as well.
>
> T: Right, so we’re both improvising then, are we?

This assessment-driven approach to composition was unfamiliar to the teacher-researcher but Sada and Nayan happily accepted that ‘the teacher knows more’ and that teachers know what to ‘add on next’:

> N: The teacher should [provide assessments and targets] because if you don’t know what to do and the teacher knows more than us, then they have to give us like feedback, so we know how to improve it.
>
> INT: So, you liked having that?
>
> S: Yeah, so we knew what to add on next.
>
> N: That’s how we made ours better, when you told us to put chords in and that made it better, it helped us develop ours.

To ‘make students’ compositions better’, the teacher used a blues worksheet to link new creative ideas to EBI targets. During Owen and Kasar’s first session, the teacher showed the students how to locate middle ‘C’ on the keyboard. From there, the worksheet was used to introduce the remaining notes of the C blues scale:

> T: The blues scale is where the circles are. Can you copy where they are?

As the students began to play the scale, the teacher pointed to the notes in real time, as illustrated by Figure 8-6:

Figure 8-6 Owen and Kasar use the worksheet and their teacher’s note-pointing gestures to learn the blues scale.

Findings presented here suggest that the teacher balanced a range of structural guidance with opportunities for creative freedom, linked learning to curriculum-based targets and kept students on task.

Findings will now be presented which describe how the teacher influenced the broad musical direction of students' compositions.

8.3.3.2 Influenced the broad musical direction

Community participants appeared to respond well to structural guidance. After all, they expected to routinely receive progress assessments and personalised targets in order to develop. Such expectations originated from the community's assessment-driven learning culture (see 8.1). During early sessions, the independent nature of the work could prove challenging, so the teacher questioned students to ensure compositional strategy was considered:

> T: [To Inder and Jenny] What's going to be your first layer then?
>
> T: [To Owen and Kasar] Are you going to put one part in at a time then, how are you going to do it?
>
> T: [To John and Botan] How are we going to extend it then?
>
> T: [To Liam and James] So, what are you going to do next?

If strategies remained unforthcoming, the teacher suggested which instruments to use, for example:

> T: What do you think next? Drums, or your [keyboard] part straight in, Owen?
>
> T: [To Jenny] Right, do you want to put in one more piece of flute?

The teacher also suggested which musical elements could be included:

> T: [To John and Botan] In the second part, you could have an improvisation.
>
> T: [To Owen and Kasar] So, first step, I would get your chords in.

These teacher-led ideas brought with them no additional guidance for how they should be achieved. Their purpose was to stimulate new, independent, creative thought.

Findings presented here have revealed that the teacher was required to manage pedagogical and musical discourse during tablet composing activity.

Now, findings will be presented to enhance understanding about how the student partner (peer) helped the student to find creative ideas.

8.3.4 The Peer

The peer developed a range of macro-level musical and technological support. They blended their musical ideas with curriculum targets to create a shared goal and they also suggested new ways to operate the tablet.

8.3.4.1 Began to develop musical and technological roles

During the early stages of tablet composing, the peer collaborated with the student to develop a shared goal. To achieve that goal, peers often developed a different (but entirely complementary) role to the student. Throughout the tablet sessions, Liam and James' roles were polarised. Liam improvised music with his electric guitar and James recorded and edited those parts. James also inputted the group's drum parts. James and Liam explained why labour was divided in this way:

> J: I think it's definitely easier in pairs because without him, we wouldn't have got any guitar in there and if we did, I would probably have to play on that guitar app and to be honest…
>
> L: …he's never played guitar before…
>
> J: …so having him there to play the guitar so well, it helped out so much. Plus, the fact that I could play the drums and I already understood GarageBand. So, I could teach him a bit and he could see how to use it…

Liam and James developed musical and digital technological roles to achieve their goal. This was a common occurrence. During session one, Nayan practised the blues scale (a music-centric behaviour) and Sada operated the tablet (a technology-centric behaviour). Jenny and Inder both operated the tablet to capture each other's musical ideas. During session two, Jenny moved seat position to record Inder's improvisation on-screen.

Sada found her partner Nayan was a 'more knowledgeable other' and to have one student as leader was essential for the group dynamic:

> S: Imagine I didn't know what to do and Nayan knew. You have to have that one person, who knows and they can help you develop…and then they teach the other person.
>
> N: …and that's how you like work together because if you were the same, you wouldn't get along. It's like when people say, 'opposites get along and sames don't'.

At this stage of creative development, routines were not fully formed but peers and their students began to devise musical and technological strategies. These strategies evidently supported students as they found ideas. Students also valued peer teaching and found it necessary for effective, collaborative development.

8.3.4.2 Influenced the broad musical direction

Community two peers immediately influenced the broad musical direction of creative musical Activity. They requested new ideas from the student, suggested their own broad musical ideas, reconciled different ideas to create a goal and linked their group's work to both imposed targets and their own goals. Reproduced below are findings transcribed from sessions one and two. They evidence peers requesting new ideas from students:

> John: Unless…unless you've got anything else?
>
> Botan: Let's try yours first and see.
>
> Sada: Which one do you want to do [Nayan]?
>
> Inder: Where shall we start then?
>
> Jenny: Shall we start with drums?
>
> Inder: We can create a beat first.
>
> Jenny: What shall we do now?
>
> Inder: Are you going to add another drum?

During the first two sessions, peers also suggested broad musical directions for the tablet activity. This was where a musical idea was suggested but little detailed guidance is given:

> John: We could do with something quicker, more upbeat.
>
> Botan: Maybe we should try that with the strings as well, because it kind of does change how it sounds.
>
> Botan: Shall we try putting another [part] with the piano part?

During the first session, the peer incorporated both their own ideas and the students' ideas to create a singular, achievable goal for the project. This was a complex process which required a level of maturity and cognitive effort. John and Botan discuss how they merged ideas together until they were 'right':

> J: We both helped create the actual piece of music. So it helped having two people to do it. You just have two ideas all the time and then eventually, you'd come together to make a good idea because when one has an OK idea the other has an OK idea, then you meet in the middle and it would be an actual good idea.
>
> B: So, it's like you've got two ideas which are kind of different. So, if John wanted country and I wanted pop, we would slowly merge them together until they went right.

Owen and Kasar adopted a similar approach:

> K: We talked about it, to see what to do, what was best. There was the blues [aspect] also.
>
> INT: Thinking about your partner then. Was it essential to have them, or could you have done it with just one person?
>
> O: I think it was more essential because you got different ideas…
>
> K: …different ideas.
>
> O: Different ideas from two different people.
>
> K: Make it better, together. Use both ideas.

Participant pairs also worked together to link their goal to project targets found on their progress tracker. Jenny described how both curriculum targets and her knowledge of pop music influenced a shared goal:

> INT: So how did you actually go about making your piece, what was your strategy?
>
> J: Well, in a normal piece, you have the beat, so we decided to do the beat first and then some songs have guitar and it's a kind of blues [project].
>
> INT: So, did you want to link it to the classroom?
>
> J: Yeah.

Botan discussed with John how to make his riff meet institutionalised blues targets:

> B: Hey John, you know my riff. Maybe I should make it a guitar because that is one of my EBIs, so can we use a guitar for it?

Peer Kasar also quickly corrected partner Owen when his rapping did not link to curriculum targets:

> K: Yeah but that's not blues.

Findings presented here suggest that peers influenced the musical nature of tablet composing via a range of interventional and collaborative behaviour. Findings will now be presented which report that peers also developed broad technological strategies during the early stages of their tablet composing.

8.3.4.3 Developed broad technological strategies

Student peers made suggestions about how the tablet technology could be used. They even outlined complete technology use strategies for their partner. Listening to a newly recorded track in track-view, John noted that:

> J: It needs to go a little bit more that way.

Botan suggested volume alterations:

> B: Do you think we should raise the volume of that one's track, so you can hear it all [the way] through the whole track, so it doesn't get pulled apart by everything else.

James mentioned to Liam about looping content:

> J: So, I can actually loop that – that would work perfectly actually.

During session two, John and Botan began to discuss and develop their technology-use strategy with each other and their teacher:

> B: Could we like copy it and then put it on the other side? So, what we could do is, we could put that bit over there and then we could do that bit again after that.
>
> J: So just have like a fill in it?
>
> B: A fill, yes.
>
> T: Do you know about the copy and paste and stuff?
>
> J: Where you could copy that [point to a track] and paste it again?
>
> T: Yeah. So, are you going to have a fill in it then?
>
> J: We need to cut this down to there, [crop the chord so they line up vertically with the other track] so it will be exactly the same time and then we stop. Then, we have the fill and restart it all again.

The peer's technological influence gained momentum once creative ideas were developed (from 8.4.2.2). 8.3 has presented findings which describe how the community two peer, teacher, tablet and student ensured that creative ideas were found in the system.

8.4 will now present an account for how the teacher, peer, tablet and student came together during creative musical Activity to develop creative ideas.

8.4 Community two develop their creative ideas

An account for how community two students found their creative ideas has now been provided. Findings will now be presented to explain how the peer, teacher and tablet influenced the development of systemic creative products.

8.4.1 The Teacher

When community two participants began to focus their creative ideas, the teacher influenced tablet-mediated discourse by musically instructing; modelling musical ideas; providing close technological support; intervening 'just in time' and routinely providing feedback. Accounts will now be presented which evidence these findings.

8.4.1.1 Modelled musical ideas

Once students found a goal, the teacher could respond by demonstrating (or modelling) potential musical solutions in a range of different ways. James found touch-screen music input preferable. Consequently, the teacher lifted the tablet out of its stand to model an Amin-Gmaj chord progression on-screen. The chords were designed to accompany Liam's blues scale:

Figure 8-7 James (left) observes the teacher (right) modelling a two-chord progression using the GBIOS smart-piano interface.

The teacher also modelled chords, riffs and improvisations at the external keyboard. In the rare event that participants failed to respond to these ideas, musical content could also be prescribed and even recorded into students' tablet projects, as detailed by Table 8-6:

Table 8-6 The teacher as musical modeller for community two.

Community: Two			**Dimension:** Teacher **Finding:** The teacher models and prescribes musical ideas	
The teacher…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…models chords	18	F;G;H;I;J	T: What were your chords John? Teacher then finds the chords on the external keyboard. John struggles to re-learn the chords that were used in a previous session. Notes of Jenny's melodic pattern clash with the chords, which are already in the track. T: Right, so you know the chords which are already there, they are going [teacher sings rhythm of chord pattern]. The teacher models a similar chord pattern to Jenny's but the rhythm is altered, to fit with the existing Cm, F and G chords.	2 3
…models scales	3	F;H;J	The teacher subsequently demos the A blues scale at the external keyboard for James (so that his music fits with Liam guitar parts, which are in 'A').	2
…models melodies and riffs	21	F;G;H;I;J	Teacher sings a riff for John and Botan based on the blues scale and then models it on the external keyboard with the backing track. The teacher then models a riff for Sada and Nayan. It's keyboard based and uses the A minor scale. He selects the notes A B C D E as an ascending pattern but only to show students the possible notes to use. Now both students begin to play the A B C D E pattern, as modelled by the teacher.	2 3
…models improvisations	5	H;I;J	Teacher demos a blues scale, catchy riff and improvisation for Owen and Kasar. It uses the blues scale. T: So, all I'm doing is using the [scale] notes but I'm mixing them up.	2
…models on-screen	9	F;G;H;I;J	T: I'll show you what I mean, look. Teacher models a chord pattern for James and Liam using the on-screen smart chords. T: Now if you use this [on-screen], what you are going to need to do is decide which chords you will use…	2
…models with a backing track	7	F;G;I;J	Teacher models a blues scale riff over GBIOS auto-play chords for John and Botan (in part to check the possibilities). Teacher models syncopated C/F major chords over Sada and Nayan's drum beat track.	2 2
…prescribes musical content	3	I;H	More discussion about the lyrics between Owen, Kasar and teacher. The teacher suggests lyrics linked to the blues story; 'Not free, no cash, no worry'. The teacher records in a A minor and D minor chord progression for James and Liam. Each cycle completes with the use of an E major chord.	2 2

In addition to modelling ideas in response to student desires and curriculum targets, the teacher also became a musical instructor and an account of this role will now be provided.

8.4.1.2 Musically instructed

The teacher answered musical questions, contributed musical knowledge, instructed new musical concepts and made musical suggestions. In terms of student questioning, the teacher received requests for musical ideas, clarifications and permissions. Reproduced below are instances when students requested musical input from their teacher:

> Nayan: Sir, what would we use?
> T: The same minor pattern but…
> Jenny: I'm just trying to think what we could put in there?
> T: What about a little improvised riff, using the blues scale?

Jenny sought clarification about a musical concept:

> J: Are there four beats in each bar?
> T: Four beats per bar, yes.

Surprisingly, prior to engaging in musical activity, Botan and Liam sought permission from their teacher:

> B: Hey Sir, can we use these? [Pointing to the amp boxes on screen.]
> T: Yeah go for it, it's there to use.
>
> L: Before we record, is it OK if I can practice it?
> T: Of course you can!

With students' musical questions answered, the teacher continued to mediate tablet composing with musical knowledge. The findings below evidence this influence:

> T: So what scale was I using there? It's not a trick question!
> John: Was it the blues scale?
> T: Yes!
> Nayan plays a repeating single note pattern on the pitch 'A'.
> T: Good, well done Nayan, that's an ostinato, a repeating pattern? Do you remember that from the test that Miss gave you, at the start of today?
> Nayan: Yeah.
> T: [To Inder and Jenny] Improvising just means mixing the notes up…

In addition to mediating action with musical knowledge, the teacher also made suggestions and provided instructions during the development of creative ideas. These interventions are reviewed by 8-7:

Table 8-7 The teacher's musical instructions and suggestions for community two participants.

Community: Two			**Dimension:** Teacher **Finding:** The teacher intervenes with musical instructions or suggestions	
The teacher instructs or makes suggestions about…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…bass parts	4	H;J	T: Liam. Bass riff. Could you use one of those [charts from Liam's guitar book]? T: [To Jenny and Inder] We could put some bass on?	2 2
…the beat	5	F;G;H;J	T: [To Liam and James] At first, it's best to just get a simple beat down and then you can add bits as additional drum tracks.	1 2
…chords	19	F;G;H;I;J	T: What we might do James is to record your own version of the chords and get rid of mine. T: Now you need something there [bars 7 -11] because it's just the drums and solo piano. Maybe some chords? What about the chords you had to start with?	3 3
…improvisations	4	G;H;J	T: [To Sada and Nayan] We've done the chords, effective use of two blues instruments, we've done that and [we need to do] a little bit more improvisation. Jenny: I'm just trying to think what we could put in there? T: What about a little improvised riff, using the blues scale?	2 3
…instruments	4	G;H	T: [To Sada and Nayan] Could we have more piano in the second section? T: Do you know what Liam, I reckon we get your guitar for the blues scale…	3 2
…loops	2	F	John: Is there a loop where you can do keyboards? Botan opens the live loops screen. T: I think you should put it in yourself.	3
…melodies and riffs	24	F;G;H;I;J	T: [To John and Botan] OK, so we need to practise that a little bit. Each of you could play a nice riff. Listen guys, a riff could go at the start [in the gaps] and a riff could go in the second section as well. T: [To Sada and Nayan] OK. So, we are in A minor. We need something perhaps that uses A B C D E? T: So, what sort of melody do you think for that, Liam? L: Something kind of like…[Liam plays a variation of the blues scale.] T: So, Jenny, if I was to say C, Eb, F to you, could you play that on your flute? J: I can play a high C?	3 3 2 3
…raps	3	G;I	More discussion about the lyrics between Owen, Kasar and teacher. T: Not free, no cash, no worry. Sophie: And some songs, which have a bit of rapping in. T: Ah rapping yes…Have either of you rapped before? Are you going to do that on this? Sada/Nayan: No! [Giggles.]	2 1
…rhythms	4	F:G:I	T: Now, instead of just triggering the chords, what about developing a rhythm? Da Da Da Da Da Da Da. Do you know what I mean? John: Yeah. T: Let's try and create a rhythm with that Owen.	2 1

Findings presented here suggest that the teacher contributed theory of music knowledge and made a range of other musical suggestions. Melody and riff development clearly occupied much of the teacher's time, presumably due to the necessity to meet blues-related targets. Alongside a musical mediator role, the teacher also emerged as a technological instructor and trouble-shooter and this role will now be described.

8.4.1.3 Provided close technological support

The teacher was required to make technological suggestions, or even direct how the tablet was used, as students began to develop their creative ideas. The teacher mediated students' action as they added bars; selected instruments; loops; sounds; configured smart instruments; recorded tracks; recorded live audio; edited tracks; dragged content; listened back; zoomed and scrolled, for example. For a full review and description of the teacher's technologically-centric interventions, please refer to Table 8-8:

Table 8-8 How the teacher mediates students' use of the tablet technology.

Community: Two			**Dimension:** Teacher	**Finding:** The teacher mediates the participants' technological action	
The teacher mediates…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**		**Obs. Session**
…the external keyboard	3	H;J	The teacher adjusts the octave button on the external keyboard for Liam and James.		2
…adding bars	2	G;I	T: Tell you what's happened Sada and Nayan, we didn't add the extra bars on, did we? Go to track-view. Has it looped back around? If you press the + on the end, go to section A and make it 50 [bars], or something.		1
…selecting instruments, sounds, synths or loops	4	F;G;J	T: [To Sada and Nayan] Right. OK, go back onto yours. OK. Load your new song. Load a piano. Load that. Then tap grand piano at the top. Now there are some other synths. Go onto synths and have a look. Now click some of those and try the keyboard.		2
…the configuration of smart instruments	4	H;J	T: Look, if you go to notes [in the smart electric guitar interface], then tap blues scale. Have a go [Liam] and see what it feels like and how it compares [to a regular guitar].		1
…real audio recording	12	H;I;J	T: So, Inder, you can record it by holding the microphone. Turn the microphone on. Go back to instrument selection and then, you tap audio recorder. Tap the mic., any signals? Tap monitor in the bottom right hand corner of the screen. You can also put the 'IN' slider up and the 'OUT' slider up a bit more also.		3
…the recording process	15	G;H;I;J	T: [To Jenny and Inder] Let's record it this time and see what happens. We can always delete it and redo… J: Yeah. T: [To Sada and Nayan] Now go to piano again and record again. It will give you four counts before you start.		3 1
…copy and paste	8	G;H;J	T: [To Sada and Nayan] What about copying and pasting those chords out first? You need to get some layers in there. Now you might not want that all of the time James. You might want to copy it into different places. Liam's riff might sound good now, if you bring that back in as well.		3 3
…cropping	4	H;I;J	Owen and Kasar now crop the audio track with assistance from the teacher (dragging the end of the track).		2
…deleting	7	G;H;I;J	T: [To Jenny and Inder] Delete it, you can always undo.		2
…dragging	6	G;J	T: [To Sada and Nayan] What you need to do is, instead of doing that, is drag the whole thing. So, keep moving it around until it fits in with the beat exactly.		3
…listening back	2	H;J	T: [To Liam and James] It's there, do you want to have a listen, to see if it's worked? T: [To Jenny and Inder] Then, you can listen to it back. So, rewind, have a listen. See if it works.		1 1
…looping	2	G;H	T: Well, what else could you do to sort that then? Sada: Repeat it? T: Yeah, copy and paste it, or loop it maybe? Sada loops the track.		2
…muting or soloing tracks	2	I;J	Jenny wants to hear only one part as she practises. The teacher explains that tracks can be soloed when the headphone button is tapped. Jenny solos her original riff.		3
…play stop	4	G;I	Kasar works on a bass-line riff. T: Owen, do you want to press play, so Kasar can practice with the beat? Owen presses play.		2
…the vertical slider	7	F;G;H;J	James: What I could do, as a last thing to do, is go straight to drums, go to electronic drums and literally right at the end of the piece, hit the crash cymbal. T: So, you can wiz that [the vertical slider] along, can't you?		3
…zooming	5	F;H;I;J	Listening – John stops the track straight after the copy and paste point – more focussed. J: Oh! T: I would use zoom. John zooms in two or three times to focus on the copy and paste join.		2
…scrolling	2	H;I	T: [To Owen] Is that in section B now then? Scroll it back…		2
…the tempo	2	G;J	T: [To Sada and Nayan] Why don't you slow it down?		2
…undo	2	H	James: There is no un-loop button. T: Why don't you just undo? Just keep undoing it. Now get it to bar nine and zoom in. Press play and let's see.		2
…mastering	9	G;H;I;J	T: If it's still not loud enough, you will have to turn the other parts down a little bit. Owen takes this advice and works through each track, decreasing the track volume. T: [To Jenny and Inder] Right. So, it is very quiet. Click mixer. Slide compressor all the way up and track volume right up as well.		2 3
…the transport bar	5	G	Sada attempts to record the beat but presses the 'play' button. T: You have to press the red button to record.		1

Once students found a musical idea and simultaneously worked out how to use GBIOS, music could be ‘made to happen’ in sonorous terms. Typically, students found an idea and then proceeded to embark upon an extended period of rehearsal.

Findings will now be presented which evidence those rehearsal processes and how the teacher supported them through a range of ‘just in time’ interventions.

8.4.1.4 Provided ‘just in time’ support

Rehearsing creative ideas prior to recording could quickly consume participants’ attention. EBI targets expected students to include blues scale riffs, improvisations and chord progressions: these ideas soon required additional support. The teacher maintained a pulse for Owen and used hand gestures to indicate when he should switch from a C minor chord to an F major chord, as illustrated by Figure 8-8:

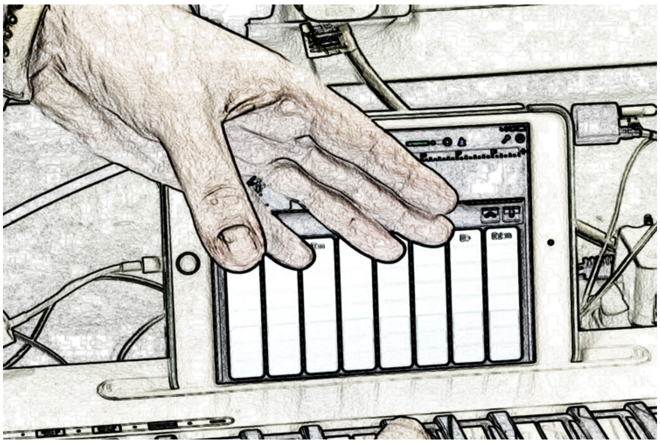


Figure 8-8 The teacher’s ‘just in time’ hand gesture, which prompts Owen to move up the keyboard to an F major chord.

When Owen was required to *hold* a chord, the teacher issued a flat hand gesture, in time with the music:

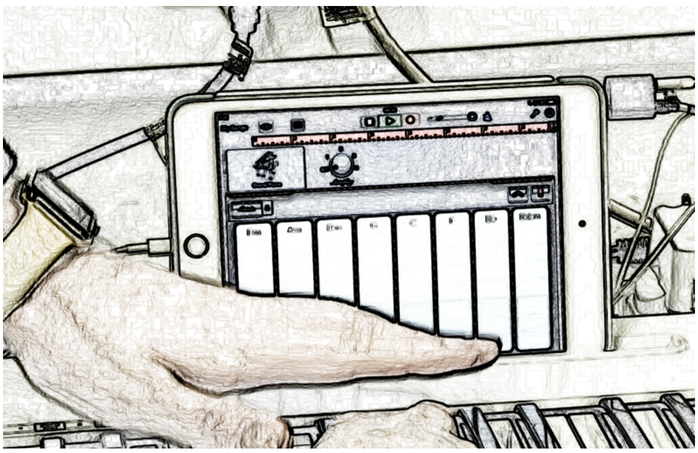


Figure 8-9 The teacher issues a ‘hold’ hand gesture ‘just in time’ to show Owen when to change chord.

The teacher also helped students to locate the key of their work; differentiate a complex part; practise more; find notes on the external keyboard and maintain a beat. Data which substantiates these findings is presented as Table 8-9:

Table 8-9 The teacher as provider of 'just in time' musical support.

Community: Two			**Dimension:** Teacher **Finding:** The teacher provides 'just in time' support	
'Just in time', the teacher…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…locates key tonality	10	F;G;H;J	Sada and Nayan now attempt to copy and paste parts from their first composition into their new project. T: It won't necessarily go with it though girls because one's based in a minor key and the other one's written in a major key. … it is suggested to James that he can use the A minor and D minor smart chords on screen. Then, his new chords will fit with the group's existing composition. Jenny then performs a progression of C F and G chords. T: That's good but in your composition, you've got a C minor chord, so you need to be careful about how you use that. The middle note is flattened.	3 3 3
…differentiates a complex part	11	F;G;H;I:J	The teacher also writes an 'F' on the keyboard for John and Botan's second chord. T: Maybe you could play one each? The teacher models a modified version of Sada and Nayan's original riff. This is differentiated, so that it can be quickly recorded to 'plug' gaps in the texture.	1 4
…points to notes on the external keyboard	8	F;G;I	Teacher points to Botan's first note and provides feedback/encouragement as he plays. T: Yeah that's it. T: You [Kasar] were there [pointing with finger]. The teacher then helps Owen to revise his blues scale by calling 'yeap' after every correct note and pointing to notes as required.	3 1 2
…writes notes on the external keyboard	4	F;G;I	The teacher writes the letter C on the keyboard with a marker pen [for John and Botan] The teacher then draws dots onto the A blues scale notes just to speed up the process for James.	2 2
…sings or speaks note names	7	F;G;J	Now the teacher suggests easier fingering and guides John as his plays. 'Big leap, small leap, big leap'. The teacher guides Sada verbally, singing the pitches of each chord and changing at the correct moment (after 4 beats per chord).	1 2
…verbally counts and/or clicks fingers to maintain the beat	14	F;G;H;I;J	The teacher now clicks and speaks a beat while John rehearses his blues scale part. T: Your go Botan. As Sada taps the pads, the teacher clicks fingers and calls out the beats of the bar.	3 3

In addition to the 'just in time' support outlined here, the teacher augmented it with corrective and supportive feedback, often in real-time. An account for this musical and pedagogical behaviour will now be presented.

8.4.1.5 Provided feedback

As an extension of 'just in time' support, the teacher provided both corrective and supportive feedback. This was also typically delivered 'just in time' during rehearsal, or just after a new track recording, for example. The table below records the range of corrective musical and technology-related feedback issued by the teacher:

Table 8-10 A review of corrective musical and technological feedback issued by the teacher.

Community: Two			**Dimension:** Teacher **Finding:** The teacher provides musical and technological feedback	
The teacher provides feedback by	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…posing a question	12	H;I;J	T: I'm not sure about Liam's first solo that he did the other week. Do you think that's in time? T: [To Owen and Kasar] That's it! Sounds good to me now. What do you think?	3 2
…promoting listening	5	F;G;H;J	T: [To Sada and Nayan] I had a listen to it and the timing still isn't quite right. Let's listen to it. T: [To Liam and James] That's pretty good you know for a manually input part. Let's have a listen.	3 3
…suggesting practise	5	F;G;H;J	T: [To John and Botan] OK, so we need to practise that a little bit. Each of you could do a nice riff. T: [To Sada and Nayan] You maybe need a whacky sound on it. Or do you like the piano? Go on then, have a practice.	3 4
…commenting on notes	14	F:G:H:I;J	T: [To John and Botan] When you go up [the keyboard], don't rush to come back down, that's where things are going awry a little. T: [To Owen and Kasar] That was perfect, except for one note. What could we do with that then? O: We could edit it.	3 2
…commenting on rhythm	1	F	T: [To John and Botan] You might want to think about your rhythm on those. [Teacher then sings a syncopated rhythm.]	1
…commenting on timing	14	F;G;H;I	John: Shall we have a listen? T: Think the timing was a bit out but have a listen. T: [To Sada and Nayan] I had a listen to it and the timing still isn't quite right. Let's listen to it.	3 3
…commenting on technological aspects	3	G;I;J	T: [To Sada and Nayan] It's pretty good. What about turning down the volume of the strings a little. Do you know how to do that? T: [To Owen and Kasar] One thing we might need to do is, in the settings, we need to make more sections of music or add more layers onto that.	3 1

Additionally, the teacher used feedback to praise and encourage students during their tablet composing activity. Seventy-six instances of praise and supportive feedback were issued by the teacher during community two's tablet activity and a sampling of these interventions is reproduced below:

> Botan uses the 'gentle bells' synth to play the blues scale. T: That's brilliant, let's use that?
>
> T: [To Sada and Nayan] It's beautifully mysterious.
>
> T: I think you guys must hold the record for getting the most done in one session. Are you happy with it? Owen: Yeah [said enthusiastically].
>
> T: [To Liam and James] I really like those chords and the drum beat.

Findings presented here suggest that the teacher issued feedback to support and tacitly correct students' work.

An account for how the teacher mediated the development of students' creative ideas has been presented. Findings will now explain how the peer influenced community two's development of creative musical ideas.

8.4.2 The Peer

Community two peers continued to evolve their mediational role as creative ideas developed. They musically collaborated with their student partners through a range of interactional modes. They also directed technological activity for their partner and used feedback to correct, support and to reach mutual agreement.

8.4.2.1 Musically collaborated

Peers could be close musical collaborators and much of their input was negotiated with their student partner. Sada, Nayan, Inder and Jenny negotiated 'who plays what':

> Nayan: You press that three times [Sada] and I'll press two.

> Jenny: So, you're putting it in that big gap from bar six.
>
> Inder: You can do the small ones [gaps]?
>
> Jenny: But I'll need to stop at bar 7, won't I?
>
> Inder: But when you get off, I need to get ready?
>
> Jenny: Yeah but we can just record it again.

Liam, James, John and Botan also collaborated to input their material via the tablet screen. Liam and James simultaneously played the smart electric guitar instrument, as illustrated by Figure 8-10:

Figure 8-10 Liam (right) and James (left) simultaneously audition the effectiveness of the smart guitar interface.

Comparatively, John found it too challenging to input all of his drum parts manually via the drum simulator interface. Fortunately, Botan offered to take responsibility for the bass drum part. This enabled the pair to create a custom drum track. This musical collaboration is captured at Figure 8-11:

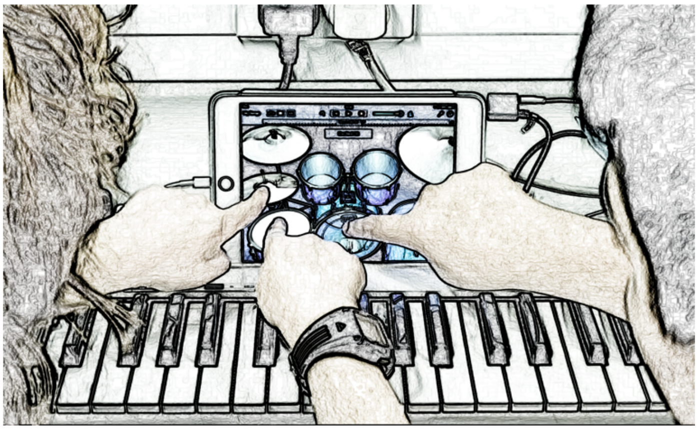


Figure 8-11 Botan (right) moves in to help John (left) input a drum kit beat.

The external keyboard also mediated collaborative musical behaviour. Nayan held down an F major chord while partner Sada performed a new riff based on the 'A' minor scale:

> N: Maybe you play something [Sada] and I hold three notes down.

John monitored Botan as he recorded different chords into GBIOS. He turned his hand over to signal when Botan should switch to an F chord:

Figure 8-12 John (left) turns his hand over to indicate when his partner (right) should change chord.

Note pointing was also a common collaborative behaviour. Sada, Inder and Owen routinely pointed to notes and chords for their student partners. Figure 8-13 illustrates one such example. Sada taught Nayan the C chord by pointing to the correct notes. Nayan subsequently played the chord, repeating it many times.

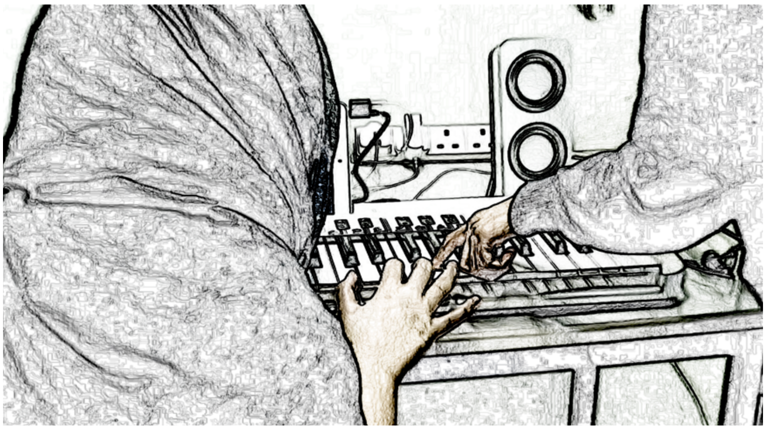


Figure 8-13 Sada (right) helps Nayan (left) find a C chord by pointing to its constituent notes.

In addition to pointing and other symbolic hand gestures John conducted the beat of the music to help both students identify errors:

> During the listening, John moves his hand in circles as to conduct the beat of the music. His hand jolts at the join point, which might indicate that the looping was unsuccessful.

Community two peers also added musical knowledge; counted their partner in; differentiated challenging tasks; invented ideas; made suggestions; took decisions; suggested listening and verbally instructed musical content. Data extracts for these findings are presented at Table 8-11:

Table 8-11 How community two peers musically collaborate with their student partner.

Community: Two			**Dimension:** Peer **Finding:** The peer musically collaborates with their student partner	
The peer…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…adds musical knowledge	2	F;J	Botan: [To John] So we've got the hi-hat [pointing], the snare drum [pointing] and this one as well [pointing to the bass drum].	2
…counts in	12	F;G;H;I	Sada: Ready Nelly. 1 2 3 go! Owen counts in 3,2,1 and taps record.	3 2
…differentiates part	2	F	John: I think we should forget that one [pointing to the G]. John now shows Botan a modified pattern just using a C pitch but with an interesting, syncopated rhythm.	3
…invents musical content	1	G	Sada: It's better to have a partner… Nayan: …and she's the person who thinks of the ideas at first.	INT
…makes a musical decision	10	F;G;H;I;J	John and Botan trigger loops on-screen. J: I think we should stick with that one Billy. Owen: I think I prefer the soul organ.	3 2
…suggests listening	6	F;G	Sada: [To Nayan] Shall we listen to it? Botan: [To John] I think we should have a listen.	4 3
…makes a music suggestion	35	F;G;H;I;J	Botan: Maybe we should try….[points to piano smart chords on-screen]. John 'strums' a piano chord with a descending, vertical touch gesture. James: [To Liam] So, do just one single bit and if we do it in time, we can loop that but as long as we make sure that it's in time. Jenny: [To Inder] You want to try that one? What I mean is, do you want to do that scale, or do you want to change it?	4 3 1
…verbally instructs musical content	16	F;G;H;I;J	Jenny plays the F chord. Inder: The G is just one note up. James: [To Liam] Stop holding onto the note once we get to bar 12, I think. Inder is a little rusty, so Jenny helps him out by showing him the notes on the external keyboard. She also gives verbal cues saying 'there' for each note.	3 3 2

It is evident that peers musically collaborated with their student partners at a micro level. They also collaborated to edit the work done, direct technological actions and even took charge of the tablet to enable their partner to maintain their musical role. Data for these findings will now be presented.

8.4.2.2 Technologically collaborated

Once new musical ideas had been focussed and recorded, student pairs could fix them via a collaborative, on-screen editing process. During Sada and Nayan's second session, both students simultaneously edited their second percussion part (track 42). Sada dragged the track, while Nayan cropped the starting point. Their aim, which is successful, was to realign the drum beat so that it played in time. The relevant gestural and visual modes are captured by Figure 8-14:

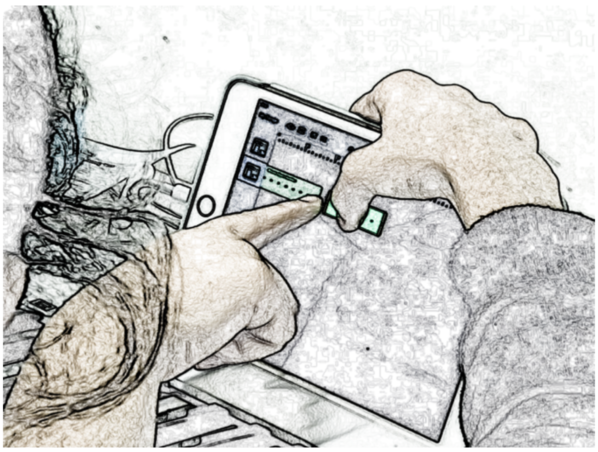


Figure 8-14 Sada (right) drags a drum track in track-view while Nayan (left) crops the new starting point.

Peers also directed technological action. As Table 8-12 shows, peers took ownership of the tablet and directed various technological processes:

Table 8-12 The peer collaborates by directing technological activity

Community: Two			**Dimension:** Peer	**Finding:** The peer directs technological Activity	
The peer…	**Subtheme**	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…directs technological Activity	*Directs editing*	28	F;G;J	Botan moves inward to begin the chord crop but John pinches to zoom first and then he actualises the crop but with Botan directing. B: …and then….stop! Jenny [To Inder]: You see where it says section A, tap that and put a lot of bars in there, so it doesn't run out.	2 1
	Directs recording	26	G;H;I;J	Jenny: We are going to stop at [bar 15] and record the chords separately. Nayan is now operating the tablet for Sada, so that she can record in the new part.	3 3
	Suggests recording attempt	13	F;G;H;I	John: Right shall we do that then? Shall we record it? Botan: OK.	1
	Taps record	4	F;I	Owen counts in 3,2,1 and presses record. John: [To Botan] Can you press record? Botan: 3,2,1 Go!	1 3
	Taps play stop rewind	3	F	John presses play on the tablet. He directs Botan with his finger. As John is recording, Botan is already preparing to stop the recording at a certain point – at six bars.	3 1

Findings presented here describe the peer as a close musical and technological collaborator. Peers also mediated tablet composing by providing feedback. Findings which describe the peer feedback process will now be presented.

8.4.2.3 Provided feedback

Student partners mediated tablet Activity with a range of supportive, corrective and negotiated feedback. Table 8-13 presents examples of these feedback behaviours:

Table 8-13 The community two peer mediates tablet activity through supportive, corrective and negotiated feedback.

Community: Two			**Dimension:** Peer / **Finding:** The peer provides corrective, supportive and negotiated feedback	
The Peer provides…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…direct, corrective feedback	19	F;G;H;I;J	John: [To Botan] That didn't really work. Sada: [To Nayan] I think that bit should go. Liam: [To James] It kind of sounds too upbeat and too jazzy? Owen: [To Kasar] You can't really hear the tambourine, can you? Jenny: [To Inder] I think it's not in time.	2 1 3 2 1
…supportive feedback	14	F;G;H;I	John: There we go, that was dead on the beat. Botan: That was really good. T: You got a lot of stuff done there. Sada: Thanks to Nayan. Nayan: Thanks to Sada. James: [To Liam] That definitely sounds like the blues now.	2 3 2
…negotiated feedback	10	F;G;H;I;J	Owen selects a different instrument – electric piano. Owen: [To Kasar] I don't think it's that good, do you? Sada: I think that we both listened to it and then I thought I might change it, so I ask Nayan and ask her what she thinks about it and then when we've really thought about it, we then change it…If I just said let's change it and I didn't ask Nayan, it wouldn't be fair, if she liked it and I didn't. Nayan: So, you have to ask…	2 INT

Findings presented here indicate that the peer was a musical and technological collaborator who assisted creative musical development by providing negotiated, supportive and corrective feedback. To complete an account of community two's tablet composing, findings for how the tablet mediated creative musical development will now be presented.

8.4.3 The Tablet

At 8.3.2, findings suggested that the tablet both enhanced and impeded students' ability to find creative ideas. When those students began to focus their creative ideas, they developed primarily musical and/or primarily technological tablet strategies. These strategies resulted in creative ideas becoming fixed as compositional layers.

8.4.3.1 Facilitated musically driven recording strategies

Community two participants made use of the tablet to rehearse and record their ideas. Listening strategies were developed to identify problems and initiate the next steps. This tablet-use strategy was typically cyclical and it is described here as Rehearse-Record-Listen. It is thought to be 'musically driven' because of its emphasis on the rehearsal and critique of musical material. Table 8-14 sequentially reviews those findings which evidence the Rehearse-Record-Listen cycle:

Table 8-14 Those community two tablet-mediated interactions which describe the Rehearse-Record-Listen cycle.

Community: Two			**Dimension:** Tablet	**Finding:** The tablet facilitates 'Rehearse-Record-Listen'	
The tablet facilitates…	**Subtheme**	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…practise with backing	*N/A*	74	F;G;H;I;J	Practise attempt – with backing. Now Owen is speaking the words in time, with the beat – like a proper rap. Sada has learnt the A minor/G major chords and she plays them with the backing track in the low register.	2 2
…practise solo	*N/A*	78	F;G;H;I;J	Nayan improvises with the blues, sometimes with and sometimes without the backing track. Jenny practises, no backing (C, F, G pattern). She is now playing C C F F G G F F C C. Jenny: I like the G and the F, when they are together.	2 3
…recording	*Chords*	5	G;H	Sada records one cycle of chords. That consists of two chords or two bars worth of music. She then calls 'stop'.	2
"	*Drums or percussion*	14	F;G;H;I	Recording attempt with Sada playing the bass drum. Recording attempt two – James inputs the drum part using the 'Roots' drum simulation.	2 3
"	*Improvisation*	2	H;J	Recording attempt. Liam's blues scale improvisation is much more in time.	4
"	*Melody or riff*	6	H;I	Owen records a blues scale riff over the drums and bass-line in section B. Successful – but for one wrong note near the end.	2
…vertical slider	*N/A*	15	F;G;H;J	Botan rewinds the vertical slider. Nayan moves the vertical slider to that point and listens to that track to check. She taps the track.	2 3
…failed recording	*Mistake*	6	F;G;I;J	Recording attempt – Inder makes a mistake very quickly and stops playing. Inder: Can we delete it? Recording attempt, which this time begins in the second section. John makes a few errors in his blues riff but the pattern is now in time.	2 3
"	*Out of time*	8	G;H;I:J	Recording attempt – failed. James: I went out [of time] again! Inder recording attempt. Unsuccessful – Inder came in late.	3 2
"	*Student unhappy*	5	G;H;J	Sada inputs a riff but the students do not seem too happy with it. It's deleted. James now records a random series of chords triggered on-screen. He returns to track-view and deletes the track.	3 1
"	*Technical issues*	7	G;H;J	Another recording attempt for Sada and Nayan. The main reason why the recordings are failing is confusion over the transport buttons. Recording attempt – unsuccessful because James forgets to delete the other drum track first.	2 3
…Focussed listening	*Checking*	27	F;G;H;I;J	Focussed listening - ending only. John: There we go, that was dead on the beat. Botan: That was really good. Slider moved to just before the faulty note: focussed listening – to check the edit. There are also suspect notes at the end of the track. Owen identifies these and deletes them. Sada and Nayan now listen back to their work. Sada has a good ear and identifies where the weak chords are. Sada: I think that bit should go.	2 2 1
"	*Follow notation*	2	I	Both students [Owen and Kasar] watch the notation blocks intensely during the focussed listening. Owen correctly identifies the weak note. Owen: It's that bit! I've got it too long. Owen points to the note.	2 3
"	*Listen to specific issue*	18	F;G;H;I;J	Listening – John stops track straight after the 'copy and paste' point – more focussed. John: oh! James: I just need to wait for the crash at the end [which works perfectly].	2 3
"	*Muting parts (ultra-focussed)*	11	H;I	Recording attempt – Owen's rap in time with beat. Back to track-view. Both students mute tracks for a focussed listening. [Liam and James] Focussed listening to a number of different soloed tracks.	2 3
"	*Suggests next step*	6	F;G	Another focussed listening. John: There is still a little gap though isn't there. Sada and Nayan then listen to their drum part, which repeats on loop and plays in real-time, as changes are made to the beat.	3 1
Broad listening	*At start or end of session*	4	G;I	Sada and Nayan's second session begins with a general listening to the composition. Broad listening to the different sections of their composition. Kasar: I think that's about done. T: I think that's about it guys.	2 3
"	*Initiates next step*	2	J	Broad listening. Jenny: You were going to go there, right? [Into the large gap on track view.] Broad listening. Jenny: We need to add…I think the guitar was going at the end.	2 3

Table 8-14 describes a cycle of creative focussing and fixing. A cycle typically began with students either rehearsing their music solo or alongside their existing composition. When ready, students attempted a recording, which was either successful, or it failed. The point of failure could be identified during focussed listening processes, where students isolated specific sections, tracks, or even single notes. Students also developed technologically driven recording strategies to fix their ideas and these approaches will now be described.

8.4.3.2 Facilitated technologically driven recording strategies

Participants could find it challenging to record large fragments of musical material without incurring melodic, rhythmic or timing errors, as Table 8-14 indicates. Consequently, some participants developed technologically driven strategies to work around this problem, as Liam explains:

> L: The loop? Because it's easier for me, I don't have to play the same riff over and over again, you can just loop it.
> INT: So, is that how you recorded parts in then?
> L: Sometimes yeah, I just improvised with my riffs and then you can get it looped.

Jenny also commanded the tablet to loop material, which saved her arduous practice:

> J: If you're sat at a piano, you have to practice, practice and practice but with this, you can do it once and then you can edit it.

In between recording and looping, participants could be required to edit their recorded track to make it fit with their existing tracks. Table 8-15 summarises how students manipulated track-view to edit and loop their recorded ideas:

Table 8-15 How students manipulate track-view to technologically edit, loop, master and create new musical fragments.

Community: Two			**Dimension:** Tablet **Finding:** Track-view facilitates a range of techno-centric activities	
The tablet track-view facilitates…	**Coding Count**	**Pairing Code(s)**	**Data extract(s)**	**Obs. Session**
…copy and pasting	13	F;G;H;J	Sada copies and pastes the A minor/G major chords. Sada also copies and pastes the bass drum beat, to extend their work.	3
…cropping	16	F;G;H;I;J	Now in track-view, Sada crops the track, possibly to remove the slightly 'wobbly' first inputs. Inder taps and drags the track-end, to crop the recorded part.	2 1
…looping	10	F;G;H	By chance, John finds the loop option when he taps on the pasted drum track. John: Ah you can press loop! James attempts to loop but it doesn't work. James: The loop's 'off' – it has a gap in-between it where it doesn't…when it goes 1 2 3 4, you have to start immediately.	2 2
…deleting	22	F;G	Sada taps and deletes the surplus track material. Now, all of the tracks line up. This is to create a first section. John deletes the pasted track (which was out of time) and loops the original. Inder returns to track-view and deletes the new piano track. Jenny now configures the tablet for a second take.	1 2 2
…dragging	23	F;G;H;I;J	Nayan drags the track horizontally and vertically closer to the first section. Now Sada isolates the high-pitched riff, by dragging it away from the rest of the track.	3 3
…zooming	13	F;G;H;I;J	Jenny zooms in on the recorded chord, using the pinch gesture. Kasar zooms around to look at the part.	13 2
…scrolling	13	F;G;I;J	John zooms in and scrolls across the track-view to examine the composition so far. Jenny scrolls across the whole track in track-view to re-familiarise herself. She is debating whether to record her riff part again, or not.	2 2
…track splitting	3	G;H	James: What we need to do is split it. T: Zoom in as well. Sada taps the tracks and taps split.	2 1
…mastering	3	H	James then reintroduces the two remaining parts and remixes them to develop a good balance across the whole composition. James: I may want to turn that down a bit but I think you can hear most of it.	2 3

Rather than relying upon musical performance to fix ideas, the table above suggests students utilised track-view's technological functionality to fix their creative products. Additionally advanced track-view features were also required to fix ideas. When Owen zoomed into an individual track, he fixated upon the square blocks which represented his individual notes. During session two, Owen selected the graphic notation system to correct the notation in his recorded part:

> Owen positions the slider to only listen back to the area of concern. Focussed listening to one note. Owen now reduces the length of the weak note. Now the slider is moved to just before the

> edited note. More focussed listening to check. There are also suspect notes at the end of the track. Owen identifies these and deletes them.

Figure 8-15 captures the moment Owen edited a note by reducing its duration to match the other repetitions of that note:

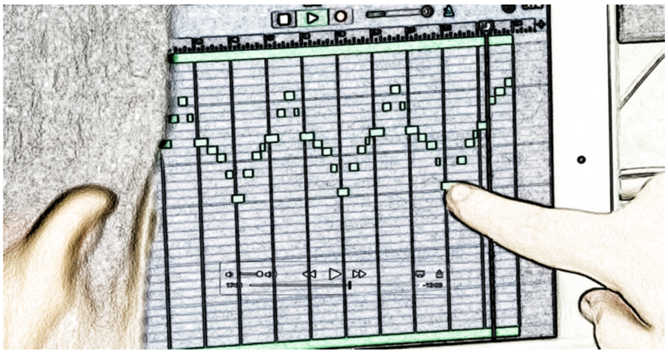


Figure 8-15 Owen (right) reduces a note's duration by dragging to the left. The aim is to copy the two previous repetitions of that note.

Students also used the notation system to correct timing. John explained how he 'moved notes around' until they were in time with the beat:

> INT: Can you name any features on the tablet that helped you?
>
> J: The main part was where it showed you where you pressed a key and how long you pressed it for [graphic notation on the track view]. It helped because you could see where it came out of time and where it came in time, so if we messed up and we needed to move it around so it was in time with the beat, then we could move it around and make sure it was in.

When participants combined graphic notation and track-view editing with looping and a record-once approach, they developed a Record-Edit-Loop tablet strategy. This technologically driven strategy offered students ways to develop and fix customised creative ideas, without the necessity for prolonged musical engagement.

An account for how community two initiated and developed their creative ideas has now been presented. The sum of community two's creative ideas were visually charted as part of the secondary analysis process. A data reduction strategy ensured that the charts to be presented here credibly represent the broad range of interactional trends observed in community two. For a review of the data reduction strategy, see 6.6.6.

8.5 How community two initiated and developed their creative ideas over time

A secondary analysis grouped community two observation data by ‘creative idea’ and not by ‘Activity dimension’. This analysis revealed that community two developed forty-nine creative ideas for their tablet-mediated compositions.

Analysis by creative idea promises simultaneous consideration of the relationships *between* Activity dimensions during the lifecycle of any creative musical idea. To better observe these relationships, visual charts will be presented which map the lifecycle of individual creative ideas over time. For more information about how the visual charts emerged and how to read them, please see the community one case report, part 7.5.

8.5.1 John and Botan (Community Two)

John and Botan developed eight creative ideas for their Blues composition. Their first two ideas, a blues riff and a drum beat (tracks 31 and 32) will now be presented in more detail.

8.5.1.1 Idea 1: Blues Riff

John and Botan found, focussed and fixed their riff over a duration of seven minutes, thirty seconds. Thirty-six pieces of data from all Activity dimensions were coded to the idea and they are longitudinally charted at Figure 8-16:

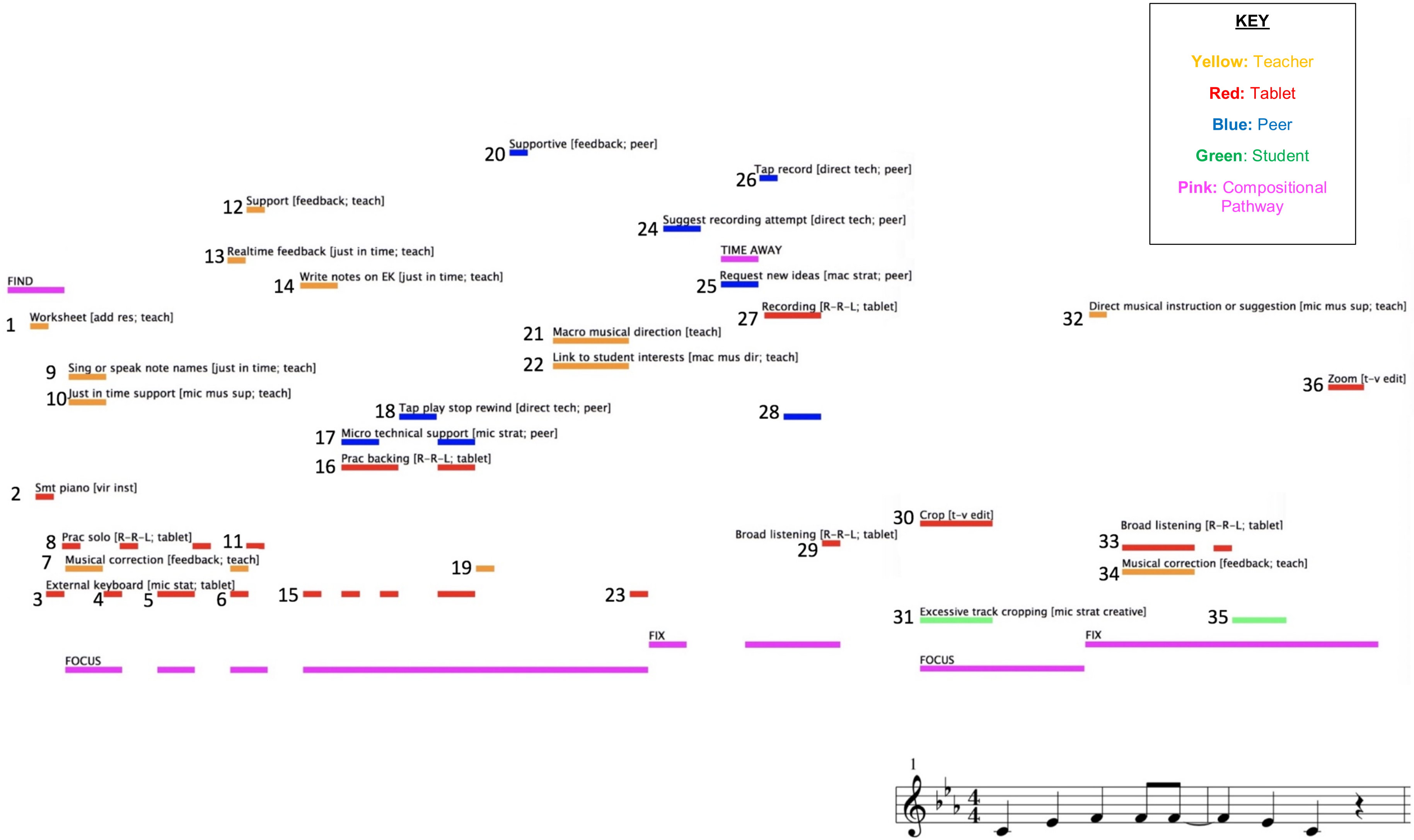


Figure 8-16 A chart mapping those activity dimensions active when John and Botan found, focussed and fixed their blues riff. Duration: seven minutes, thirty seconds.

Figure 8-16 provides insight into how John and Botan's riff was created. Firstly, Botan 'found' the blues scale idea from the teacher-supplied worksheet (1). The teacher soon began to provide 'just in time support' to 'teach' John and Botan the blues scale (9-14). Intensive musical practice began via the external keyboard (3-15). To ensure John could continue practising, Botan began to develop a technological role operating the tablet (17-25). Just prior to recording, John stepped back and had second thoughts (25) but it was decided to proceed with the recording. The riff was performed by John (27) with Botan operating the tablet (26,28). John and Botan listened to the new track (29). From this listening, they technologically edited their idea (30,31,35). John independently cropped more track material than his teacher desired.

Table 8-16 accompanies Figure 8-16 and it presents data which corresponds to the chart numbers. The table also highlights musical or technological influence, compositional pathway and prevailing pedagogy. These theoretically-driven labels only represent my *personal interpretation* of the symbolic data and *they are far from absolutist* in their intention. Readers may interpret the (included) source data differently. In any case, musical technological influence and pedagogical conditioning will be properly addressed in chapters nine and ten.

Table 8-16 How John and Botan's tablet-mediated activity musically, technologically and pedagogically influenced the initiation and development of their blues riff (creative idea 1).

	Community: Two	**Participants:** John and Botan **Creative Idea:** One (Keyboard Riff)				
ID	**Code**	**Data**	**DIMENSION**	**INFLUENCE**	**PEDAGOGY**	**FIND/ FOCUS/FIX**
1	**Worksheet**	Botan picks up the blue worksheet containing the blues chords and blues scale.	TEACHER	MUSICAL	DIALECTIC	FIND
3	**External keyboard**	John begins to play the blues scale on the external keyboard.	TABLET	MUSICAL	EMANCIPATORY	FIND
4	**External keyboard**	Now Botan tries out the scale.	TABLET	MUSICAL	EMANCIPATORY	FOCUS
6	**External keyboard**	John makes another attempt.	TABLET	MUSICAL	EMANCIPATORY	FOCUS
7 9 10 13	**Musical correction; Sing or speak notes; Just in time support; Real time feedback.**	Now the teacher suggests easier fingering and guides John as his plays. 'Big leap, small leap, big leap'. Teacher guides in real time. E.g. Yes/no for each note.	TEACHER	MUSICAL	DIALECTIC	FOCUS
12	**Support**	T: Don't worry if you blow it up, that's all part of it!	TEACHER	TECHNOLOGICAL	EMANCIPATORY	FOCUS
14	**Write notes on EK**	The teacher writes the letter 'C' on the keyboard with a marker pen.	TEACHER	MUSICAL	DIALECTIC	FOCUS
15	**External keyboard**	John now begins to experiment with a riff based on the notes of the 'C' blues scale.	TABLET	MUSICAL	EMANCIPATORY	FOCUS
17	**Micro tech support**	John now begins to experiment with a riff based on the notes of the 'C' blues scale.	PEER	TECHNOLOGICAL	DIALOGIC	FOCUS
18	**Tap play stop rewind**	Botan now operates the tablet for John. He stops, plays and rewinds the music. He rewinds by dragging the vertical slider.	PEER	TECHNOLOGICAL	DIALOGIC	FOCUS
19	**Music correction**	T: That's good John, it was more in time then.	TEACHER	MUSICAL	DIALECTIC	FOCUS
20	**Supportive**	B: Yeah that's alright.	PEER	MUSICAL	DIALOGIC	FOCUS
21 22	**Macro musical direction; Link to student interests**	T: What music do you listen to? B: [Inaudible]…I don't listen to Justin Bieber! J: I don't enjoy listening to music to be honest, I enjoy playing it. Like I like Ed. Sheeran. I like his songs but…	TEACHER	MUSICAL	EMANCIPATORY	FOCUS
23	**External keyboard**	John then practises his blues riff without the backing track.	TABLET	MUSICAL	EMANCIPATORY	FOCUS
24	**Suggest recording attempt**	J: Right shall we do that then? Shall we record it? B: OK.	PEER	TECHNOLOGICAL	DIALOGIC	FIX
25	**Request new ideas**	J: Unless…unless you've got anything else. B: Let's try yours first and see.	PEER	MUSICAL	EMANCIPATORY	TIME AWAY
26	**Tap record**	Botan presses the record button.	PEER	TECHNOLOGICAL	DIALOGIC	FIX
27	**Recording**	Recording attempt. John plays in time (after all the riff is now well practised).	TABLET	TECHNOLOGICAL	DIALECTIC	FIX
28	**Tap play stop rewind**	As John is recording, Botan is already preparing to stop the recording at a certain point – at six bars.	PEER	TECHNOLOGICAL	DIALOGIC	FIX
29	**Broad listening**	Back to track-view. Broad listening to the whole track with the new part added.	TABLET	MUSICAL	EMANCIPATORY	FIX
30	**Crop**	J: Is there a way of making the piece…ah there! John already sees that he can crop the new part to make it fit the drums. This is disappointing because the riff is perfectly formed, with two full repetitions of the original idea, all played in time. It's actually the drum part which should be modified because it's too short.	TABLET	TECHNOLOGICAL	DIALECTIC	FOCUS
33	**Broad listening**	Still listening to the whole track, even when it is the ending that was of interest.	TABLET	MUSICAL	EMANCIPATORY	FIX
34	**Musical correction**	T: Does it come off clean there though, is it a clean ending?	TEACHER	MUSICAL	DIALECTIC	FIX
36	**Zoom**	Both Botan and John attempt to pinch the screen at the same time. It works and the track zooms in.	TABLET	TECHNOLOGICAL	DIALECTIC	FIX

The table above suggests that John and Botan's riff Activity began musically but the whole system increasingly became engaged in technological matters to ensure the riff became fixed into the composition.

Once John and Botan zoomed in (36) to check their riff was properly aligned and secure in track-view, their thoughts soon turned to their next creative idea. As findings will now show, idea two was initiated and developed in ways quite different to their first.

8.5.1.2 Idea 2: Drum Matrix Part

John and Botan's second idea was a drum beat, created in partnership with the drum matrix GBIOS interface (track 32). Its initiation and development was primarily tablet-centred and technology driven because John and Botan did not rhythmically input the part themselves. It took John and Botan just two minutes to fix this idea and ten pieces of data are coded to it. This data is longitudinally arranged, colour-coded and charted at 8-17:

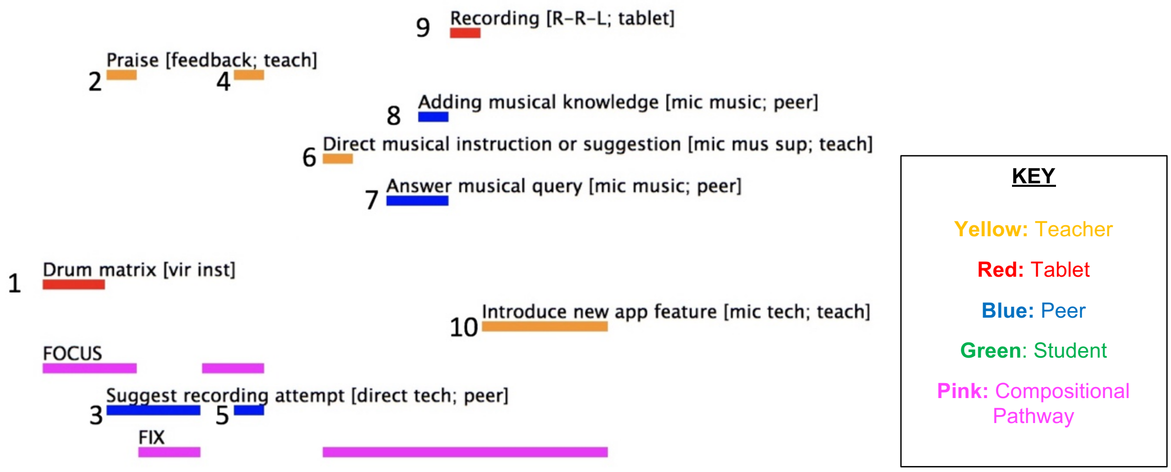


Figure 8-17 A chart mapping those Activity dimensions active when John and Botan focussed and fixed their drum part using the GBIOS drum matrix.

Figure 8-17 provides insight into how John and Botan created their drum part. Most of the drum beat creation was handled semi-autonomously by GBIOS and John's dragging gestures (1,9). Nevertheless, the teacher praised the students because it was their first tablet session (2,4). Botan considered recording/fixing the automated part straight away (3,5). Keen to trigger musical thought, the teacher asked the pair to consider how long their drum part should be (6). John musically corrected his partner when he suggested an odd number of bars (7,8). Once the tablet drum part was recorded (9), the teacher introduced John and Botan to track-view to inspect the part (10). On this occasion, John did not fully explore the drum matrix to find custom possibilities before focussing the idea (1).

Table 8-17 accompanies Figure 8-17 and it presents data which corresponds to the chart numbers. The table also highlights musical or technological influence, compositional pathway and prevailing pedagogy: these will be discussed in chapter nine.

Table 8-17 How John and Botan's tablet-mediated activity musically, technologically and pedagogically influenced the initiation and development of their Drum Beat.

Community: Two		**Participants:** John and Botan **Creative Idea:** Two (Drum Beat)				
ID	**Code**	**Data**	**DIMENSION**	**INFLUENCE**	**PEDAGOGY**	**FIND/ FOCUS/FIX**
1	**Drum Matrix**	John selects the drum matrix and begins dragging drums onto the matrix. He creates a 'chilled' beat very quickly. The beat sounds unique and interesting.	TABLET	TECHNOLOGICAL	DIALECTIC	FIND/ FOCUS
2	**Praise**	T: That's a really good beat!	TEACHER	MUSICAL	EMANCIPATORY	FOCUS
3 5	**Suggest recording attempt**	B: So, can we record that and add to it? T: Yes.	PEER	TECHNOLOGICAL	DIALOGIC	FIX
4	**Praise**	T: Nice, I like that!	TEACHER	MUSICAL	EMANCIPATORY	FOCUS
6	**Direct musical instruction or suggestion**	T: Yeah, think about how long you want to record it for.	TEACHER	MUSICAL	EMANCIPATORY	FIX
7 8	**Answer musical query** **Adding musical knowledge**	B: Can you do five? J: Five is a bit of an odd number in music.	PEER	MUSICAL	DIALECTIC	FIX
9	**Recording**	Recording of drum matrix part.	TABLET	TECHNOLOGICAL	DIALECTIC	FIX
10	**Introduce new app feature**	T: Now if you go back to track view, you can hopefully see… The students navigate back to track-view and see the drum part recorded, together with some basic graphic notation.	TEACHER	TECHNOLOGICAL	DIALECTIC	FIX

Table 8-17 indicates how little human and digital interaction was necessary to create the drum beat. It also suggests that human participants had to step in to compensate for a lack of musical influence from the tablet.

John and Botan's creative ideas evidently reflect a broad musical-technological spectrum, copious real-time teacher intervention, less independent creative behaviour and a collaborative peer input.

Owen and Kasar also relied upon teacher intervention during the early stages of their tablet composing and two of their creative ideas will now be analysed in more detail.

8.5.2 Owen and Kasar (Community Two)

Owen and Kasar developed eleven creative ideas for their composition. By composing their music in three sections, the pair succeeded in combining Owen's passion for rap music with a school-led requirement to create a blues composition. Owen and Kasar's third and eleventh creative ideas (tracks 56 and 64 respectively) were both guitar riffs. They are presented here to evidence how interactional routines changed over a much broader timescale, even when the goal (to create a guitar riff) remained broadly comparable in both instances.

8.5.2.1 Idea Three: Acoustic Guitar Riff

Owen and Kasar's third idea was an acoustic guitar riff which made use of the blues scale. The pair input the idea via the external keyboard and the tablet-situated, acoustic guitar virtual instrument. It took Owen and Kasar thirteen minutes to fix the riff and 33 pieces of data are coded to it. Throughout the riff's initiation and development, the teacher was notably musically and technologically influential (yellow bars), while the peer was found to primarily observe action. Neither participant much behaved independently (green bars). These broad trends can be visually observed at Figure 8-18:

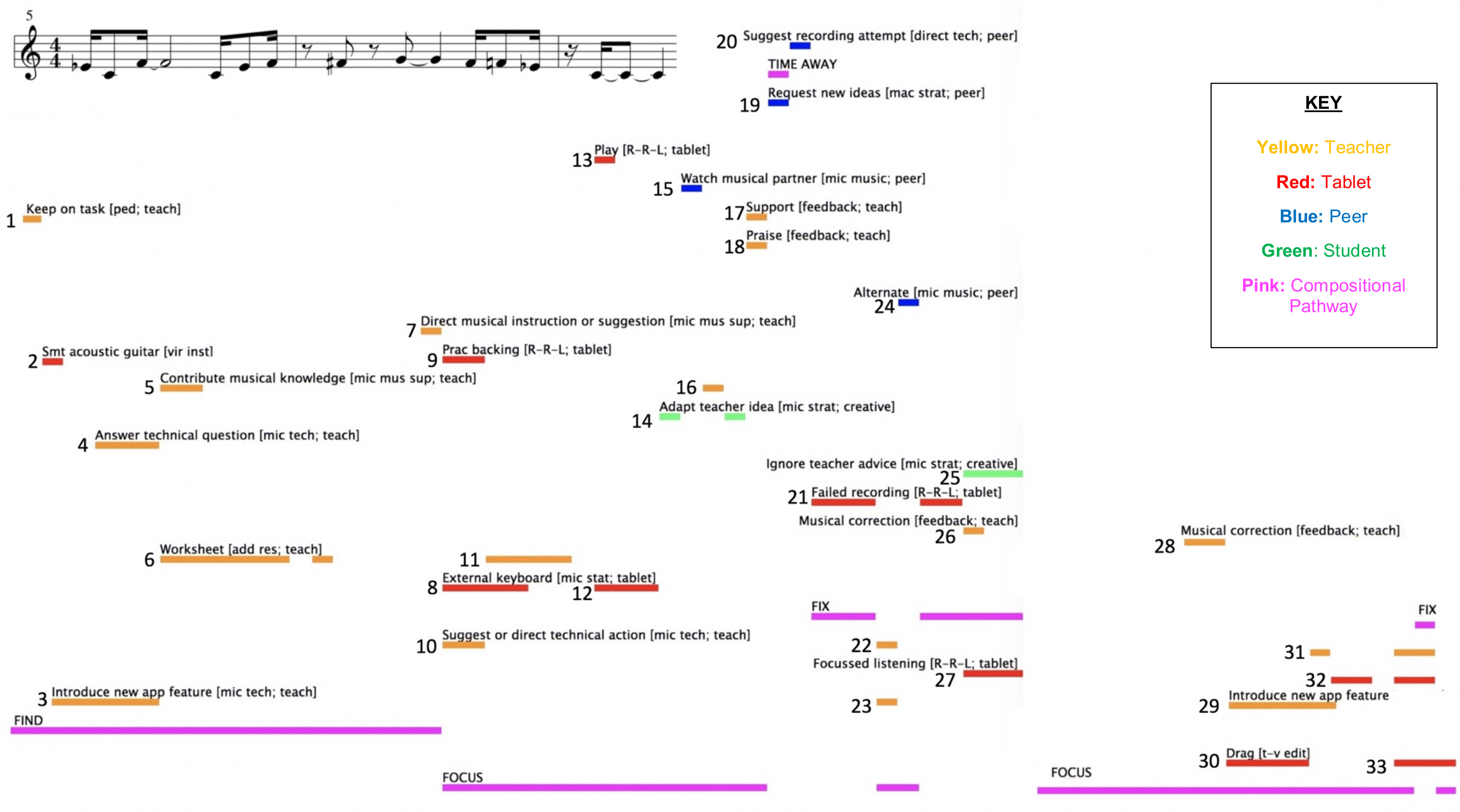


Figure 8-18 A chart mapping how Owen and Kasar's first guitar riff was initiated and developed (creative idea 3). Duration: thirteen minutes.

Figure 8-18 helps to develop an understanding of how Owen and Kasar developed their first guitar riff over time. In this case, the teacher prompted the pair to think about a new creative idea (1) and consequently, Owen loaded the acoustic guitar virtual instrument on the tablet (2). The teacher subsequently guided Owen to select ‘major blues scale’ on-screen and he suggested that ideas could be input both on-screen and/or at the external keyboard (3,4). The teacher pointed out C pitches on the external keyboard (5) and referenced the blues worksheet to link the newly-found C pitches to the remaining C blues scale (6). As both students tried out the scale, the teacher pointed to notes as they played (7). As the students increasingly focussed during practice (8,9), the teacher operated the tablet (10). Owen began to operate the tablet to ensure he practised the scale alongside the backing track (12,13) and Kasar began to copy Owen’s notational patterns (15). As the idea became more focussed, the teacher praised progress (17,18) and suggested an improvisation (16). Kasar ‘took a step back’ and reflected (19) and the pair decided to attempt a recording (20) but this failed (21). The teacher intervened to suggest how to delete recorded tracks (23). Kasar ignored advice to re-record the idea and chose to listen critically to the recorded idea instead (25, 26, 27). The teacher responded by introducing the ‘drag’ function (29,30) and he dragged the students’ track nearer to the first beat of the bar to improve timing (31). The pair again engaged in focussed listening (31,32) and the teacher dragged other parts on-screen to improve timing (33).

Table 8-18 accompanies Figure 8-18 and it presents source data which corresponds to the chart numbers. The table also highlights musical or technological influence, compositional pathway and prevailing pedagogy but these will be discussed in chapters nine and ten.

Table 8-18 How Owen and Kasar's tablet-mediated activity musically, technologically and pedagogically influenced the initiation and development of their acoustic guitar riff (creative idea 3).

	Community: Two	**Participants:** Owen and Kasar **Creative Idea:** Three (Ac. Guitar Riff)				
ID	**Code**	**Data**	**DI-MENSION**	**INFLUENCE**	**PEDAGOGY**	**FIND/ FOCUS/ FIX**
1	**Keep on task**	T: What do we think next?	TEACHER	MUSICAL	EMANCIPATORY	FIND
2	**Smart acoustic guitar**	Owen loads the smart acoustic guitar.	TABLET	TECHNOLOGICAL	DIALECTIC	FIND
3	**Introduce new app feature (smart instruments)**	T: If you put it on notes and then you can change the scale by tapping there. Is the blues there? O: Major blues? T: Go on, yeah. Now, if you tap this [the virtual guitar neck on screen] and stay on one string. Or, you can play it on here [on the external keyboard].	TEACHER	TECHNOLOGICAL	DIALECTIC	FIND
4	**Answer technical question (virtual instruments)**	O: Major blues? T: Go on, yeah. Now, if you tap this [the virtual guitar neck on screen] and stay on one string. Or, you can play it on here [on the external keyboard].	TEACHER	TECHNOLOGICAL	DIALECTIC	FIND
5	**Contribute musical knowledge (music theory)**	…teaches students how to find a C anywhere on the keyboard.	TEACHER	MUSICAL	DIALECTIC	FIND
6	**Worksheet**	The teacher now refers to the worksheet to link the C notes, found by the students, to the rest of the scale. T: The blues scale is where the circles are. Can you copy where they are?	TEACHER	MUSICAL	DIALECTIC	FIND
7	**Direct musical instruction or suggestion**	The teacher points to notes for both students. T: Now, if you Owen just play those notes and play along [with the backing track].	TEACHER	MUSICAL	DIALECTIC	FIND
8 9 10 11	**External keyboard;** **Practice with backing;** **Suggest or direct technical action;** **Worksheet**	Practice attempt with backing – tablet operated by the teacher. Successful – notes work well with chords. Both students begin to work more independently, working out the notes of the scale without teacher input.	TABLET TEACHER	MUSICAL TECHNOLOGICAL	EMANCIPATORY DIALOGIC	FOCUS
12 13	**External keyboard;** **Play**	Practice with backing track. Owen presses play on the tablet and plays a chromatic pattern of notes on the external keyboard. He begins to struggle, so the teacher points to the notes required.	TABLET	MUSICAL	EMANCIPATORY	FOCUS
14	**Adapt teacher idea**	Owen begins to develop a five-note riff, based on the blues scale. C Eb F Gb G. Kasar is the first to take the five-note pattern and mix up the order slightly.	STUDENT	MUSICAL	EMANCIPATORY	FOCUS
15	**Watch musical partner**	Now, Kasar copies Owen's pattern.	PEER	MUSICAL	DIALOGIC	FOCUS
16	**Contribute musical knowledge**	T: Now you've got those notes, you can improvise with them, mix them up.	TEACHER	MUSICAL	EMANCIPATORY	FOCUS
17 18	**Support;** **Praise**	T: You've learnt it fast, well done.	TEACHER	MUSICAL	DIALECTIC	FOCUS
19	**Request new ideas**	K: What are we doing?	PEER	MUSICAL	DIALOGIC	FOCUS
20	**Suggest recording attempt**	O: We can record it. Kasar triggers a practice attempt with backing but he stops this and selects a recording attempt.	PEER	TECHNOLOGICAL	DIALOGIC	FIX
21	**Failed recording (out of time)**	Recording attempt – unsuccessful. Owen triggers another recording attempt – while the notes were 'correct' the timing was inaccurate.	TABLET	TECHNOLOGICAL	EMANCIPATORY	FIX
23	**Introduce new app feature**	T: Go back to track-view. Tap the track Owen, then delete.	TEACHER	TECHNOLOGICAL	DIALECTIC	FOCUS
24	**Alternate musical input**	Now the participants are alternating playings of the five-note pattern.	PEER	MUSICAL	DIALOGIC	FOCUS
25 26 27	**Ignore teacher advice;** **Musical correction;** **Focussed listening**	T: Could you hear then, how some of the notes were a bit 'out'? K: Yeah, let's just listen to it [act of defiance – don't need the teacher to identify mistakes]. A few laughs, when mistakes are heard.	STUDENT TEACHER TABLET	MUSICAL MUSICAL	EMANCIPATORY DIALECTIC	FIX
28	**Musical correction**	T: It sounds a bit out of time – I think it could be the first note. Just drag your first note to that line.	TEACHER	MUSICAL	DIALECTIC	FOCUS
29 30	**Introduce new app feature;** **Drag**	O: Copy? T: No, you see that big line that's next to it [these mark the beats of the bar]. I reckon if that was dragged to it…that's the first beat of the bar, you see. T: If you tap it and hold, you can move it.	TEACHER TABLET	TECHNOLOGICAL	DIALECTIC	FOCUS
31	**Suggest or direct technical action**	The teacher takes over to move the first 'note' nearer the first beat of the bar.	TEACHER	TECHNOLOGICAL	DIALECTIC	FOCUS/ FIX
32 33	**Focussed listening;** **Drag**	Focussed listening. Owen then plays the track – the first note is now in time but other remain 'out'. T: If you do the same to the others then, it might… The teacher then quickly drags the other blocks to align with the vertical grid.	TABLET	TECHNOLOGICAL	EMANCIPATORY	FOCUS/ FIX

Data at Table 8-18 suggests that the teacher was influential in guiding those musical and technological behaviours which led to a guitar riff becoming fixed. For instance, the teacher provided a worksheet, operated the tablet and instructed learning at the external keyboard. Towards the end of the idea cycle, the Activity appears to have become more technological because the tablet influenced editing behaviours which improved the quality of the recorded riff. The group's final creative idea will now be presented and this makes for interesting comparison.

8.5.2.2 Idea Eleven: Electric Guitar Riff

As Owen and Kasar's tablet-mediated Activity progressed, the pair retained their musical knowledge learnt earlier (the blues scale) and began to use the tablet in more technological ways, without reliance upon real-time teacher intervention. This became most evident when Owen and Kasar developed their eleventh and final creative idea: a second guitar riff (track 64). It took Owen and Kasar nine minutes to fix this idea and twenty-seven pieces of data are coded to its lifecycle.

In musical terms, this idea was less adventurous than idea three but the way in which the Activity focussed the idea appears to be different. The length of time required to fix the idea was also reduced but the quantity of tablet dimension interactions increased. These trends can be visually observed at Figure 8-19:

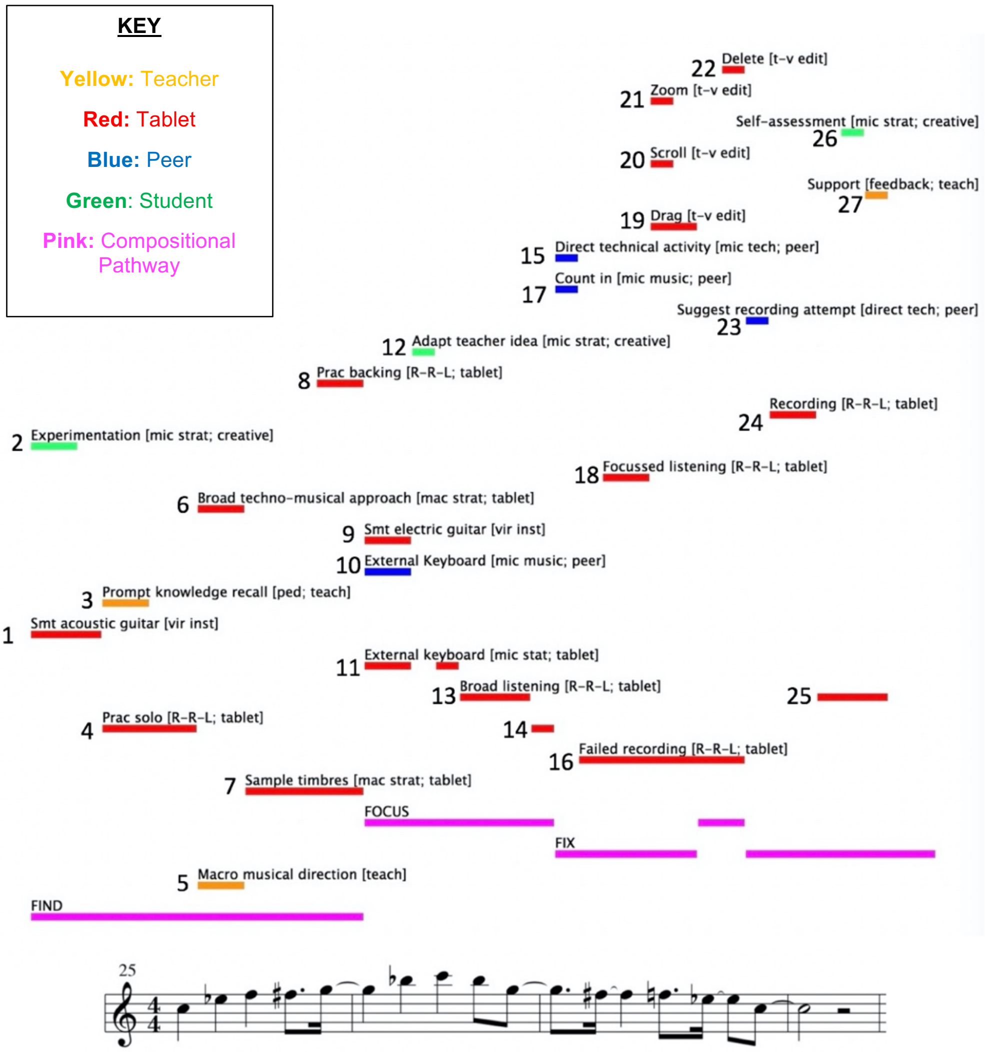


Figure 8-19 A chart mapping how Owen and Kasar's electric guitar riff was initiated and developed (creative idea 11). Duration: nine minutes.

Figure 8-19 evidences that this second guitar riff was initiated when Owen loaded the GBIOS acoustic guitar virtual instrument and chose to experiment with its on-screen scales (1,2). Owen then auditioned different instruments through the tablet (7). Subsequently, he practised the scale using a new timbre (8). However, it is Kasar who found the electric guitar timbre and he began to play the scale securely on the external keyboard. Both students then move away from the original scale (as provided by the teacher) and adapt the rhythm to suit their expressive intentions (12). They listen back to their existing work (24) and then Owen makes a solo practice attempt (14). Kasar then developed a technological role. He set up the tablet for Owen and counted him in (15, 17). The recording failed (16). Both students used track-view to attempt to diagnose the problem. They dragged, scrolled and zoomed around the new track (19,20,21) but eventually, Owen suggested that it should be deleted (22). Then, the roles switched. Owen operated the tablet (23) and Kasar recorded a new blues riff, which was in time (24). To finish, the pair broadly listened to their whole composition (25) and Owen assessed their composition as complete (26).

Table 8-19 accompanies Figure 8-19 and it uses fieldnote data to provide a more detailed account of how Owen and Kasar's developed their eleventh idea. The table also highlights instances of musical or technological influence, compositional pathway and prevailing pedagogy but these will be discussed from chapter nine onwards.

Table 8-19 How Owen and Kasar's tablet-mediated activity musically, technologically and pedagogically influences the initiation and development of their electric guitar riff (creative idea 11).

Community: Two		**Participants:** Owen and Kasar **Creative Idea:** Eleven				
ID	**Code**	**Data**	**DI-MENSION**	**INFLUENCE**	**PEDAGOGY**	**FIND/ FOCUS/ FIX**
1 **2**	**Smart acoustic guitar** **Experimentation**	Owen loads the smart acoustic guitar and experiments with a number of different scales on screen. Kasar tries out pitch bending the strings on-screen.	TABLET STUDENT	MUSICAL	EMANCIPATORY	FIND
3	**Prompt knowledge recall**	The teacher helps Kasar revise the blues scale with verbal assistance ("big leap, small leap" and "yeah" when correct notes are struck).	TEACHER	MUSICAL	DIALECTIC	FIND
4	**Solo practice**	Owen practices the scale also. Kasar now plays the scale ascending and descending.	TABLET	MUSICAL	EMANCIPATORY	FIND
5 **6**	**Macro musical direction** **Broad techno-musical approach**	T: Do you want to move to the third section, so we can try these ideas out? O: Ah I remember, I remember what it was.	TEACHER TABLET	MUSICAL	EMANCIPATORY	FIND
7 **8**	**Sample timbres (triggers strong response)** **Practice with backing**	Owen moves back to the instrument selection screen and loads a range of different smart instruments. Owen responds quite dramatically to hearing new sounds, such as the Chinese lute, for instance. He laughs when an unfamiliar sound is triggered. Practice attempt with backing (but using a world instrument). O: That just sounds annoying!	TABLET	MUSICAL	EMANCIPATORY	FIND
9 **10** **11**	**Smart electric guitar** **External keyboard** **External keyboard**	Kasar loads the 'Classic Clean' electric guitar and refocuses the activity, by playing the blues scale on the EK. Owen experiments with the pitch-bend on the EK.	TABLET PEER/ TABLET	MUSICAL	EMANCIPATORY	FOCUS
12	**Adapt teacher idea**	Now the students begin to improvise with their scales in a more original and confident way.	STUDENT	MUSICAL	EMANCIPATORY	FOCUS
13	**Broad listening**	Finally, the students discover section C on the track-view. O: That's our section C! Broad listening to section C.	TABLET	MUSICAL	EMANCIPATORY	FOCUS
14	**Practice solo**	Owen – practice attempt of blues scale, no backing.	TABLET	MUSICAL	EMANCIPATORY	FOCUS
15 **17**	**Direct technical activity; Count in**	Kasar sets up the tablet and counts in "3,2,1 Go!".	PEER	TECHNOLOGICAL MUSICAL	DIALOGIC	FIX
16 **19** **20** **21** **22**	**Failed recording** **Drag; Scroll; Zoom; Delete**	Recording attempt – nearly correct, apart from the ending. Focussed listening in track-view. Both students are intensely staring at/following the new track. Both students scroll around to view the track and Kasar zooms in. He then accidently drags the track. O: Shall I just delete it? K: Bye bye.	TABLET	TECHNOLOGICAL	EMANCIPATORY	FIX FOCUS
18	**Focussed listening (follow notation)**	Focussed listening in track-view. Both students are intensely staring at/following the new track.	TABLET	MUSICAL	EMANCIPATORY	FIX
23	**Suggest recording attempt**	Owen triggers a recording attempt for Kasar to replay the same part.	PEER	TECHNOLOGICAL	DIALOGIC	FIX
24	**Recording**	Excellent take. In time and no 'wrong' notes.	TABLET	MUSICAL	EMANCIPATORY	FIX
25	**Broad listening**	Broad listening to the different sections of their composition.	TABLET	MUSICAL	EMANCIPATORY	FIX
26	**Self-assessment**	K: I think that's about done.	TABLET	MUSICAL	EMANCIPATORY	FIX
27	**Support**	T: I think that's about it guys.	STUDENT	MUSICAL	EMANCIPATORY	FIX

Table 8-19 primarily evidences how Owen and Kasar influenced their tablet-mediated activity. The pair made avid use of the tablet, without persistent teacher intervention. Additionally, the tablet met Owen and Kasar's creative intentions. It enabled them to inspect faulty parts, make fresh recordings and record their own bespoke material at the external keyboard.

The creative ideas charted from 8.5 have visually and tabularly evidenced the extent to which tablet-mediated Activity Systems change form over time to meet the personal goals and local agendas of this situated community.

Research findings generated from participating in, observing and interviewing two communities of tablet-mediated composers have now been presented. Chapter nine will now undertake a cross-case analysis of all research findings, as presented by the two case reports. That chapter will conceptually organize and summarise the new understandings in one place. Chapter ten will then reference existing theoretical assumptions to discuss these new understandings. Ultimately, a new conceptual framework will be presented, one which intends to explain that systemic, tablet-mediated creative musical behaviour which defined the two participating school communities.

Chapter 9:
A cross-case analysis of the two case reports according to research question

Two case reports, each evidencing how a community created music in the Activity System Framework (see chapter five), have now been presented as chapters seven and eight. These chapters also presented idea charts designed to evidence how community Activity Systems found, developed and fixed creative ideas over time. Following a brief introductory summary of the case reports at 9.1, 9.2 will undertake a cross-case analysis of the reports to answer research questions. Findings will be compared, contrasted and summarised to bring together some of the key thematic trends found to define the digitally-mediated, creative musical action observed in the two settings. To better understand how complete systems find and develop creative ideas (RQ 5), the visual charts (presented at 7.5 and 8.5) will be analytically compared and thematic trends noted.

Throughout the forthcoming analysis, abbreviations for community one and two are applied (C1 and C2 respectively) and where particular behaviours are repetitive, numbers indicate how many times a particular behaviour was coded in any one community. *These numbers are not fundamental to the analysis*: they merely suggest to readers how influential a particular behaviour was (number count) and how definitive it was for a particular community (C1/C2 identity coding). The broad themes as identified by research question will ultimately guide a theoretically-informed discussion of findings and this will be presented as Chapter Ten.

9.1 Review of case report findings

Two case reports have evidenced a range of behaviours. Some behaviours are broadly comparable *between* communities and others are evidently conditioned by situations *peculiar* to their setting. In terms of the latter, the extent to which student behaviours appear to be a consequence of cultural forces, which include institutional ethos, behavioural expectations and approaches to learning (e.g. independent learning or target-based learning), is an unexpected finding. At the outset of this research, it was assumed that the tablet computer would remain a dominating influence in any setting. Given the quantity of data coded to the teacher, student and student partner dimensions for example, this ultimately transpires not to be the case.

Likely because C2 participants were required to meet institutional targets and behavioural expectations, they appeared to expect/welcome and/or require more persistent teacher intervention than C1 participants. Additionally, C2 peers were less keen to ‘sit back’ and let their partner achieve on their behalf. Meanwhile, C1 participants appeared to learn very much on their own terms: that is, they made a *choice* to learn and only engaged with their music teacher when they saw fit. C1 participants did not record, critically listen to their work or produce as much music as C2 but most behaved in a distinctive, creatively independent fashion.

9.2 Revisiting the research questions: a cross-case analysis

The summary review presented at 9.1 forwards some of those broad behavioural differences which defined each community's creative musical development (CMD). This is a useful situating context for 9.2, which will now explain, in more abstract terms, how a tablet computer, student partner and music teacher can influence CMD. This explanation will be achieved by presenting a micro, cross-case analysis of the case reports presented by research question. To answer RQ5, the creative idea charts presented at 7.5 and 8.5 will be collectively analysed to develop new understandings about how creative musical ideas can be found, developed and fixed, over time.

9.2.1 RQ1: How, if at all, can tablet computers enhance or constrain musical creativity ?

The tablet computer plus GBIOS app, its connected external keyboard (EK) and microphone (collectively termed the tablet workstation) is found to both enhance and constrain creative musical development. While its constraints are substantive (see 9.2.1.2), the tablet workstation (TW) helps students to find creative ideas and develop tablet-use strategies to develop and fix those ideas. Perhaps most critically, case reports identify that polarising 'enhancement' and 'constraint' is ultimately a misnomer. Participants recognise that alongside their own personal creative influence, digitally-mediated constraints are also fundamental for CMD.

9.2.1.1 The tablet enhances creative musical development

The tablet workstation enhances CMD because it facilities creative freedom; provides musically inclusive opportunities; enables students to collaboratively develop their music via a gesture-based touch screen; reveals how songs are made and develops musical skills. The tablet computer provides opportunities for creative freedom because:

- the range of GBIOS timbres enables students to make a creative choice around which timbres best suit their music (C1)
- it is possible to invent sounds which are not included on the tablet (C1)
- the EK can be played at any time – some apps would not provide this freedom (C1)
- GBIOS helps students to hear sound, assemble musical fragments and layers into a desired order and mix different instruments together (C1)
- students can choose what instrument they play, customise its timbre, volume, pitch and how to play the melody. According to one participant: students can be 'master of their own music' (C2)
- it is possible to 'play around' with the app, which is unlike restrictive classroom music learning (C2)

These tablet influences empower students to experiment, which in turn helps to ensure that creative ideas are found. One of the most interesting features of the tablet is its potential to ensure students create music, musical background notwithstanding. Students can *choose* to enter into a performance-enhancing musical partnership because:

- there is no requirement to have learnt the piano or guitar, for example, in order to record musical parts (C2)

•parts can be recorded straight away, which inspires confidence and further inputting of more complex and original parts (C1)

•adding a drum part in the app is ‘easier’ than performing drum parts on a real drum kit over and over again. Students ‘just tap’ and experiment with content (C1)

• it is ‘easier’ to ‘put music down’ in the app rather than having to write it down on paper. To use stave notation, students must first work out what the notes are, where to draw them and where to draw bars and other symbols, for example (C1)

• GBIOS provides a scale and every note for that scale. The student need only make their selection from those eight notes. Creating a melody therefore becomes a real proposition for all students. Contrastingly, using just a piano, students must find those notes unaided and ‘skip over’ those not required (C2)

These performance-enhancing features are catalysed via the fluidity and flexibility of multitouch gestures. These gestures enable different editing and musical input enhancements (e.g. simulated graded touch piano response on-screen) that a mouse cannot match. Also unlike a mouse, touch gestures trigger multiple input commands simultaneously (e.g. triggering three notes on-screen - not just one - and determine their dynamic). This multi-touch input recognition ensures that the glass screen is a genuinely collaborative, music-making space. This is different to a desktop computer, where only one person can manipulate the mouse.

As well as inclusively creating music collaboratively and via experimentation, GBIOS also reveals to students how songs are made because:

•the app simulates what it can be like to be a real musician working in a recording studio. Students learn how challenging it is for those artists who create remixes (C2)

•when students learn how to use the track-view, they learn how some composers make songs. Track-view teaches students to build and edit their compositions by track (horizontally). This is perceived as something that real musicians do (C2)

•GBIOS changes typical conceptions of composing. The traditional conception of composers sitting around a piano or someone playing a guitar and then scribing music down on paper is challenged (C1)

There is also evidence that musical skills develop. In C2 for instance, students’ counting and timing improves as they input musical ideas over time.

Perhaps the most significant enhancement of CMD is the way in which the tablet influences how creative ideas are found, developed and fixed. 9.2.1.1.1 and 9.2.1.1.2 will now summarise these influences.

9.2.1.1.1 The tablet finds creative ideas

The tablet computer helps students find ideas because it provides:

•timbres for experimentation;

•presents virtual instruments which help students discover new melodic and rhythmic content via pre-loaded scales and/or chord progressions;

•an external keyboard to recap students’ existing ideas or find chords;

•a track-view, which visually signposts new creative opportunities.

Ultimately, these performance enhancements are also found to constrain CMD in equal measure. This idea will be explored at 9.2.1.2 and 9.2.1.3. Meanwhile, experimentation with GBIOS timbres does help students to find their creative musical ideas. The speed of instrument/timbre selection encourages students to ‘tap around’ the app (sometimes randomly) and consequently, new instruments and/or creative ideas are stumbled upon in an unplanned way.

Once a virtual instrument is loaded, students are invited to further customise its timbre at a micro level via on-screen dials, sliders and sound effect boxes. The customisation and range of timbres is seminal to finding creative ideas because a ‘normal keyboard’ can be transformed into a ‘soul organ’, for example. When students customise instruments in this way, those instruments become more closely aligned with student desire. For instance, when students drag rhythmic parts onto the drum matrix, their head, arm and hand gestures collectively express an excitement for finding content they genuinely like. The robot and Sc-Fi audio effects also excite students to the extent that they more confidently experiment with their voice and find rap-based ideas, for example.

Once a genuine connection to a timbre is established, students begin developing melodic or rhythmic content for that timbre. Virtual instruments then assist students to find notes and chords. For example, the smart piano enables students to trigger a series of harmonically compatible chords with just one finger and this feature invites them to develop a rhythmic idea for those chords.

Alongside timbre selection and melodic/rhythmic assistance from virtual instruments, the external keyboard (EK) helps students find ideas because:

- students use the EK to find and then practice a range of chords. They also replay known musical material e.g. chords for an Adele song, as originally learnt in class (C1)
- random keys can be struck which enables unplanned ideas to be tested, even if those ideas have no tonal centre and/or are not linked to any goal (C2)
- it enables new ideas to be tested at any time. Therein, student ideas can be practised in minute detail first, instead of recording that idea over and over again (C2)

Moving back into the GBIOS app, its track-view helps find creative ideas because students scroll back and forth to visually identify gaps in their compositional writing. The placement of on-screen gaps can suggest the type of creative idea required. Namely, its duration, timbre, dynamic, tempo and harmonic centre, for instance. The track-view also helps students relearn material they recorded in previous sessions. Once relearned, this content can be developed into a new musical idea, or simply re-recorded to a higher standard.

In addition to helping students to find creative ideas, 9.2.1.1.2 will explain how the tablet workstation helps students to develop and fix those ideas into their emerging compositions.

9.2.1.1.2 The tablet develops and fixes creative ideas

The tablet workstation (TW) develops and fixes creative ideas because it drives CMD in musical and technological ways. The TW musically drives development because students can develop a tablet-use strategy which requires them to rehearse, record and listen (RRL) to musical ideas. To use this strategy, students must develop their musical performance skills. Once an idea is rehearsed, the TW enables students to record their music. Once that recording is complete, students undertake focussed listening, where the new part is checked for rhythmic and melodic errors, for example. When searching for new ideas to RRL, students also broadly listen to their whole composition, much like a regular consumer would. The behaviours which define each stage of this RRL tablet-use strategy are summarised below:

<u>Rehearsal</u>
•*Practice with backing track* e.g. performing a rap in time with the drum beat (C1:21 C2:74)
•*Solo practice* e.g. practising a chord progression at the EK without the tablet backing track (C1:10 C2:78)

<u>Recording</u>
•*Failed recording attempt* e.g. because of a musical mistake, timing inaccuracy and/or student(s) not satisfied (C1:9 C2:26)
•*Successful recording* e.g. acoustic guitar part recorded into track-view via microphone (C1:18 C2:27)

<u>Listening</u>
•*Focussed listening* e.g. diagnosing/listening to a specific issue (C1: 18 C2: 62)
•*Broad listening* e.g. listening to a new part in context with the whole composition or to remind students of their work to date (C1: 14 C2: 6)

The coding counts between communities make for interesting comparison here. Those students who are expected to include pre-mediated concepts in their work (C2 participants) are seen to rehearse, record and critically listen to their work more routinely than those awarded a roaming brief (C1 participants). Again, institutional conventions seemingly influence behaviour through and around the TW.

Alongside RRL for musical development, students also use the TW to develop and fix their creative ideas in ways which do not require musical rehearsal and extended performance. A Record-Edit-Loop strategy (REL) can emerge. This strategy ensures that unlike composing for an acoustic instrument, for example, riffs, chords and improvisations need not be performed repetitively to extend duration. At the record stage, a number of attempts are captured and the best performance can be isolated and edited. This edited performance is then looped to extend duration. Cleverly, this ensures that time is not wasted perfecting ideas which are ultimately rejected. When using REL, students maturely and critically listen to their work, identify issues and edit them after the event. The editing aspect of REL utilizes the tablet's opportunity to digitally fix ideas. The on-screen mediated behaviours which define the editing stage include deleting (C1:16 C2:22); cropping (C1:11 C2:16); dragging (C1:16 C2:23); copy and pasting (C1:16 C2:13); zooming (C1:6 C2:13); scrolling (C2:13); splitting tracks (C1:3 C2:22) and mastering content (C1:5 C2:3). Finally, a looping stage necessitates the selection and looping of the digitally edited creative idea (C1:7 C2:10). Comparing the editing practices of both communities, those students who have more classroom-based experience of digital technology (C2) more frequently develop technological ways to fix their creative ideas.

Despite the finding that the TW enhances CMD, in part by helping students find, develop and fix their creative ideas, it also constrains CMD across communities and this influence will now be evaluated at 9.2.1.2.

9.2.1.2 The tablet constrains creative musical development

While the performance-enhancing design of GBIOS has been found to be musically inclusive and conducive for CMD, those same features also restrict CMD. Additionally, there is insufficient musical support for students and various technological design issues arise which also constrain CMD.

Beginning with those performance-enhancing features of GBIOS which constrain CMD: participants recognise that only 'some notes' can be triggered on smart instruments. Then, any creative idea that is input either via real audio or digital means cannot be transposed. Additionally, students attempting to strongly imitate their favourite music (C1) cannot sufficiently 'tweak' or 'fade' bundled loop content to meet that goal. This forwards unauthentic practices because Dubstep artists, for example, manipulate loops in particular ways to communicate their peculiar musical signature to audiences. Students also argue that tapping a tablet screen 'is just not real' and they accept that it is 'just pressing buttons' in a way which is diluted, as compared to contemporary compositional practices.

Questionable performance enhancement processes are compounded by insufficient musical support. For instance, when notes are struck on the EK, GBIOS does not feedback note names in track-view as do many desktop software packages. Further, there are no corrective consequences for when students attempt to record creative ideas which bear no harmonic relation to their existing creative ideas.

Technological design issues further compound questionable performance partnerships and musical support. When students use GBIOS for the first time, there is scant guidance for how to use the app. This most acutely manifests itself when students encounter interface buttons and find them ambiguous in their meaning. For example, contemporary students can be unfamiliar with the symbols for play, stop, rewind and record. This is especially prevalent when students have not experienced formal digital music technology tuition in school (C1 participants). There are shortcomings with hardware design too. Those students who formally learn an instrument discover that the touchscreen cannot realise their musical ambitions (C2). For instance, the touchscreen cannot satisfactorily respond to four-finger simultaneous tapping, which is found necessary for inputting a drum kit part in real-time (C2). Additionally, an electric guitarist concludes that the app is not a substitute for a real guitar because (s)he cannot replicate their blues solos on the tablet screen (C2). Students also report that it is too easy to inadvertently tap the screen and accidently drag parts out of alignment (they seldom can be snapped back to their original position). While the touchscreen has been heralded as a space for collaborative creativity (see 9.2.1.1), it can become an incredibly busy place when two students frequently tap sometimes contradictory commands. It is now clear that the TW can enhance CMD as much as it constrains the same development. Consequently, 9.2.1.3 will now propose that polarising TW influence in this way ignores student perspective. This argues that in fact, opportunity and constraint collectively describe a symbiotic relationship: one essential for CMD.

9.2.1.3 Enhancement and constraint: a necessary symbiotic tension

The various ways in which the TW can enhance *or* constrain CMD have now been analysed and presented. Yet, there is a wealth of case report data which questions any polarisation of freedom and constraint narratives. Instead, participants encourage us to conceptualise human-computer interaction as an influential partnership, one driven by a symbiotic tension. This tension will now be explored.

Students know well that the tablet does things *for* them but the extent to which it constrains CMD remains an issue. Student John sums up the issue. He admits that it is difficult to know whether the tablet is 'good or not good' and 'whether it should, or should not be used'. In response to John, the TW can be 'good' *and '*not good' at the same time. For instance, the sheer quantity of instruments and sounds embedded in GBIOS necessitates a level of human creative input. This creative input manifests itself as persistent decision-making, even in regard to automated content and consequently, students attach a sense of ownership to their work. This is because students must make a choice about genre, timbre and how sonorous content should be manipulated for use in their work. For example, within the drum matrix interface, students are constrained by ready-made rhythmic patterns. In the same moment, students are awarded freedoms within that interface: its constraint framework. Students must make a creative judgment about which drum kit to select, how complex each rhythmic pattern should be and what volume each individual part must reach considering the other drum parts chosen.

Automated content can also catalyse students to create their own musical content. For example, an automated drum part can be used to inspire and then accompany a student's invented piano chords. Students can also listen to the LiveLoop content with the intention of recreating and adapting those sounds.

Another important finding is that students can *choose* to reject all automated TW assistance. Instead, they can develop and record their own creative idea via the EK, acoustic instrument or voice. The RRL strategy enables students to record any creative idea however they wish. Students also have the opportunity to increase their creative challenge by adding more musical layers to their work, adding more instruments or extending overall duration, for instance. The key point here is that constraint frameworks simultaneously provide creative opportunity. In fact, creative opportunities would not exist without these frameworks because they establish a medium through which creative action can take place and musical products made.

While case reports reveal that those students expected to behave more independently at school (C1 participants) protect their rights as a composer to exercise choice, the GBIOS constraint frameworks do provide a level of freedom which ensures that meaningful CMD can take place but in a musically inclusive fashion.

A cross-case analysis for how the tablet computer influences the finding and development of musical products has now been presented. 9.2.2 will now analyse case reports to understand how classroom music teachers influence CMD.

9.2.2 RQ2: How, if at all, can classroom music teachers influence tablet-mediated creative musical activity?

The music teacher is an influential force for CMD. The case reports evidence that this influence is in part shaped by what students and institutions expect from their music teacher. This could be an expectation to deliver the national curriculum for music, or conversely an expectation to facilitate student-centred learning, for example.

The teacher can be proactive (instruct/dialectic), reactive (student-centred/emancipatory) or partner with their students to achieve a shared creative goal (collaborative/dialogic). Through these broad pedagogical approaches, the teacher forwards technological and musical knowledge designed to help situated students find and develop creative ideas relevant to them and their community. The full range of behaviours which define teacher influence will now be reviewed by 9.2.2.1 and 9.2.2.2.

9.2.2.1 The teacher influences how creative ideas are found

The teacher influences how creative ideas are found by connecting creative music-making to students' musical interests and experience. The teacher better connects the classroom-situated Activity System with students' musical interests and experience by:

- encouraging students to bring their guitar, flute and/or own musical resources to school (C1/C2)
- suggesting students adapt songs they can already play and enjoy (C1)
- remaining enthusiastic about what students want to create (C1)
- supporting students to achieve their chosen goal by making personalised interventions in real-time (C1)

In the first instance, students can be reluctant to share their innermost musical interests and ambitions or conversely, they might not have a strong relationship with, or interest in music. Consequently, the teacher suggests broad themes or musical ideas as creative starting points. This is typically actualised by posing opening questions. When there is little institutional intervention (C1), these questions are completely open: 'Any ideas?'; 'So, what are you thinking now?'; 'So what are we doing then?'. In response to these questions students might then suggest a musical theme: 'I want to create music for a chase', for example (C1). Meanwhile, when the teacher is expected to adhere to music faculty curricula (C2), the questions are less open and lead the student to a particular behaviour: 'Are you going to put one part in at a time?'; 'How are we going to extend it then?'; 'Right, do you want to put in one more piece of flute?'. Instruction can be given at this stage too: 'So, first step, I would get your chords in.'; 'In the second part, you could have an improvisation' (C2).

Students form strong opinions about the level of support a teacher should provide for them and these opinions appear to align with that student's community conventions, as 9.2.2.1.1 will now evidence.

9.2.2.1.1 The teacher is a pedagogical manager

Unexpectedly, the teacher constrains or enhances CMD in ways comparable to the tablet computer's influence. When learning is student-driven and flexible (C1), students argue that teachers can impede CMD. Conversely, when students expect their teacher to heavily support their learning (C2), they argue that the teacher is imperative for enhancing CMD. Case reports then reveal polarised opinions about teacher role. Ultimately, both reports concede that there is an interventional balance to be found. Those self-directed students (C1) believed that the music teacher:

- teaches students how to use the GBIOS app but nothing more (C1)
- helps students to define their goal (C1)
- refrains from prescribing goals because students would 'not be doing it themselves' and they may not be interested in 'that type of music' (C1)
- waits for the student to consult them for advice (C1)
- only intervenes when students 'have no idea what to do' or if they suddenly find themselves struggling (C1)
- never says 'no' to a student idea because their creative wishes would be suppressed (C1)

Almost unanimously and with stark contrast, those students who expect target-based learning (C2) believe that the music teacher enhances CMD. To enhance CMD in these settings, the music teacher:

- explains to students how to improve their work (C2)
- guides student thinking by providing suggestions (C2)
- instructs students how to use the GBIOS app (C1/C2)
- promotes the use of students' existing skills and knowledge from the classroom
- overcomes confusion by troubleshooting musical or technological problems (C2)
- provides opportunities for students to compose and perform music alongside a professional musician (C2)
- performs/demonstrates musical ideas which inspire students (C2)
- conducts assessments to issue written and verbal feedback (C2)
- links students' creative behaviour to their curriculum targets (C2)

Accepting that those students who compose according to targets (C2) might lack the intrinsic motivation of those able to develop their own brief (C1), the teacher must 'keep students on task'. To ensure targets are met and community behavioural values are upheld, the teacher manages behaviour (C2:11); encourages participation (C2:7); expects students to record their work (C2:4); requires students to set targets/goals (C2:4) and uses timekeeping to ensure outcomes are achieved within timetable allocations (C2:11).

This analysis reveals a polarised teacher role. One report argues that the teacher should be non-interventional (C1) while the other argues that teacher intervention drives CMD (C2). As for tablet computer role, this understanding of teacher role is likely an over polarisation. This is because all students make concessions to argue that a balance must be found. This 'balancing' is evident throughout case reports because the teacher:

- makes interventions but any decision-making remains the privilege of the student (C1).

•understands that students make a choice about when assistance is required. Students prefer it when the teacher is not 'really into it with them' (C1)
•responds to students who want to be guided by introducing musical concepts to them (C2)
•provides 'a guideline' because students openly accept that they are 'children' and lack experience (C2)
•supports students to improve their work via new ideas and feedback because they welcome that support (C2)

In concert with carefully balancing pedagogical support and helping students to find creative musical ideas, the music teacher also works closely with students to develop their ideas. How the music teacher undertakes this work will now be explained at part 9.2.2.2.

9.2.2.2 The teacher influences how creative ideas are developed

To develop creative ideas, that is to transit from idea to musical product, the music teacher: models musical ideas; provides musical and technological support; suggests or directs technological action and provides feedback. 9.2.2.2.1 to 9.2.2.2.3 will now explain how these behaviours can develop creative ideas.

9.2.2.2.1 The teacher musically models ideas

Music teachers have the potential to develop musician roles (and not just teacher roles) in front of students. Actively modelling musical fragments which align with either student or institutional creative goals can be a powerful catalyser for CMD. This is borne out in the case reports, which evidence that music teachers can model basslines (C1:3); chords (C1:9 C2:19); scales (C2:3); melodies or riffs (C1:8 C2:21) and improvisations (C2:5). Music teachers also model ideas on-screen, at the EK, via an acoustic instrument or voice (C1:8 C2:21). These ideas typically fit in with students' existing backing tracks. Teachers can also prescribe musical content for students (C2:3). Teacher content can even be recorded into a composition (C1:2 C2:1). This ensures students can either learn that part or develop more parts around the teacher's material. 9.2.2.2.2 will now reveal that once students begin to rehearse their creative ideas, the music teacher can also provide musical-technological support in real-time.

9.2.2.2.2 The teacher musically and technologically supports creative musical development in real-time

To ensure the development of creative musical ideas, the teacher musically and technologically supports CMD, most typically in real-time. During idea development, the teacher can react second-by-second to situated creative behaviours. The teacher also suggests or even directs technological action (that is how the TW should be used to achieve particular objectives).

In terms of musical support, the music teacher contributes specialist musical knowledge to the System. They reference music history, identify flat notes in chords, apply appropriate musical terminology during action and clarify that there are four beats in a bar, for example. They also suggest musical ideas when development begins to falter. The music teacher suggests a melody/riff (C2:24); a bass part (C2:4); looping content (C1:2 C2:2); an improvised riff (C2:5); laying down a drum beat (C2:5); selecting a particular instrument (C2: 4); developing a rhythmic pattern (C2:4); inserting a chord progression (C1:10 C2:19) and creating a rap (C1:2 C2:3). When students are required to develop their own goals (C1), the teacher helps them to develop the structural and textural design of their music (C1:6). In those settings which prescribe targets (C2), instructional guidance is necessary. Instruction for bass parts (C2:4); how to establish a beat (C2:4); chord progressions (C2:19); blues-scale improvisations (C2: 4); instrument selection (C2:4); loops (C2:2); melodies and riffs (C2:24); raps (C2:3) and how to develop a rhythm is necessary (C2:4).

Also necessary for target-based creative development is for the teacher to work alongside students to provide 'just-in-time' musical support. This ensures that creative ideas develop in ways which align with curriculum aims. Just-in-time, the teacher locates students to a tonal centre (C2:10); differentiates a musical part by splitting workload between participants (C2:11); points to notes on the EK and/or labels them (C2:12); sings or speaks note names (C2:7) and maintains the beat verbally and/or by clicking fingers (C2:14).

In settings where students have not received musical technology training as part of their classroom curriculum (C1), the music teacher must answer questions about the tablet workstation. The teacher answers technological questions about how to: adjust a track's volume within the mix (C1:2); copy and paste sonic fragments (C1:1); delete a newly recorded track (C1:3); find and use looping features (C1:1); record a new creative idea (C1:4) and record real audio via the microphone (C1:3).

Students from different communities request that the teacher introduces the GBIOS to them. Beyond this basic introduction, the music teacher directs students how to configure the external keyboard (C2:3); add extra bars (C1:1 C2:2); select an instrument, sound or loop (C1:4 C2:4); configure 'smart' instruments (C1:4 C2:4); loop content (C1:2 C2:2); activate the metronome (C1:3); mute or solo tracks (C1:2 C2:2); record parts (C2:15); record real audio (C2:12); master their composition (C1:5 C2:13); use the transport tool bar (C1:10 C2: 5); delete content (C1:5 C2:7); copy and paste content (C2:8); undo edits (C2:2); crop tracks (C2:4) drag content (C2:6); use the vertical slider (C2:7); zoom (C2:5); scroll (C2:3) and listen back to their work (C1:2 C2:2).

Reviewing this broad range of interventions which forward technological knowledge, it is discovered that those students who have targets to meet and previous experience of desktop-based music technologies (C2) sought out more advanced features of the GBIOS app. In addition to just-in-time musical and technological support, the music teacher also provides some students with feedback to further catalyse idea development. This feedback role will now be explained by 9.2.2.2.3.

9.2.2.2.3 The teacher provides feedback to students during their creative musical development

Teacher-student feedback is not necessarily an integral part of CMD. Those students who argue that composing is a 'personal' act (C1) can find deterministic support from a teacher or tablet computer creatively impeding. Conversely, when the teacher is expected to develop creative outcomes which align with classroom curricula (C2), feedback becomes a fundamental part of the learning process.

In addition to written feedback issued at the start of each composing session, the teacher questions aspects of students' work (e.g. timing) (C2:12); promotes listening to indicate there are errors to be 'corrected' (C2:5) and suggests practice if scales or other parts are not fluent (C2:5). The teacher also comments on notes (C2:14); rhythm (C2:14); timing (C2:14) and technological configurations (C2:3).

This cross-case analysis has revealed that music teachers can influence creative musical action in different ways to ensure that different community-wide needs are met. Alongside the influence of the music teacher (RQ2) and the tablet workstation (RQ1) student partners also influence the finding and developing of creative ideas. Their role across two communities will now be explored in order to answer RQ3.

9.2.3 RQ3: How, if at all, can student partners influence tablet-mediated creative musical activity?

Case reports reveal that student partners can behave differently in different settings. For instance, when there are no imposed targets (C1), students are freer to make a choice about their level of engagement. In this setting (C1), one student more than another would find an idea, while the student partner would happily sit back and observe. Only later, when their own motivation increased, do student partners begin to musically and technologically collaborate. Meanwhile, in settings which expect students to meet institutional targets and behavioural requirements (C2), the student partner is a more collaborative force from the outset.

9.2.3.1 Student partners influence how creative ideas are found

Those peers managing institutional expectations (C2) immediately influence the broad musical direction of creative musical action and how the digital technology will be used to achieve their goal. In terms of musical direction, the peer:

- requests new ideas from the student (C2)
- makes broad musical suggestions (C2)
- combines their own idea with the student's idea to create a shared musical goal (C2)
- links idea finding to institutional targets (C2)

It is interesting how C2 peers digest their institutional requirements to the extent that these influence the nature of their musical direction. Given the behavioural values expected by the setting, it is unsurprising that the C2 peers are diplomatic and polite with students from the outset. This leads to powerful collaborative relationships and consequently, shared goals emerge at the 'find' stage. In the same setting (C2), peers also help students develop initial tablet-use strategies by:

- collaboratively developing a technology-use strategy with the student (C2)
- assigning musical and technological roles to the student and themselves (C2)

Both case reports also present data which suggests that a student partner's musical and/or technological roles become better established as creative ideas develop. These influential roles will now be explained from 9.2.3.2.

9.2.3.2 Student partners influence how creative ideas are developed

It has been established that student pairs can assign each other musical or technological roles. Student partners can also musically or technologically collaborate by dialogically inputting musical content via the tablet screen. Student pairs can *simultaneously* drag drum parts onto the matrix screen; strum chords with their fingers; tap in drum parts and input a new hook using different registers of the EK. Collaboration in this way is found to be an effective 'division of labour' whereby workload is distributed between the student partners.

The simultaneous, often doubling up of actions is more common when there are less institutionally-imposed behavioural expectations (C1). A lack of expectations (e.g. C1) can ensure that student peers not only unnecessarily double up routines but also dominate the student in technological and musical ways. For instance, peers can forbid their student to tap the screen or audition timbres. Hands or arms are even used to physically stop this from happening (C1). Therein, a peer who struggles to develop effective dialogic relationships (C1) can marginalise another student's deeply held musical ambitions. In a setting which expects students to act with purpose, respect and excellence (C2), it is perhaps unsurprising that peers provide a range of supportive, corrective and negotiated feedback for the student. The nature of this feedback will now be explained from 9.2.3.2.1.

9.2.3.2.1 Students partners provide feedback to the student during creative musical development

It is evident from the analysis presented from 9.2.3 that peers influence CMD in different ways, according to their situation. In settings which unrelentingly expect students to behave much like any professional adult would in a place of work (C2), it is unsurprising that peers develop a consummate range of verbal feedback to enhance CMD. These peers provide feedback in three ways. They provide straightforward corrective feedback, supportive feedback and negotiated feedback (C2). Instances of corrective feedback are when peers exclaim 'I think it's not in time', for example. Supportive feedback showcases some exceptional behaviour. For instance, the peer recognises the student's role in CMD by thanking them. Perhaps the most advanced form of peer feedback is when peers instigate negotiated feedback. One (C2) peer explains that they would not suggest or make any changes without asking their partner first because 'that would not be fair'. Another peer issued negotiated feedback through the use of a question: 'I don't think it's that good, do you?'. These type of interactions suggest that feedback can become a negotiated rather than a wholly instructive or supportive process.

It is interesting that certain interactional routines, such as when peers provide feedback, are seldom recorded in those settings which do not impose accountability upon teacher or students (C1). This said, an analysis for RQ4 will evidence that while CMD is likely compromised by an absence of institutional intervention, students' musical interests and experience can be better integrated into those classroom settings where learning and social behaviour is less prescriptive.

9.2.4 RQ4: To what extent, if at all, can students' broader musical cultures, current musical interests and experience influence their tablet-mediated creative behaviour?

Case reports reveal that when the music teacher is free to draw upon student interest and experience in the classroom (C1), that community takes more control of their creative development. This said, it is overly simplistic to assume that in heavily regulated settings, students' broader musical cultures, interests and experience are ignored. In fact, analysis here will suggest that despite institutional and local constraint frameworks, students *are* able to build upon their musical interests; transfer their pre-existent compositional beliefs to the TW and take control by experimenting, inventing and adapting musical ideas. However, students working in heavily regulated settings (C2) are more willing to copy existing creative ideas in order to meet institutional requirements. 9.2.4.1 to 9.2.4.3 will now better understand how students' broader musical cultures, current musical interests and experience influence creative musical development.

9.2.4.1 Students build upon their musical interests

Students creating music in both more and less regulated settings are able to build upon their musical interests. Students develop shared goals with their peer which reflect a shared enthusiasm for rap or for particular artists (C1/C2). Students also draw upon their knowledge of pop song structures (C1); find creative ideas which celebrate their favourite instruments and create music according to a genre of music which defines them as a person (C1). Across settings, students transfer their informally-acquired digital music technology skills to the TW. For example, a student who uses phone apps to trigger loops, creates a loop-based dubstep composition (C1) and an electronic drummer inputs polyrhythmic drum parts using the tablet screen (C2). Other student interests are transferable too. The student who learns to dance out-of-school and explains that dancing requires a sense of rhythm, produces a composition which is rhythmically interesting and completely in time (C1). Those students who take instrumental lessons are also able to transfer their experience to the TW. An electric guitarist, an acoustic guitarist and a flautist use their own instruments to record creative ideas (C1/C2). Finally, those students who value the music they learn in class are able to transfer that material to the TW, so that it can form the basis for new creative ideas (C1).

Students also believe that they can carry forward their own approach to composing music in the System. This belief will now be explored by 9.2.4.2.

9.2.4.2 Students act upon their compositional beliefs

Case reports present interview data which suggests student composers typically set out to compose music with a set of preconceptions or beliefs about what composing is. Fortunately, data suggests that students with very different compositional approaches are able to purpose these for use during a TW partnership. For instance, students need not compose music in a style which is alien to them. This ensures that students can choose to authentically express themselves through a familiar musical style about which they likely have fastidious knowledge.

Those students who believe that 'creativity *is* imagination', find musical ideas which they believe 'are different from everything else'.

Student composers who perceive a composer as someone who remixes existing material, remix the tablet's loop-based content. Other students, who believe that all composers (even historical figures) initiate and develop new ideas with their friends (a collaborative view) evenly distribute musical and technological roles and work collaboratively towards shared goals (C2). Finally, those who subscribe to a 'composer as genius' belief, imagine grand creative projects and dominate their peer by forwarding their ideas at any cost (C1). In addition to acting upon pre-held compositional perceptions, students were also able to impose their interests and experience by taking control of the creative process. An analysis of students' creative control will now be presented.

9.2.4.3 Students take control of the creative process

In less-regulated formal settings (C1), students develop a range of strategies to take control of their CMD. Students:

- bring with them a personalised compositional goal, or develop one over time (C1)
- independently control the tablet in ways not envisioned or sanctioned by the teacher (C1)
- delete key content against their teacher's wishes (C1)
- abandon their composition altogether to start afresh against their teacher's wishes (C1)
- develop a resolute determination to learn chords and other musical parts (C1)
- find their own ideas and make more suggestions as ideas develop (C1:6)
- independently extend the duration of their music by adding bars (C1:7)
- apply trial and error strategies to induce creative development (C1)
- invent stories to base music content upon (C1)
- invent raps, vocal hooks, melodies and musical structures (C1)

Some of these behaviours also define action in regulated formal settings (C2), albeit to a lesser extent. Students invent creative ideas for acoustic instruments (C2:2); smart drums (C2:3) and the external keyboard (C2:9). Students also adapt existing ideas which originate from any Activity System dimension. As an analysis for RQ1 revealed, students perform melodies or chords from their favourite songs, isolate a fragment and adapt it to create a new idea (C1). Students also adapt LiveLoop content by editing, copying, pasting and triggering loops at specific points in their existing composition (C1). Students typically adapt ideas which originate from their teacher. They adapt chords (C1:6 C2:3); scales melodies or riffs (C1:7 C2:8); lyrics (C1:2 C2:1) and bass lines (C2:1) to ensure that their creative goals are realised.

When students compose music in both regulated and less regulated settings, creative experimentation remains a common behavioural practice. Students were observed:

- randomly tapping chords on-screen (C1/C2)
- toggling the vocal pre-sets to find strange audio effects for rapping (C1/C2)

- choosing to tap a new rhythm upon the body of an acoustic guitar, rather than strumming its strings (C1)
- persistently moving drum icons around on the matrix screen to vary complexity and dynamics (C1/C2)
- searching GBIOS sound libraries to audition loops and other sounds (C1/C2)
- testing ideas at the external keyboard, which are often discovered by chance (C1)

Young composers situated in institutionally regulated settings (C2) are more willing to copy musical ideas verbatim into their own composition. This is likely because students with targets believe that if official resources are adopted and incorporated, their final assessment grade will be higher. Consequently, students with targets copied chords (C2:4), riffs (C2:5) and scales (C2:2) from their music teacher.

It is clear that despite behavioural and musical regulation from institutionalised human and digital technological forces, students take control of their creative process by acting upon their musical interests and compositional beliefs, experimenting and adapting musical content to suit their own needs. In less regulated settings (C1), students take more control of their CMD, often behaving in ways which the music teacher believes are not conducive for CMD. These same students are also far less willing to directly copy a music teacher's creative ideas.

A cross-case analysis of the case reports has revealed much about how a tablet computer, teacher, peer, student and institution influence creative musical action.

By deconstructing a creative musical Activity System into its influential components, much new understanding has been developed but this same process over simplifies the Systemic nature of CMD. After all, chapter five argues that Activity Systems change through time as different influential components simultaneously interrelate to achieve a situated goal. Fortunately, RQ5 sets out to understand this systemic behaviour. To provide this understanding, part 9.2.5 will now undertake an cross-community analysis of the idea charts presented at 7.5 and 8.5. This analysis will aim to better understand how Activity Systems initiate and develop creative musical ideas over time.

9.2.5 RQ5: How, if at all, are creative musical ideas initiated and developed during tablet-mediated creative musical Activity?

A cross-case analysis undertaken to answer research questions 1-4 develops new understandings about how individual system dimensions (e.g. tablet computer, teacher, student partner and student) either wholly, or partially influence the finding and development of creative musical ideas. As insightful as these new understandings are, this analysis does not conclusively explain how different system dimensions interrelate with each other to influence creative musical action. It is for this reason that a visualisation mode was developed and presented alongside case reports. Idea charts evidence how creative ideas draw upon different combinations of system dimensions at different moments in space and time. A cross-case analysis of these charts reveals a consummate range of systemic configurations, which vary according to:

- the nature of the idea itself e.g. riff or soundscape

- •the extent to which the idea draws upon primarily technological (e.g. copy and paste) or musical (e.g. performing chords) tablet-use strategies
- •whether the idea is primarily student, teacher or tablet-led
- •which input modes are used to record the creative idea e.g. microphone or touch-screen
- •the compositional pathway of the creative idea e.g. how the idea was found and focussed
- •primary pedagogical approach e.g. dialectical (instructional), emancipatory (student-led) or dialogic (collaborative)
- •whether the creative idea is successfully fixed, or whether it failed
- •the situation of the system i.e. community one or community two

Some of these defining attributes remain constant throughout the lifecycle of a creative idea. Critically meanwhile, the majority of the chart features listed above are in fact fluid: they appear to change form over time to accommodate situated, emergent need. To best illustrate this phenomenon, 9.2.5.1 will now undertake a detailed analysis of the charts. Its primary intention is to answer RQ5. That is, to establish how system dimensions combine at moments in time and space to support the initiation and development of creative ideas.

9.2.5.1 Creative musical Activity Systems change form over time to accommodate situated, emergent need

To explain how Activity Systems change over time to produce creative ideas, a cross-case analysis of the creative idea charts will evidence how:

- •system dimensions change over time
- •idea development is reliant upon different combinations of musical and technological processes
- •different pedagogical approaches both independently and simultaneously influence CMD
- • the quality of students' compositional pathways influences creative development, or the lack of it

Based upon this summary of how CMD takes place in Activity Systems, creativity is found to be an inherently distributed phenomenon. Therefore, this analysis suggests that only by embracing the inherently distributed nature of creative musical action can we truly understand how creative ideas emerge in digitally-mediated, formalised learning situations.

9.2.5.1.1 The emergent and relational nature of primary system dimensions

A cursory review of the idea charts presented in chapters seven and eight reveals a range of coloured bars. When these bar trends are compared, it is evident that creative ideas are developed in part because different system dimensions emerge to overcome particular challenges. For instance, some charts have primarily red bars (the tablet) and others yellow (the teacher) or green (the student). This evidences that some system dimensions assume more importance than others in particular situations. Additionally, the role of the system dimensions is a transient one. For instance, one idea can begin with a host of yellow bars (evidencing teacher influence) and end with a clump of red bars (evidencing tablet influence). Further, as students become more musically and technologically experienced, the teacher can become more redundant, even though they were fundamental in finding that first creative idea, for example. Owen and Kasar's idea 5 and idea 11 are good examples of dimensional shift *between* one pair's creative ideas. Over time, Owen became far more experienced at using the tablet and performing musical material and consequently, yellow bars (teacher) do not dominate the idea 11 chart as they do for idea 5. A broader range of dimensional domination and transiency will now be discussed.

In less regulated communities (C1), the student is free to dominate creative musical action. When the teacher begins to work with Jackie and Mia to find their first creative idea (Figure 7-13), a macro musical direction is suggested. However, the remainder of the idea quickly becomes dominated by student Jackie, as she attempts to find and unsuccessfully develop the pair's first creative idea (green bars 2/6/7/8/11/12/13/14/16/18).

The tablet computer can also dominate CMD. When Jackie and Mia (C1) attempt to develop their first idea (Figure 7-13), they interact with the tablet (red bars 19-32) and this dimension begins to dominate. However, these finding/focussing processes soon fail and the teacher intervenes to keep students on task (34) and make musical suggestions (31/35). At that point, the teacher begins to dominate the System. Meanwhile, the tablet dominated Jackie and Mia's 5th loop-based creative idea (Figure 7-14). Despite this, Jackie still attempts to invent content (green bars) and the teacher makes musical interventions (yellow bars 4/5/6/7) to keep Jackie and Mia task oriented (12). Given the variety of system dimensions dominating action during the lifecycle of just one creative idea, it is already apparent that abstracting individual system dimensions from their emergent situation weakens deep understanding.

In a different setting, John and Botan's second idea, a drum beat (Figure 8-17), is almost completely automated by the tablet (red bars) (C2). Even though this is an automated process, the student partner does suggest a recording attempt (blue bars 3/5); answers the student's question (7) and adds musical knowledge (8). The teacher dimension also influences this idea. The teacher is unsure how to assist so students are praised (yellow bars 2/4) and students are advised to consider the duration of their new part (6). Finally the teacher introduces track-view to students (10). Again this idea evidences well that even when students rely upon the tablet computer, many system dimensions remain influential for CMD in any one moment.

Owen and Kasar's second guitar riff (Figure 8-19) reflects Owen's new-found tablet skills (C2). There is a distinct lack of teacher input: now the students are proficient in achieving their institutionally validated goal *without* extensive teacher support.

In addition to the student and the tablet, the teacher can also dominate CMD. For instance, a chart visualising John and Botan's first creative idea (Figure 8-16) is dominated by yellow bars. While the teacher is fundamental for finding the idea (a blues riff) and for the early rehearsal of that idea, blue bars then characterise the middle of the chart as the idea is developed and ultimately fixed. These blue bars identify how the student partner begins to operate the tablet for the student. Towards the end of the idea (the fixing), the tablet dimension is utilised to edit content. Therefore, three system dimensions (teacher/student partner/tablet) emerge as dominant as the idea develops through time and space.

The charts also suggest fundamental differences in the way that creative ideas are initiated and developed in different settings. Figure One below compares the opening moments of CMD from both an unregulated and regulated setting. Chart (a) is an excerpt from Jackie and Mia's 1st creative idea (C1) and chart (b) is an extract from Owen and Kasar's 1st idea (C2).

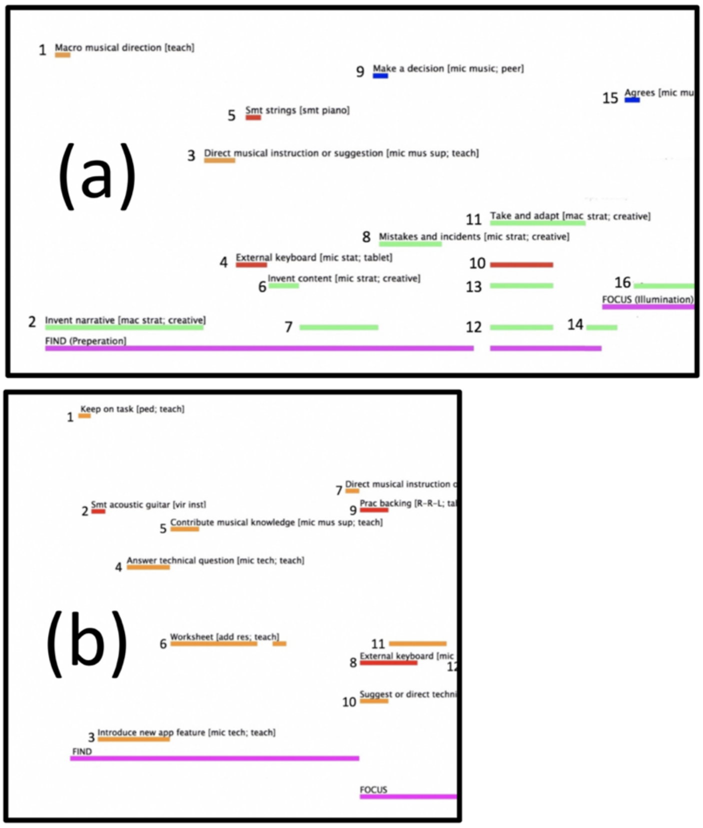


Figure 9-1 A comparison of how Jackie and Mia's (C1) first creative idea (a) and Owen and Kasar's (C2) first creative idea (b) vary by system dimension.

At chart (b), it is evident that these C2 students welcome and even require a high level of teacher intervention. Meanwhile, at chart (a), the student (green bars) dominates creative musical action. This behaviour is possible in that setting because the students are encouraged to take control of their learning.

The way system dimensions come together in peculiar ways during the lifecycle of a creative idea and between different created ideas has now been analysed. RQs 1,2 and 3 also indicated that system dimensions have the potential to influence action in musical and technological ways. The charts will now be analysed to better understand this facet of creative musical Activity Systems.

9.2.5.1.2 The emergent nature of musical and technological processes

An analysis to answer RQs 1,2 and 3 has already revealed that system dimensions influence CMD in musical and technological ways. The idea charts develop this understanding further. These charts evidence that creative musical ideas are routinely found and even developed via traditional musical means (e.g. performing chords on a piano) but latterly, technological processes dominate in order to fix that idea. For instance, John and Botan's idea one (Figure 8-16) begins when the teacher and tablet computer influence action in primarily musical ways. When this idea is recorded, the tablet is merely a recording device, capturing the musical performance. However, when the idea is fixed, the students use the tablet computer to listen to and then edit their work via the zoom and crop function. This indicates that the system's musical and technological continuum appears to shift. A similar phenomenon is observed during Owen and Kasar's CMD routine. Their ideas emerge from traditional musical origins (performing improvised riffs at the EK) but to edit recordings, Owen deletes, drags, zooms and scrolls content to make changes. Once again, the digital technology primarily influences idea fixing but it was those traditional musical processes (rehearsal and performance) which enabled Owen and Kasar to reach that stage in their pathway.

In addition to ideas influenced by the system's musical *and* technological processes, there are some ideas which are found and fixed in *primarily* technological ways. Jackie and Mia's 5th loop-based, creative idea (Figure 7-14) is found and fixed as a direct consequence of the digital technology. This said, the teacher desperately attempts to make musical interventions to encourage the students to invent a rap or compose their own loops. Similarly, John and Botan's drum beat (Figure 8-17) was primarily found and fixed through digital technology and once again, the teacher attempted to address the lack of musical value by making musical interventions.

This analysis illustrates well that musical and technological influence is flexible: it is a continuum that changes through time. Moreover, any system dimension can simultaneously act in musical or technological ways.

Alongside dimension and musical/technological influence, the idea charts also help to reveal that a range of pedagogical approaches individually and/or simultaneously condition CMD.

9.2.5.1.3 The emergent and relational nature of pedagogical approach

A cross-case analysis for RQs 1,2,3 and 4 has already discussed the ways that the tablet computer, teacher, student partner and student can pedagogically influence learning. For example, the tablet can heavily constrain musical ideas by largely *determining* students' creative behaviour e.g. via the smart instruments or LiveLoops (dialectical conditioning). The peer and teacher might also *instruct* students to do certain things (dialectical conditioning). These same dimensions can equally award the student opportunity to behave as (s)he wishes (emancipatory conditioning) or partner with them to achieve a shared goal (dialogical conditioning). The point here is that when technological or musical knowledge is made available in the system, it is pedagogically conditioned. Identifying prevailing pedagogy is a highly subjective process because typically, a number of approaches can be suggested by any one data fragment. Preamble given, the data tables which accompany the idea charts (7.5 and 8.5) bravely attempt to label data fragments with a prevailing (but not absolutist) pedagogical approach. Using this data, the pedagogical fluidity of creative musical ideas will now be considered.

Instances of dialectic, emancipatory and dialogic pedagogical conditioning litter the creative idea charts in much the same way as RQs 1-3 evidence how system dimensions instruct (dialectic), facilitate opportunities for self-direction (emancipatory) and collaborate (dialogic) with students to ensure systemic musical goals are achieved.

Students who expect to direct their own learning (C1) can fuel pedagogical tension in the system. Jackie and Mia's loop-based idea (Figure 7-14) evidences a tension between the student desire to work in 'open space' (emancipatory/green bars) and teacher desire to instruct the students to ensure they experience CMD (more dialectic/yellow bars). The chart and its associated data table indicate that these pedagogical approaches persistently 'jostle' with each other as the system switches between idea finding and unsuccessful focussing. A more obvious example of dialectic pedagogical conditioning is evidenced as part of John and Botan's first creative idea (Figure 8-16). In this instance, a worksheet is used to dialectically establish a constraint framework within which the students are excepted to work. Shortly afterwards, the teacher instructs students according to this framework (7/9/10/13). Even as John and Botan begin to fix their idea, the tablet computer determines how that work can be edited. The digital device prescribes set options such as crop and zoom (30/34/36). John and Botan's second creative idea is further determined by the tablet. Here, the tablet prescribes rhythmic patterns for the students to drag and drop into their work in ways comparable with a dialectical teacher prescribing musical content. Owen and Kasar's first guitar riff is also found and developed via dialectical teacher instruction (2/3/4/5/6/7). Essentially, dialectical pedagogical conditioning constrains musical action to ensure CMD can take place. Without a worksheet, targets or pre-made rhythmic patterns for example, students might not fix their creative ideas (evidence to support this assumption will be presented at 9.2.5.1.4).

Even when constraint frameworks are ever-present from multiple dimensions, opportunities remain for the teacher to promote emancipatory (student-centred) approaches. For example, during the development of John and Botan's riff (Figure 8-16), the teacher encourages students to make a *choice* to engage with the resources and latterly, the students are supported when they take their own risks and experiment (12). Even when the tablet behaves dialectically as John and Botan fix their drum beat, the teacher conditions CMD in emancipatory ways. For instance, the teacher praises students for the decisions they have taken (2/3) and continues to support the students' goal, even if that teacher does not personally believe it represents the best approach (6). By the time Owen and Kasar reach their eleventh creative idea (Figure 8-19), it is apparent from the chart that the teacher is seldom present. Although Owen is working in a particularly institutional way, he has become intrinsically motivated to work in this way. Consequently, the teacher conditions action in an emancipatory way to ensure Owen can realise *his* intentions.

Analysis for RQ3 reported that peers dialectically instruct students, empower them in emancipatory ways (e.g. via encouragement or support) and/or work dialogically with them towards a shared goal. Especially in more regulated communities, student partners expect to develop close musical-technological roles to support students so that a shared goal can be achieved. John and Botan's riff chart (Figure 8-16) evidences well how student partners can operate the tablet for those students who are practising and performing musical content (18/24/26/28). The peer also injects musical knowledge into the System, answers student questions and remains supportive in relation to the student's work (7/8/20). Dialogic peer roles are also prevalent during Owen and Kasar's Activity (see idea tables thirty and thirty-one).

The tables for the visual idea charts presented at 7.5 and 8.5 indicate that any one creative idea is typically reliant upon emergent combinations of pedagogical conditioning and this appears to change according to real-time need. For instance, Owen and Kasar's third creative idea (Figure 8-18) is first defined by the teacher 'teaching' a scale (4/5/6/7) and suggesting improvisation (16) (dialectic). Shortly afterwards, the students apply what they have learnt and decide to create their own riff (emancipatory). While this is happening, the student partner learns some of the musical parts (15) and helps to record the riff onto the tablet computer (20) (dialogical). While the students use the tablet, the teacher continues to dialectically instruct the students to tap particular icons in the interface (29/30/31). It is evident therefore that this guitar riff is in part initiated and developed because of a *pedagogical fusion* which bridges traditional pedagogical paradigm divides.

When there is pedagogical fusion in this way, students develop those compositional pathways which lead to high quality musical outcomes. A cross-case analysis of compositional pathways will now be presented.

9.2.5.1.4 The emergent nature of compositional pathways

When the full spectrum of pedagogical approaches condition the lifecycle of a creative idea, students appear to develop a high-quality compositional pathway, one which awards sufficient time to the finding, focussing and fixing of their ideas. Owen and Kasar's ideas (C2) suggest their music-making draws upon a balanced range of musical and technological processes. These are in turn, conditioned by the full spectrum of pedagogical approaches. In consequence to these system characteristics, the pair ably develop an evenly staged compositional pathway. This is hallmarked by a progression through time from divergent (Find) to convergent thinking (Fix) processes. The pair spend about the same period of time in each phase. This leads to commendable creative musical outcomes (see tracks 55 and 63). As evidenced by their charts, Owen and Kasar do attempt to fix their ideas too quickly. This 'skipping to fix' is replicated in both their idea charts. Fortunately, Owen is a motivated student (personal forces) who has a supportive teacher, peer and tablet (local forces) and the benefit of strong institutional expectations (cultural forces). These forces combine to ensure that Owen does not 'give up' but chooses to re-focus his idea before attempting a second recording attempt (fixing).

In less regulated settings (C1), there is a dominance of emancipatory pedagogy and a lack of musical processes emerging from the system dimensions. Consequently, while Jackie (C1) is evidenced as a fantastic divergent thinker (imagining ideas and concepts), she is routinely unable to converge her ideas into creative products. Therein, Jackie and Mia are 'floaters': they float at the find stage and every time they attempt to focus an idea, they quickly 'give up' and return to finding new ideas.

To summarise, this chapter has undertaken a cross-case analysis to reveal a better understanding of how creative ideas can be initiated and developed in different communities. It has become evident that creative ideas are not only influenced by system dimensions working in isolation (RQs 1-4). System dimensions in fact emerge and transition overtime, according to systemic need (the need to achieve a goal). These system dimensions can intervene with that knowledge somehow deficient in another dimension. Consequently it can be proposed that:

1) system dimensions are relational and react to each other as ideas develop
2) each dimension influences CMD in musical and technological ways
3) the musical and technological knowledge which system dimensions use to influence CMD is pedagogically loaded

Ultimately then, Activity Systems are multi-dimensional and consequentially, multi-pedagogical. Once irreconcilable theories of knowledge and their associated pedagogies are found here to simultaneously condition a singular phenomenon that is creative musical action. In consequence of these Systemic characteristics, students can develop rigorous, staged compositional pathways, which are necessary to create high-quality musical products.

A cross-case analysis of two communities' case reports and idea charts has been presented. Chapter ten will now draw upon existing theoretical frameworks to discuss this cross-case analysis. Its aim is to introduce a revised systemic understanding for the digitally-mediated, creative musical development which took place in two different school communities.

Chapter 10:
A discussion of the cross-case analysis

This chapter will present a theoretically-informed discussion of the cross-case analysis presented at chapter nine. 10.1 will use theoretical concepts to discuss how the CMD reported in this study was influenced by cultural, local and personal forces. 10.2 will determine that these forces influenced action in musical and/or technological ways. Finally, 10.3 will propose that these musical and/or technological influences pedagogically conditioned each community's CMD in either dialectic, emancipatory or dialogical ways. This newfound level of theoretically-informed understanding is synthesized into a framework at 10.4 to help concept how CMD emerged in two Yorkshire Secondary Schools. This framework is a new contribution to the field of creativity in music education research. This is because it uses Activity Theory to bring together a wealth of different research areas (e.g. distributed intelligence, mediated action, pedagogical development, tool-based digital technology) and traditionally opposed paradigms (e.g. materialistic objective reality [positivism] and humanistic subjective reality [constructivism]) into a singular, pluralistic framework. This framework will require further testing in diverse community settings but it describes well the creative musical action observed in the two participating communities.

10.5 uses the new framework and discussion at 10.4 to make a second contribution. Namely, that creativity might be better conceptualised as constraint-based action. Consequently, the new framework will deeply question the individualistic/cognitive account of composing introduced in chapter two. In fact, it will be marginalized in favour of a systemic understanding.

Ultimately, Activity Theory will be used as a starting point to embrace a pragmatic approach to the reality of creative musical development. This approach will bring together humans and material objects to say that creative musical action is the consequence of a symbiotic relationship between the natural and social world.

A discussion from part 10.1 will refer to this study's research findings and existing theoretical constructs to argue that creative musical action is defined by culturally-conditioned local and personal forces.

10.1 Cultural, local and personal forces

The findings of this research study have evidenced that CMD is culturally, personally and locally conditioned in ways proposed by Hatch and Gardner (2001). For instance, how music teacher role was perceived by community members and how human actors behaved in different settings provides evidence for how cultural forces influence behaviour at the local and personal level. A student's personal forces also conditioned CMD because all students were able to impose something of their musical interests and compositional beliefs upon the system. The teacher and tablet dimensions amplified these personal forces and therefore, the system answered Finney's (2007a) plea for classroom practices which widen choice and autonomy: not restrict it.

The system bridges informal and formal music-making settings because it helps students to collaborate, explore, share, self-express and playfully imitate through digital technology. Students exhibited these behaviours in formalised and structured classroom-situated, musical settings. Howell (2017), Lum (2017b), Webster and Williams (2017), Jaffurs (2004) and Green (2002) define these behaviours as informal music-making practices. The majority of this study's data was coded to the teacher, tablet and student partner: it is unsurprising then, that these local forces were especially influential for CMD. Consequently, 10.1.3.1 will discuss how the tablet computer promoted musical inclusion via its performance-enhancing intellectual partnerships. 10.1.3.2 will also discuss the tablet's functionality as a pedagogical partner: the device enables students to develop robust cognitive and collaborative tablet-use strategies. These strategies are compositional development pathways which lead to the invention and rehearsal of students' own musical content.

10.1.3.3 will discuss how the teacher and peer can equally influence action at the local level. Moment by moment, the teacher musically and technologically supports CMD and provides feedback. The peer also helps to find ideas, develop shared goals, develop musical content and/or operate the tablet computer for the student.

Now, 10.1.1, 10.1.2 and 10.1.3 will use existing theoretical argument to discuss how research findings from this research evidence that CMD is culturally, personally and locally conditioned respectively.

10.1.1 The system is culturally conditioned

This study's cross-case analysis has evidenced how a community's behaviour and its physical artifacts (situated at the local and personal level) change according to their cultural conditioning. For example, when I was awarded professional autonomy as music teacher in C1, interventions reflected my commitment to a deeply student-centred music education. This locally-held belief was culturally conditioned by my teacher training and liberal university education. The tablet too, is the product of cultural forces. While the device has been defined in this research as a local force, at 3.2, Pea (2001) rightly identifies that the device carries intelligence within it: this intelligence represents patterns of reasoning from some previous individual or community: in this case a multinational company and its software designers.

The tablet and music teacher aside, the primary cultural conditioning in this research arose from the two situated school communities themselves. 9.1 comparatively analysed their different curriculums, views of knowledge, behavioural and pedagogical expectations. Consequently, 9.1.1 and 9.1.2 discover that student behaviour, student expectations and overall systemic pedagogical approaches closely align with their community's cultural conditions and values. Specifically, students musicking in a more regulated setting more willingly copied ideas in order to achieve a target (C2). Student partners behaved differently in each community too. With little external motivation (e.g. target or punishment) C1 partners often 'took things easy' and even sat out. Whereas, when institutional targets and behavioural requirements were mandatory, the peer became a collaborative force from the outset. Every composition to emerge from the less regulated setting was musically individualised. Compositions emerging from the more regulated setting strongly embodied the community-imposed constraint frameworks: most notably a blues-based scheme of work (see attached audio CD).

The way in which this study has compared and contrasted cultural values *between* the two situated research communities (embodied by their social and pedagogical expectations) is compelling evidence that CMD is culturally mediated. Just as Cole and Engeström (2001) explain at 5.1: those expectations of previous generations are cumulated in the present moment and this is a powerful mediational mode which directly induces developmental change. It is now clear that different community cultures mediate action in ways which lead to a diverse range of behaviour. This phenomenon is best explained by Hatch and Gardner (2001) at 5.1. They argue that cultural forces - the practices and beliefs of community institutions - affect an individual's 'local' cognition. Findings here closely align with Hatch and Gardner's (2001) perspective because when students compose in different settings, they exhibit different kinds of skills (e.g. copying versus inventing creative ideas); develop those skills in different ways (e.g. succeeding or failing to fix a creative idea) and direct them to different purposes (e.g. towards imposed targets or self-directed goals). The student and their broader musical background, experience and interests are also culturally mediated but in the moment of action, they became influential personal forces. This will now be discussed.

10.1.2 The system is personally conditioned

Alongside findings which contribute understanding about how creative musicking is culturally-mediated, this research study has also evidenced that this musicking is simultaneously personally conditioned to some greater or lesser extent. 5.1 defines personal forces as 'the attributes and experiences that individual children bring with them to many of the "local settings" where they spend their time' (Hatch and Gardner, 2001, p.169). In the research community systems, personal forces appear to account for the variation in people's abilities and individual differences (see Hatch and Gardner, 2001). Importantly, this study provides new understandings about how a *range* of dimensions in CMD systems help to amplify these personal forces. For example, the teacher can encourage students to bring their own musical instruments to school; support student goals and remain enthusiastic about students' work. Meanwhile, the tablet computer simultaneously connects students to familiar genres and musical experiences. For instance, students successfully apply their knowledge of pop songs, dancing and dubstep when they compose with the tablet device. Students also draw upon their identity and musical background by recording tracks with their own instrument or voice. These findings align with Clennon's (2013) study, which found that computer software can help young offenders develop music which explores and reflects upon their street life and anti-social behaviour. Similarly, students participating in the Gall and Breeze (2008) study, could 'hear the music they were into' which was 'new and good' for them. Bolden's (2009) study reports how GarageBand software can present students with sounds and timbres which are familiar to them. In this study, these same sounds connected to students' personal preferences in ways which helped them effortlessly 'build music' (Bolden, 2009).

The discovery that tablet and teacher dimensions draw upon students' personal forces during CMD is important new understanding. This is because evidence of such phenomena responds to a key tenet of the research rationale: namely, a desire to connect informal and formal music-making settings. This study has evidenced that instead of participants becoming '…exposed to materials and manipulatives used for the past 40 years…', they use 'the digital media to which they were accustomed' in classroom settings (Annetta, 2008, p.229). As Huberstone (2017) suggests, this type of digitally-mediated, creative musicking better engages students because it connects with popular music cultures during action, rather than simply imparting information about music. This is found to be empowering because students share '…a little bit of extra knowledge' either about their instrument or their favourite genre, for example (Dorfman, 2016, p.169).

A further contribution of this study's case reports and cross-case analysis is the finding that students with diverse musical backgrounds can use the GBIOS app to compose because it provides sounds; tools to assemble musical fragments; scales; notes; chords and even ready-made creative ideas. The range of timbres and customization levels also help students to make choices and behave in ways specific to themselves.

GBIOS's allegiance with personal forces minimizes the daunting and/or frustrating 'cognitive disturbance' which creative musicking can require (Morgan, 1975; Wilson, 2001; Swanwick, 1979). Critically then, whatever 'personal forces' students bring with them, '…regardless of ethnic and cultural origin, or gender, and…physical and mental ability…', these students personally impose themselves upon a musical experience (Comber et al., 1993, p.123). The way in which the tablet computer and music teacher forward personal forces helps students to dispel those traditional preconceptions of composing as summarized by Mills (2005). These preconceptions are manifested in the belief that some people are 'not musical', or that they have to play a musical instrument, or that they have to be Mozart to compose (Mills, 2005) .

This study also evidences those barriers which prevent students' personal forces becoming influential in the system. Those who play 'real' instruments find the tablet device cannot replicate their acoustic playing experiences beyond simplistic hitting or strumming, for example. This finding directly contradicts Randles who argues that tablet computers manipulate '…melodic and rhythmic materials in musical performance, just like the keys on a saxophone and the slide on a trombone' (2013, p.50). It is clear that despite this claim, participants with instrumental experience risk having their personal forces suppressed by the tablet computer.

10.1.3 The system is locally conditioned

Alongside cultural and personal forces, prominent local forces are situated in the classroom: namely the tablet device, music teacher and student partner. Chapter nine reveals in micro detail how these local forces influence CMD through time. This is compelling evidence that '…individuals depend on a wide variety of tools, people, and other resources to help them carry out their [creative musical] activities' (Hatch and Gardner, 2001, p.168). Findings indicate that this 'dependence' can both enhance musical performance (by constraining human action) and/or provide pedagogical opportunities for students to invent new ideas, strategies and goals.

The performance-enhancing and pedagogical partnerships which the tablet computer makes available will now be discussed, prior to a summary of music teacher and peer influence.

10.1.3.1 The tablet computer: performance-based intellectual partnerships

This research study has discovered that performance-enhancing partnerships can develop between students and the tablet/GBIOS configuration. Novice composers engage in cognitive, creative action normally out of their reach: see Salomon et al. (1991). As for Roschelle et al., the tablet workstation simulates reality (professional digital composing practices) and dynamically links together notational representations so that '…ordinary students…achieve extraordinary command of sophisticated concepts' (2000, p.86). The tablet helps achieve this spectacle in part because of its fluid and flexible opportunities for action proposed by its multitouch gestures. Namely, an ability to trigger multiple input commands simultaneously (e.g. one gesture to trigger pitches, rhythm and dynamics). These findings support Vanderlinde's (2017) argument at 3.4. That is, the belief that touch-screens make musical processes 'highly accessible' for students, especially those who struggle with notation, cognitive processing and/or musical performance via acoustic instruments.

Additional behaviours which defined performance-enhancing partnerships are: students recording new ideas quickly, easily adding a drum part and making use of the tablet's notes, scales and chords in their music. Sometimes, performance partnerships define a student's tablet use strategy. A consummate example of this is the record-edit-loop strategy. Students require little or no traditional musical experience to quickly fix their creative idea using the REL strategy. For music teachers, concern abounds at this point. 3.2.4 rightly identifies that performance enhancement is a threatening concept because when a young composer '…becomes a servant of the system [they are] no longer able to control or influence what is happening…it depersonalizes the job' (Norman, 1998, p.197). 'Depersonalizing the job' is that moment when a student's personal forces become suppressed. This study has evidenced that personal suppression happens when:

- musical content cannot be sufficiently customized to align with student goals;
- recorded parts cannot be transposed;
- there is an insufficient range of instruments to suit all needs;
- tapping the screen is found to be inadequate compensation for real-world, musical experience.

These research findings substantiate the Shibazaki and Marshall (2013) study, which identifies that music software can be developed in such a way that there is insufficient timbral range and opportunities for customization.

Worryingly, 10.1.3.1 suggests that the performance-enhancing features of GBIOS can make traditional musical skills redundant. As Dafoe (2015) warns at 3.1, GBIOS has the potential to determine its user's creative musical actions. Despite the accessible creative opportunities evidenced, it is inescapable that performance-based intellectual partnerships determine an increasingly dystopian relationship with technology: one where students are in some way enslaved by it (Vermaas et al., 2011). Meanwhile, performance enhancement is but one influence of digital technology. Concurrently, this study also reports that the tablet workstation provides a range of opportunities for *unpredictable, humanistic behaviour*. The TW achieves this by helping students develop pedagogical intellectual partnerships during their creative musical action. This influential facet of local force will now be discussed.

10.1.3.2 The tablet computer: pedagogical intellectual partnerships

Alongside digitally-mediated, performance-enhancing partnerships, this research study also contributes understanding about how tablet workstations help students to develop pedagogical intellectual partnerships. This type of partnership is defined as a cooperative division of labour where 'the computer tool carries out tedious lower level operations, leaving the user to hypothesize' (Salomon, 1993, p.182). The tablet and GBIOS provide these partnerships because students are able '…to sonify and visualize their ideas…[and have] the opportunity to perform, edit and hone the sounds in order to create, iteratively, their sonic product' (Moir and Medboe, 2015, p.153). These practices are evidenced in this study's findings which detail how students can hear sound, assemble musical layers and mix different instruments together. Additionally, because the tablet stores and presents a wide range of timbres, students quickly get on with the business of composing. The always-on EK also enables students to try out, rehearse and record ideas at any time. When students use these type of resources (i.e. sounds, blank track-view screens, the EK, microphone), they choose to use the tablet only as an unintelligent tool (i.e. a storage device). They impose their own cognitive strategies upon the tablet computer. Using the TW in this fashion also necessitates students demonstrating traditional musical skills in order to get ideas fixed. The Rehearse-Record-Listen strategy described at 9.2.1.1.2 is a good example. For RRL, participants tirelessly design their music *around* the tablet as opposed to *through* it. As Hamman (2002) premises at 3.2.3, this aspect of GBIOS's functionality helps students to remain focussed upon domain-related (in this case compositional) concepts rather than having to adapt their personal cognitive forces to how the system thinks.

Whether students create their music by primarily distributing intelligence to the tablet computer (a performance partnership), or use the device as a simple storage unit so that personal composing strategies could be developed (a pedagogical partnership), the tablet computer is a cognitive tool. This is because it helps '…transcend the limitations of the mind..' (Pea, 1985, p.168). It does this by '…providing physical representations of abstract strategies and concepts, making them tangible for inspection, manipulation, and discussion…' (Derry and Lajoie, 1993, p.6). Students therefore experience a technology which promotes utopianism because, as Chrysostomou argues at 3.2, the device can be 'subservient to a young musician's learning needs, interests, and ways of thinking' (2017a, p.350).

Critically, in spite of whether students choose to enter into primarily performance (dystopian) or pedagogical (utopian) partnerships, they are required to act. As Pignato (2017a) argues, students must 'work upon' creative products in ways which either affirm (dystopian/performance) or subvert (utopian/pedagogical) market intent.

Chapter nine revealed that the music teacher and student partner are equally influential local forces within and across different settings and their role will be now be discussed.

10.1.3.3 The teacher and student partner

A seminal contribution of this research study is its revised understanding for how systemic creative musical action addresses those suppressive, dystopian and musically threatening characteristics of the chosen digital technology. In this research, threatening characteristics are embodied in the tablet's inability to offer feedback; correct musical errors and provide sufficient musical or technological instruction (see 9.2.1.2 for a complete list of deficiencies). When the system is researched as a single unit, it is found that other system dimensions can compensate for, or neutralise, 'weak' system components. For instance, when the tablet entices students away from creating their own music, the music teacher or student partner can intervene in that same moment. These human, local dimensions might advise upon or model musical ideas: thereby restoring the balance of musical knowledge in the system. How music teachers can respond to the tablet computer's deficiencies will now be discussed.

Considerable cross-case analysis has been assigned to how the teacher musically and technologically supports CMD through/around the tablet workstation in real-time and how they provide supportive and corrective feedback to students (see pages 219-221 for more details).

Research findings in this study evidence that the music teacher compensates for the tablet computer by developing a 'live musician' role. In this role, the teacher models/demonstrates musical content which is either personalised to student need and/or meets institutional requirements. This classroom behaviour aligns with Ross' (1978) expectation that creative arts teachers should help students by presenting (or demonstrating) a suitable medium through which their creative impulses can be expressed. As for Wilson (2001), this teacher models melodies, harmonic (chords) progressions and provides musical tracks so that the students can layer complementary material 'on top' of them.

These research findings underline that music teachers must renege on 'do as I say and not as I do'. As Odam (2000) argues, if teachers are perceived as working composers, students will follow.

Turning to the student partner, they further reinforce teacher roles, especially when creative musical ideas are found in more regulated settings (C2). For instance, peers question students to initiate idea finding, suggest musical ideas and make sure any new idea satisfies institutional targets. Peers also provide supportive, corrective and negotiated feedback. These roles align with Ginocchio's (2003) argument that peers contribute musical knowledge; discussion; leadership and even develop formalised teaching roles. As Cox (1999) suggests at 1.6, student partners appear to mature emotionally and socially when there is interplay of personality upon personality.

While these facets of peer behaviour are influential, it is those truly collaborative behaviours which define peer influence in the system. Dimock (1986) predicts that as products of learning emerge, leadership can shift from one person to another: therefore, sharing is integral to the

Activity. Comparatively, cross-case analysis reveals how students assign each other musical and technological roles and how those roles routinely interchange. That is, students divide labour in ways which align with personal experiences, skills and level of confidence (i.e. their personal forces). Shared action is also apparent when students develop a shared goal. That is, when students 'meet in the middle' to combine their ideas. These moments in action are a '…collision of ideas, experiences, and skills…' where different encultured histories come together (Slater, 2016, p.21). Research findings have also revealed that students collaboratively and simultaneously input musical content and manipulate musical representations via the touch screen. In summation, peer roles substantiate Biasutti's (2015) research, which evidences how musical collaborators provide musical suggestions (introduction of new ideas); musical extensions (help other musicians develop that idea) and positive support (agreement and supportive interaction).

The cross-case analysis at chapter nine also provides compelling evidence to suggest that each system dimension (e.g. teacher, tablet, peer) influences action in either musical or technological ways. These influences will now be discussed.

10.2 Musical and technological systemic influence

The research has contributed new understandings about how tablet computers, teachers, peers and students actually influence CMD. Chapter nine explains how these local system dimensions inject musical and technological knowledge into the System. Critically, the nature of this knowledge changes in quantity and nature through time, according to situated needs or goals. This will be more deeply understood during a discussion on systemic transiency at 10.4.1.

Student participants acquire, adapt or dispose of techno-musical knowledge in order to achieve their creative goals. Of course, 4.1 identifies that perceiving knowledge in this way, that is, as a singular, transferable commodity, is highly questionable. Knowledge is actually concepted upon constructivist beliefs in this research (see 2.2.1/2.3.2). Knowledge here is defined as a situated way of knowing: meanings are constructed during action in consequence to situational cultural, local and personal forces. It remains controversial then, that very different 'types' of knowledge are clearly identifiable in the case reports and subsequent analysis. For example, the researcher develops a teacher role (forwarding pedagogical knowledge), a role as musical collaborator (forwarding musical knowledge) and a role as technological guide, advisor and trouble-shooter (forwarding technological knowledge). In essence therefore, findings substantiate the argument proposed at chapter four. That is, when classroom music teachers intervene during students' musical development, they must forward musical knowledge (e.g. knowing about musical genres or how to perform a chord progression) and technological knowledge (e.g. knowing how to use the computer software to record and save music).

A significant finding to emerge from chapter nine is that musical and technological knowledge are in no way privileged to the music teacher. As parts 10.2 and 10.3 will now show, any system dimension can in fact forward musical and technological knowledge. Therein, the music teacher is metaphorically repositioned in their own classroom. Parts 10.2.1 and 10.2.2 will now discuss how the whole systemic unit where CMD takes place, forwards musical and technological knowledge.

10.2.1 The system is musical

This research evidences how the music teacher shares aspects of music history, establishes known musical conventions (such as symbols for flat notes) and applies appropriate musical terminology (e.g. metronome) during CMD. Additionally, the teacher's worksheets, the GBIOS chords and GBIOS scales also transfer shareable knowledge about music. Swanwick (1994) defines musical knowledge at 4.1 as knowing *about* music and knowing *how* to music. The types of musical knowledge reviewed thus far concern themselves with knowing *about* music. That is factual propositional knowledge (shareable truth objects), which can be learnt verbally and abstractly (Swanwick, 1994). Comparatively little of this type of knowledge is recorded in the case reports. The broad analytical unit for this research project constitutes a practical project, that is where students create music during *action*. Unsurprisingly then, the majority of musical knowledge observed in the field is concerned with what Swanwick (1994) terms knowing *how* to music. This is knowledge '…which is acquired and associated directly through musical experience' (Swanwick, 1994, p.27). Dorfman (2013) adds that this type of knowledge requires students to address musical goals via musical rehearsal and performance, for example.

In the research communities, musical knowledge is forwarded by the student, their peer, the tablet workstation and their music teacher during action. In terms of the student, they repurpose their personal knowledge which concerns itself with *how* dance music works; *how to* play their own musical instrument, *how to* play an electronic drum kit, *how to* compose dubstep and *how to* apply the performance skills they learnt in the music classroom. This 'how to' musical knowledge is applied when students develop loop-based dubstep, polyrhythmic drum parts, strict-time rhythmic patterns and melodies for acoustic instruments.

Musical knowledge is also forwarded by the tablet. Alongside its 'knowing about' musical knowledge, it passively teaches students *how to* music. For instance, students develop a Rehearse-Record-Listen strategy and this demands musical rehearsal and performance skills. The necessity to develop this strategy ensures that students learn *how to* make music. Equally influential is the GBIOS track-view interface which passively teaches students how to construct their music in ways comparable to the practices of professional songwriters and composers.

Despite the ways in which students, peers and the tablet forward musical knowledge, it must be conceded that the teacher remains the prime champion of musical knowledge during systemic CMD. The music teacher is an insurance policy: a system dimension which prevents technological knowledge from dominating creative action. To redress the balance of musical and technological knowledge, the teacher actively shows students 'how to' perform a range of musical parts, improvise, develop a drum beat, develop rhythms and create a rap. As Philpott (2007a) argues, the music teacher is a 'real life composer'. They are someone who jams with students or even composes music for them (Philpott, 2007a). This active application of musical knowledge aligns with Small's (1988) belief that music is not a 'thing' but an emergent process which necessitates taking part in a musical performance. Such a phenomenon is what Barrett (1996) describes as an immersive environment: some situation which develops understandings and skills for controlling the materials of music. Hugill (2012) campaigns at 4.1 that these musical skills and understandings simultaneously demand a technological understanding: be that of an acoustic instrument or digital technology. Part 10.2.2 will now discuss how CMD systems forward this technological knowledge.

10.2.2 The system is technological

This research study contributes deeper understandings about how CMD Activity systems are technologically influential. The Activity System Framework (ASF) (chapter five) is technologically influential because alongside musical knowledge, the tablet, teacher and peer demand that the student can sufficiently operate GBIOS, the EK, microphone and/or their own instrument to achieve their creative musical goal. Here, 10.2.2 will discuss how the ASF forwards the technological knowledge (TK) necessary to operate digital technology: the tablet workstation. Dorfman (2013) defines TK as techniques within software, file management and hardware connectively. Hugill (2012) is more specific with his concept of 'technical skill'. He defines this as recording, producing, processing and manipulating music using digital technologies (Hugill, 2012). These definitions are individualistic in that they assume TK lies within the composer's head. Critically however, cross-case analysis for this research study indicates that TK is actually a systemic phenomenon. For instance, the tablet mediates on-screen behaviours which ensure students can listen to, visualise and edit their music. In consequence of this tablet influence, students develop compositional strategies which heavily rely upon TK. For instance, students adapt bundled LiveLoop content by editing and triggering loops at specific points in their composition. They also develop Record-Edit-Loop strategies. REL circumvents the necessity for students to deploy high levels of musical knowledge. TK is then applied in track-view to isolate the best version of a creative idea or to edit out any mistakes. These research findings indicate that composing music with tablet computers introduces students to those contemporary composing practices more reliant upon technological knowledge. This new understanding helps dispel Chrysostomou's (2017b) concern that musical education remains rooted in traditional beliefs and values: manifested in the reading and writing of Western notation. At the same time, Jennings (2007) makes the argument that music teachers become frustrated when students leave behind their musically motivated interactions to 'play around' with superficial aspects of digital interfaces.

Despite reservations concerning the superficial nature of TK based CMD, the teacher too makes TK available in the system. Just as Kennewell (2001) suggests at 4.1.2, the music teacher 'orchestrates the supporting features' of GBIOS by explaining and demonstrating the tools and information sources available to students. This is acutely necessary because GBIOS does not make 'how to' technological knowledge available to students. Consequently, students welcome the music teacher's verbal and gestural introduction to the GBIOS app. Additionally, the teacher technologically supports in real time (e.g. directing students how to record, loop, crop or listen to their work). These findings align with the Minott (2015) study because in that study, a teacher explained to students how to insert and edit sounds in Mixcraft software.

This research study also evidences that the student partner forwards technological knowledge. This typically occurs when student partners operate the tablet computer *for* their partner. It is common for student pairs to assign themselves either a primarily musical, or technological role. Typically, student partners setup the tablet for recordings and then take charge, ultimately editing their partner's musical material.

A discussion from 10.2 has proposed that *musical and technological knowledge are not an individualistic, human privilege but a system-wide influence* which help to define creative musical products. This is a significant research finding because it is *the whole system*, and not just the music teacher, who applies technology to music and music to technology (see Dorfman, 2013).

10.1 and 10.2 have now discussed the cultural, personal, local, musical and technological influence of the tablet workstation, teacher, student partner and student. These same dimensions are also found to condition CMD in pedagogical ways. Once again, pedagogical knowledge (PK) is traditionally considered as a domain privileged to the teacher. Contrary to this understanding, 10.3 will now discuss how entire CMD systems influence action in pedagogically volatile ways.

10.3 Systemic pedagogical conditioning of CMD

For the purposes of this discussion, it is now accepted that System dimensions are personally, locally and culturally situated and that they influence CMD in musical and technological ways. This discussion will now refer to publications and findings from this research project to argue that these same system dimensions also pedagogically condition action in important ways.

Koehler and Mishra explain that PK can refer to '…deep knowledge about the processes and practices or methods of teaching and learning…[the] overall educational purposes, values, and aims' (2009, p.64). Therefore, it might be assumed that PK refers to the *teacher's* understanding of developmental theories of learning (e.g. cognitive/social) and how these apply to students in their classroom (Koehler and Mishra, 2009). However, creative idea charts and cross-case analysis have evidenced how every system dimension can simultaneously, pedagogically condition action. This produces systemic behaviour which Marshall (2001) aptly describes as a pedagogical mashup. Kirkman's (2016) 'conceptual spaces of learning' closely align with this new understanding. His spaces framework accepts that interactions between student, teacher, peer and digital technology can progress thorough institutional, open and shared spaces. Each of these spaces is defined by a pedagogical approach. The pedagogical approaches are respectively defined as dialectical, emancipatory and dialogical in nature. These approaches will be referenced at parts 10.3.1, 10.3.2 and 10.3.3 but a more detailed theoretical review can be found at 4.2. How CMD systems pedagogically condition action in dialectical, emancipatory and dialogical ways will now be discussed.

10.3.1 The system is dialectical

This project develops understanding about how a music teacher provides instructional guidance to students, especially in more regulated settings. For instance, for John and Botan's first creative idea (C2), the teacher uses a worksheet to establish a constraint framework. When the students adopt that content, the teacher dialectically instructs the notes of the scale calling 'yes/no' for each note. For the pair's second idea, the teacher takes the opportunity to dialectically instruct them about how the GBIOS track-view works. Similarly, Owen and Kasar's third idea (C2) is reliant upon dialectical teaching during its early stages. As for Kirkman (2016) then, when students begin musicking (Small, 1988), they first encounter 'institutional space': this is where students come into contact with constraint frameworks (e.g. the verbal scaffolding/structures; musical instruments; worksheets and/or digital technology).

Students also experience their music teacher intervening just-in-time (e.g. pointing to notes on the EK, differentiating music and maintaining the beat). Evidently, their music teacher is exercising what Kathard et al. (2015) term 'command and control' because the students are 'inanimate' rather than fully 'interactive' beings. To reference Freire's (2003) description of dialectic teaching: the teacher 'talks and the students listen' because 'teacher knows best'. This dialectic instruction is especially apparent when teacher feedback is provided. In more regulated settings (C2), written feedback and targets are issued and these instruct on notes, rhythms, timing and technological configurations, for example.

Perhaps unsurprisingly, dialectic instruction is especially prevalent in the target-driven, regulated setting (C2). This said, 9.2.2.1.1 reports that in the less regulated setting (C1), research students could lack motivation. Consequently, the teacher behaves dialectically to keep students on-task (e.g. by managing behaviour, requiring student goal-setting and the recording of musical products within a given time frame).

It is suggested at part 2.3.1 that students can also direct each other's learning in dialectical ways. A range of authors agree that a classroom student can demonstrate a rhythm or chord, for example, for the benefit of another student (Green, 2008; Roschelle et al., 2000; Thompson, 2012). While this was not a commonly observed behaviour in the research communities, it did happen. For instance, in the less regulated community (C1), the peer dominates CMD and dialectically instructs their partner. Meanwhile, in the regulated setting, peers issue corrective feedback to students in ways comparable to teacher behaviour.

As Ward (2009) remarks at 2.3.1, students are aware that 'messing around' wastes time and leads to rushed work. Applying this knowledge, students composing in the less-regulated setting self-instruct their learning; a behaviour which imitates dialectic teacher interventions. All students develop their own trial and error strategies and most develop a resolute determination to learn challenging musical content, such as chords. They impose strategies (constraint frameworks) upon themselves such as RRL; a strategy which closely imitates how a teacher would dialectically support CMD.

The tablet too, imposed frameworks upon students. 10.1.3 has already discussed how the tablet constrains musical action to enhance performance. Consequently, some students cannot achieve a creative musical outcome which genuinely reflects who they are. This is particularly evident from John and Botan's idea charts (8.5.1). For John and Botan's second idea (a drum part), the pair are able to choose their drum timbres, complexity of rhythm pattern and dynamic but GBIOS insists they use a prescribed range of rhythmic patterns. In essence then, human compliance is mandatory to achieve an outcome using that interface. The dystopian way in which the tablet computer determines action in these instances underlines well its ability to condition action in dialectical ways.

It is now evident that pedagogical conditioning does not just emerge from the teacher but it is fundamentally multi-dimensional. Part 10.3.2 will now expand this argument by discussing how the same, multiple system dimensions conditioned creative musical action in emancipatory ways.

10.3.2 The system is emancipatory

This research study also provides understanding about how a range of system dimensions enable students to work in open space: that is, take ownership of their learning in personal ways, to help maximise their potential (Kirkman, 2016). When students begin to examine the potential of the classroom resources and tools according to their personal forces, they soon move into open space (Kirkman, 2016). This is an emancipatory approach which encourages '…students to build on their previous knowledge and experiences in such a way that they can directly interact with and shape new ideas for themselves' (Kirkman, 2016, p.166-167). Specifically, the community CMD systems provide opportunities for students to apply their informal learning practices, musical experience and interests (their personal forces) in a formal classroom setting. This is a significant finding which addresses Shaffer et al.'s (2005) concern that music education isn't doing enough to respond to students' unprecedented opportunities to create their own informal learning trajectories outside of classroom settings.

Once again, a range of system dimensions help to condition emancipatory behaviour. The tablet workstation helps students establish their learning trajectory. The analysis at 9.2.4.3 reveals that students situated in different settings invent their own ideas, many of which do not involve the tablet computer at all. For instance, the EK enables students to invent or perform their own musical content and record it into their composition. The option to use a microphone also ensures students can forward their personal instrumental and/or vocal experience. Thus, student action is emancipated because it connects with personal forces. Students also personally adapt a range of creative ideas which originate from the tablet or teacher. The emancipatory potential of GBIOS is epitomised by its pedagogical intellectual partnerships, which rely upon the student to explore the app without 'how-to' guidance and musical mistake correction (see 10.1.3.2 for more details).

The teacher also conditions CMD in emancipatory ways because together with tablet-situated opportunities for personal expression, the teacher connects CMD with students' personal forces (e.g. via interventions which help to achieve student goals). In the research communities, the music teacher only becomes an important emancipatory enabler when they remain partly detached from the action. Decision-making remains a student privilege and new ideas or feedback are only provided when welcomed. These behaviours are particularly evident from the idea charts (see 7.5 and 8.5). For instance, John and Botan's charts (C2) detail how the music teacher supported, praised and remained enthusiastic about risk-taking, experimentation, student decision-making and student goal development.

When a community upholds mandatory behavioural expectations for all students, this study has found that peers can be highly supportive of students in emancipatory ways. When finding ideas, these peers ask students questions such as, 'What are you going do?', for example. Additionally, peers thank students for *their* input and encourage that student to continue with *their* approach by issuing statements such as, 'That was really good!'. These supportive interactions further condition CMD systems in emancipatory ways.

Emancipatory teacher, tablet and peer behaviours are especially welcome here because they imitate the absence of evaluation, institutionalization and guidance which hallmarks informal music-making practices (see Jaffurs, 2004). This is a significant finding because such emancipatory conditioning addresses Chrysostomou's (2017a) desire to bring formal and informal settings closer so that they can benefit one another. Thus music education is better positioned *between* students' formal and informal musical worlds. A CMD system forwarding emancipatory approaches also aligns with 'tinkering' in digital studios (see 4.1.2). Hein (2017) argues that students must be 'free' in order to tinker in ways peculiar to them, so that they discover the vast musical possibilities available through digital technologies. In other words, contemporary composing practices are strongly reliant upon emancipatory behaviours, some of which have been evidenced here.

In addition to emancipatory and dialectic pedagogical approaches, this research study has also presented findings which define CMD systems as inherently dialogical in nature. Dialogical conditioning emerges in the research communities when different system dimensions work together during action to achieve a shared goal. The influence of dialogical conditioning upon creative musical action will now be discussed.

10.3.3 The system is dialogical

A cross-case analysis has suggested that it is not only humans who are tools for joint knowledge construction. While dialogical partnerships are evidenced between students, their teacher and peers, the tablet computer is also found to be an influential dialogical collaborator. This is a controversial finding. It is common to associate dialogical interaction with talk, defined at 4.2 as a tool for sharing thoughts and jointly constructing knowledge (see Mercer et al., 1999). Rather than talk, it is surely better to think in terms of 'dialogical interaction' because this conception helps widen our discussion beyond that of talk alone. As Wegerif (2011) has explained, dialogical interaction is concerned with that moment when different perspectives are held together around a dialogic gap. This gap closes, Kirkman (2016) argues, when these different perspectives move closer together during dialogue (see 4.2). This study provides evidence that such a dialogue can emerge not only between humans but also between human(s) and the material world. There are two instances to reference here. The first is presented at 9.2.1.3. The tablet presents ready-made rhythmic patterns (in ways comparable to teacher or peer musical interventions) and the student imposes their creative judgement to choose rhythmic patterns. This choice necessitates related micro choices which concern the quantity, complexity and individual dynamic of the desired pattern. In a different situation, automated content provided by the tablet (e.g. ready-made drum parts) prompts students to add their own chords. At this precise moment, the goal becomes *shared* between tablet and student. *When the student and tablet come together in this way, different distributed intelligences (sets of meanings) move closer together across a dialogical gap until they become one.* This process is ultimately embodied in a singular creative product. Research findings here therefore strongly align with Kirkman (2016), who campaigns that ‘shared space’ and its definition of dialogue must be expanded to include modes of communication other than talk. His research references the importance of the audio and visual modes in dialogical settings, for example (Kirkman, 2016). These are modes which help to define the techno-human collaborations reported in this study. Additionally, the tablet computer’s performance and pedagogical intellectual partnerships (as discussed at 10.1.3.1) represent further substantive evidence that the tablet can develop a role as powerful dialogical partner.

This study has demonstrated how music teachers can also work alongside students to develop a dialogue, one which contains those verbal, gestural, visual and audio modes necessary to achieve a shared goal. In the research communities, these dialogues emerge when the music teacher responds to student goals by inventing musical fragments. These fragments are designed specifically to contribute to that goal’s completion. Once a goal between student and teacher becomes shared in this way, it could be dialogically achieved via just-in-time support, for example (see 9.2.2.2.2 for more details about these behaviours). Although some just-in-time support has been identified as dialectic, the teacher also collaborates with student aims and behaviours in mind. Essentially, musical and technological knowledge is dialogically contributed so that a shared goal can be achieved. Dialogical teaching also provides feedback and new ideas which closely align with the students’ ways of working. These findings concur with Webb (2005) who calls for more emphasis on joint planning. Webb (2005) argues that both students and teachers should employ pedagogical reasoning so that goals can be jointly forged. Dorfman (2013) also asserts that teachers should not be perceived as an authoritarian instructor ‘who knows everything’ but as someone who is fallible, willing to learn and supportive of their students. Especially in this study’s less regulated setting (C1), the teacher emerges as a collaborative, supportive resource, as opposed to an instructor. In the more regulated setting (C2), the music teacher musically collaborates with students to ensure that both *institutional* and *personal* goals are achievable.

Perhaps the most obvious candidate for dialogic collaboration is the peer. After all, they are observed alternatively or simultaneously collaborating in musical ways via the tablet screen or the EK. Ginocchio (2003) supports this finding, suggesting that students can take turns inserting notes or rhythms into a melody. Critically, peers also combine their personal forces with the student’s personal forces to create a shared goal, one which embodies a new level of shared meaning. These goals reflect a shared enthusiasm for rap, or a particular artist, for example. Perhaps the most influential dialogic behaviour takes place when students agree to divide labour into different musical and/or technological roles. These behaviours are especially evident in John and Botan's idea charts (8.5.1). Botan diligently operated the tablet so that his partner John could perfect aspects of the musical performance on the EK.

Evidently, student peers work dialogically, that is right alongside each other to achieve creative musical products. As is the case for the tablet and teacher dimensions, students peers achieve this largely without talk. Shared meanings typically emerge through gesture, screen visuals and audio. This finding redoubles the need to understand dialogical interaction as something not exclusively based around the linguistic mode (talk).

Student peers also support and comfort each other, which in turn dialogically conditions students to ensure that personal or shared goals can be met. As Roshelle et al. (2000) found, the corrective feedback which peers provide verbally helps students to correct mistakes and resolve misunderstandings.

In broader terms, student partners behaved in ways akin to Charissi and Rinta's (2014) account of collaborative human behaviour. Student peers developed negotiation skills (shared goals), empathy (supportive feedback) and exchanged musical ideas when using digital technology (Charissi and Rinta, 2014).

10.1, 10.2 and 10.3 have referenced a range of literature-based theoretical concepts and research findings to discuss how musical creativity in two Yorkshire secondary schools developed according to a situated range of personal, cultural and local forces. Each of these forces both pedagogically conditioned and influenced action in musical and technological ways. Part 10.4 will now introduce a framework to conceptualise how these variables collectively define a situated, emergent, systemic force for creative musical development.

10.4 A systemic framework to concept that tablet-mediated, creative musical development which emerged in two Yorkshire secondary schools

10.1, 10.2 and 10.3 have enhanced understanding about how CMD takes place when a culturally situated student, peer, teacher and tablet computer come together during action. This understanding represents a significant contribution to the music education paradigm because it explains how system dimensions influence CMD in musical, technological and pedagogical ways. Consequently, the Activity System Framework (ASF) proposed in chapter five will be expanded and adapted here, to explain in more detail how CMD emerged in two Yorkshire secondary schools.

The discussion from 10.1 supports Burnard and Haddon's (2015) belief that music emerges not just from the individual mind but also from those common perspectives shared between social relations and communities. A cursory glance at the tablet computer's intellectual partnerships and the diverse range of teacher or student interventions reported by this study is compelling evidence alone (see 10.1.3, 10.2 and 10.3).

Building this argument further, the cultural, personal and local differences between settings, as reported by the cross-case analysis (chapter nine), support Sherman's (1971) argument that the values of art are deeply relative ensuring that artistic culture is in a state of perpetual evolution. Accordingly, any individualist 'genius' conception of creativity must surely '…fall far short of grasping the potential multiplicity of musical creativity…' (Burnard, 2012b, p.36). This is because it is evident from this research study that creative ideas are the result of joint thinking, experimentation and collective struggles. These interactional behaviours adhere to Burnard and Haddon's (2015) description of *collaborative* creativity at 2.3 and Small's (1988) 'set of relationships' which define the musicking concept. Joint thinking in this way aligns with Kim and Baylor's (2006) belief that cognition is distributed in-between minds, social processes, physical artifacts and cultural influences. This results in an interdependent, inseparable and dynamic social cultural system of cognitions which mediate that community's discourse. Pea (2001) adds that the term 'intelligence' rather than 'cognition' is a more accurate conception, for it highlights his belief that intelligence can be stored in non-human artifacts. Building on this definition of intelligence, Salomon (2001b) rightly argues that to understand creativity we must examine the performances of whole systems comprising of individual, peers or cultural artifacts, for example. As for Pea (2001) then, any performance resulting from a system of creative musical action is *accomplished* rather than *possessed*. Creative performance is therefore achieved in ways Csikszentmihalyi (1997) proposes at 2.2.2 and 2.3.2. He rightly asserts that creative performance is achieved when a person's thoughts interact with a social-cultural context (Csikszentmihalyi, 1997). The social context revealed by 10.1, 10.2 and 10.3 is best described by Armstrong et al. (2005). Like me, these authors recognize that the CMD discussed in this chapter was situated in a local classroom culture, which was itself influenced by local, national and even global factors (local and cultural forces) (Armstrong et al., 2005). The teacher and students also brought with them a history of experience which related to their previous cultures and tool use (personal forces) (Armstrong et al., 2005, p.458).

In the two Yorkshire school communities, CMD was culturally, personally and locally conditioned in comparable ways. At the micro level, this conditioning manifested itself in musical, technological and pedagogical ways. An extension of the Activity System Framework (ASF) introduced at chapter five will now be presented. It visualizes how local, cultural and personal forces come together during action to develop creative musical products.

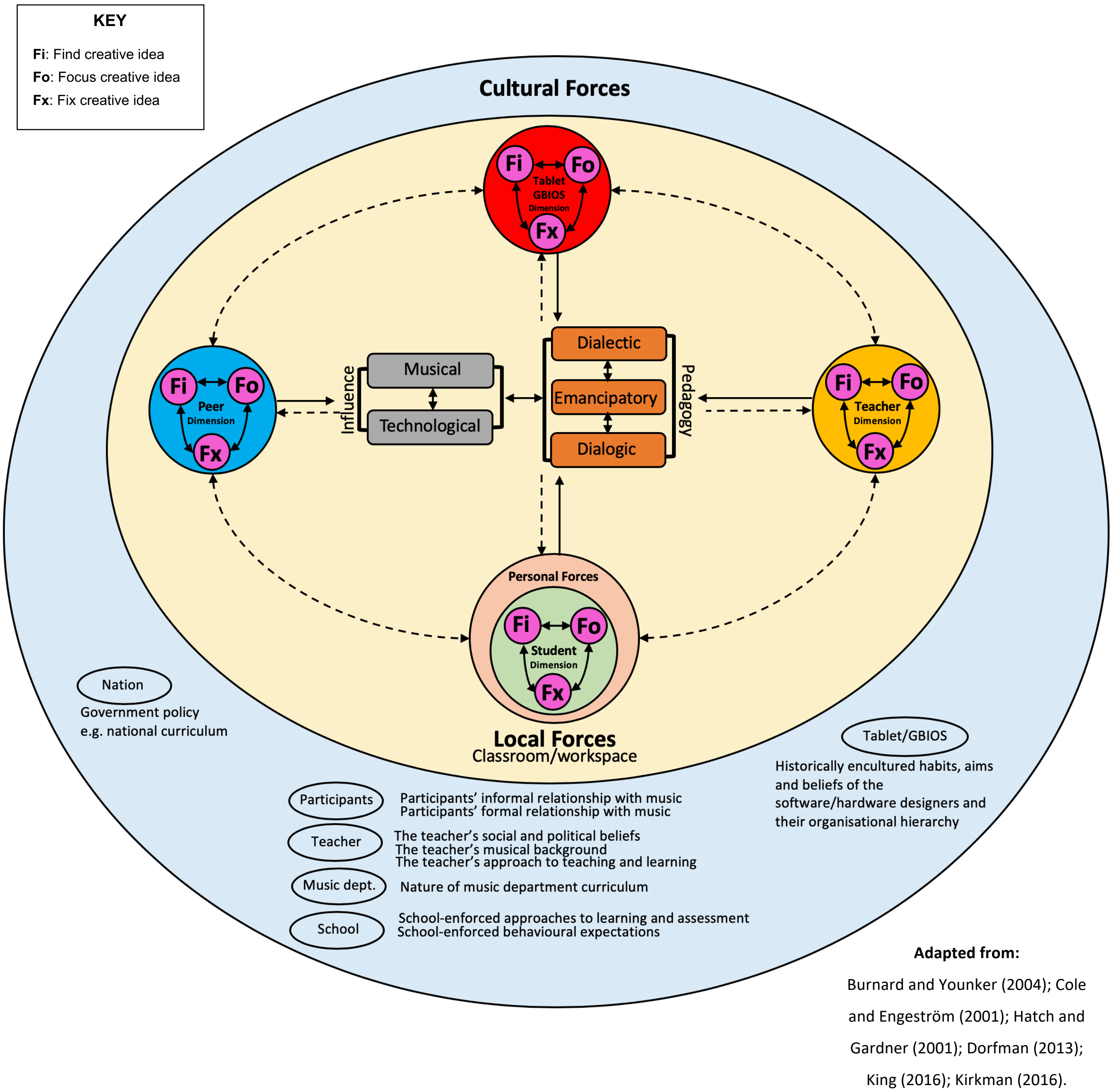


Figure 10-1 A systemic framework to conceptualise that tablet-mediated, creative musical development which took place in two Yorkshire secondary schools

The framework at Figure 10-1 visually conceptualizes the discussion at 10.1 which describes CMD as culturally, personally and locally conditioned (pale blue, tan and pale yellow concentric circles respectively) (Hatch and Gardner, 2001). It also visualizes the discussion at 10.2 to say that any local system dimension (i.e. the red, yellow, green and blue circles) influences CMD in musical and technological ways (grey boxes) (Dorfman, 2013; Mishra and Koehler, 2006; Swanwick, 1994). Finally, the framework accepts that any local system dimension can pedagogically condition CMD in dialectic, emancipatory or dialogical ways (orange boxes) (Kirkman, 2016). Of course, personal and local forces are themselves influenced by those cultural forces which collectively describe community conventions (see Lave and Wenger, 1991). Those cultural forces which are especially influential for participants, music teacher, school and the tablet computer are noted in the outer concentric ring.

10.4.1 Systemic transiency

The systemic framework at Figure 10-1 also promotes transiency through time and space. This is signposted by the Find (Fi), Focus (Fo) and Fix (Fx) pink circles within each system dimension. These terms are adapted from Burnard and Younker's (2004) compositional pathways model. They are used as a sensitizing analytical framework to structure chapter nine. Chapter nine revealed that system dimensions (i.e. the red, yellow, green and blue circles) can behave differently at different points in time and in different community situations. For instance, when students begin finding creative ideas (find), the dimensions typically behave very differently to when creative ideas are developed (focused) and recorded and/or edited (fixed). Critically, the diverse range of pathways evident at 9.2.5.1.4 indicates that Activity Systems are fundamentally fluid and malleable. This is because, as Lave and Wenger (1991) argue, social conventions (embodied by the pathways) emerge according to community need and goal, which are situated in time and space. For instance, when students transit from finding (divergent thinking) to fixing (convergent thinking) ideas, solutions are developed to meet the goal because system dimensions adapt their influence over time (Chen, 2012).

Students' compositional pathways demonstrate Engeström and Miettinen's (1999) requirement to place continuity and change into a symbiotic relationship. Such a relationship explains how CMD transits from a necessity to work with existing cultural materials (internalization) to transforming those materials into creative products in ways previously unforeseen (externalization) (Engeström and Miettinen, 1999). Therefore, the framework at Figure 10.1 '…undergoes functional development in the course of its realization' (Tikhomirov, 1999, p.350). This was evidenced by the cross-case analysis undertaken to answer RQ5 (9.2.5). Part 9.2.5.1.1 used the visual charts to evidence how the blue, red, yellow and green system dimensions behave transiently within the life-cycle of individual creative ideas. For instance, the teacher-dimension (yellow) might dominate one moment and the tablet computer (red) or student (green), might dominate the next.

10.2 also evidenced the flexible nature of musical and technological knowledge: it is a continuum which changes through time and between communities. Further still, 9.2.5.1.3 evidenced how pedagogical approach is mashed up (Marshall, 2001). Namely, how any one creative idea is dependent upon emergent combinations of pedagogical conditioning, which appears to change according to real-time need.

This study's evidence of systemic transiency supports Ezzy's (2002) claims about meanings. Namely, that meanings are constantly changing and produced and reproduced in situations with different nuances and significances which are dependent upon the nature of that setting (Ezzy, 2002). As Davydov (1999) reminds us, these meanings emerge in consequence to the means, processes and goals used to shape the final musical product.

Now that a revised framework has been introduced and discussed to more completely understand that CMD which emerged in two Yorkshire communities, one final issue must be discussed. This issue is concerned the nature of creativity itself and the fallacy of enhancement and constraint.

10.5 Creativity defined as constraint-based action: creative opportunity in constraint-based frameworks

Figure 10-1 is a concentric framework which describes how local, cultural and personal forces can constrain creative musical action. It brings together both socially-situated objects and human behaviour in ways which, in the words of Lapidaki (2007), define the creative process as a kind of personal and social tension. This tension is a hallmark of systemic Activity. Specifically, the way in which systems (such as the one visualised at 10-1) transcend the dualism of subjective and objective realities to concede that people relate to their world both in absolute objective terms and subjectively, through mental emotions (Engeström and Miettinen, 1999; Paynter, 1989). This is arguably how Engeström and Miettinen's (1999) process of externalisation (creating new products) works. Human subjective reality (i.e. personal forces) collide with objective societal circumstances (i.e. culturally conditioned local forces) to create new, in this case musical, products (Engeström and Miettinen, 1999, p.3; Ezzy, 2002; Kumpulainen, 2002). This pluralistic approach to creative musical action argues for what Robson (2011) describes as a *reciprocal* relationship between the natural and social worlds. Accepting this pragmatic description of creativity, we can empirically align with Vaggione, who argues that there '…is no musical process without representational systems at work' (2001, p.60).

Defining creativity as constraint-based action is a controversial idea because to be explicit about the integral role of constraint in action, is to further dispel Burnard's (2012b) romantic accounts of the musical genius. In the first instance therefore, this research study fundamentally accepts that local, personal and culturally situated constraints define creative behaviour. Secondly, it is accepted that these constraints can positively influence CMD. For instance, Savage (2017) ravages the musical potential of tablet computers at 1.6. He claims that the devices are over reliant on auto-accompaniments, cut and paste and the necessity to sample existing content (Savage, 2017). Kardos (2012) agrees, claiming that quick digital shortcuts can threaten traditional musical knowledge. Findings at 9.2.1.3 question these perspectives, because it is found that human and tablet typically come together in situated, pragmatic ways. For instance, participants from this study selected content, developed strategies and made a host of creative and musical judgements, even though the tablet computer tackled a sizable portion of what Salomon (1993) terms the cognitive burden. For instance, participants independently created their own ideas to accompany automated content. This student behaviour supports Paisley and Cassidy's (2016) finding that game-based, simulated rock-band experiences can develop a confidence and desire to engage with more traditional music-making practices.

The role of the teacher was also one which carefully manoeuvred between intervention and awarding students autonomy. Regulated settings unsurprisingly expected copious teacher interventions during creative music-making. Simultaneously, the teacher ensured students retained a say in how much intervention they received and ultimately, there was an aim to assign creative decision-making to them. When students developed goals with student partners a 'balance' or shared understanding needed to be reached. This new understanding constrained student action because some options were ruled out. At the same time, this human collaboration also provided creative opportunities, because new, shared meanings brought with them different understandings.

The interchangeable nature of opportunity and constraint and the framework presented at 10.4 suggest that creative action can be well described by Lave and Wenger's (1991) theory of social practice. This theory forwards the relational interdependency of agent and world, activity, meaning, cognition, learning and knowing (Lave and Wenger, 1991). Such interdependency defines the boxes and circles in the framework (Figure 10-1) as porous entities. They symbiotically interact. Consider musical and technological influence: Dorfman (2013) concedes that purity of either musical or technological content is rare. This notion of interconnectivity is best recognised by Koehler and Mishra's (2009) TPACK concept, which describes how musical (content), technological and pedagogical knowledge have a deep relationship. Critically, systemic interdependency is not biased towards either social or cognitive theories of learning but rather, it perceives action as mediated. That is, as '…an irreducible tension between an individual or individuals (i.e. intramental or intermental functioning) on the one hand and mediational means on the other' (Wertsch and Rupert, 1993, p.230).

Music teachers must surely sympathise with Louth's (2013) concern that high levels of systemic mediation ensure student agency becomes lost during digitally-mediated CMD. These concerns are carried forward because findings here have evidenced how tablet computers constrain CMD to enhance systemic performance. Perhaps with good reason then, music teachers might follow Williams' (2017) advice and resist change in their classroom.

To subdue those concerns about mediated performance-enhancement, this research study has evidenced in some detail how Activity Systems counterbalance imposed digital constraints. They make available musical, technological and pedagogically loaded interventions from the music teacher, student partner and student. Consequently, creative musical Activity Systems are powerful forces which situationally adjust dimensional, muso-techno and pedagogical influences to ensure that classroom action is conducive for CMD. This study has shown how this CMD can be understood by tracking students' compositional pathways over time. In doing this, this study has arrived at new understandings concerning how students transit between finding, focussing and fixing their creative ideas in a systemic context (Burnard and Younker, 2004). Consequently, it is proposed with some empirical grounding that music teachers and researchers might be less sceptical about the role of constraint in classroom-situated, creative musical action. After all, a '…person cannot be creative in a domain to which he or she is not exposed' (Csikszentmihalyi, 1997, p.29).

This chapter has undertaken a theoretically-informed discussion of the cross-case analysis presented at chapter nine. That chapter analysed the case reports (as presented as chapters seven and eight) to fully understand the broad range of digitally-mediated, creative behaviours which emerged within and between two Yorkshire-based school communities. This chapter’s theoretically-informed discussion of those findings has prompted the chapter five ASF to be significantly extended and re-presented here as a new framework. This new framework attempts to account for the ways in which community situated systems of Activity make available the musical, technological and pedagogical knowledge necessary for classroom students to develop creative musical outcomes which are meaningful to them. This framework requires further application to better assess its transferable value. That said, it has already *informed new understandings about how human, digital, material and conceptual local, cultural and personal forces musically, technologically and pedagogically influence creative musical development*. The framework therefore represents a potentially significant contribution to the music education and creativity research paradigms.

To conclude this thesis, chapter eleven will now review the research rationale, methodological design, cross-case analysis and discussion to concisely present the broader range contributions, limitations and recommendations of this research project.

Chapter 11:
Research contribution, limitations and recommendations

This research study has set out to provide deeper understandings about how young people with diverse musical backgrounds, situated in different secondary school communities, make use of a tablet workstation to compose music. This aim was driven by a rationale which argued that music teachers should search for new ways to overcome outdated classroom technologies, incomplete pedagogical understandings and that emergent disconnect between music classrooms and students' own relationships with music. These relationships are defined by students' informal music-making practices. Chapter one found these practices to be influenced and in some cases defined by mobile phones and/or tablet technologies.

This chapter will reflect upon the previous chapters to summarise those new areas of understanding to which this research has contributed. Ultimately ten research contributions will collectively suggest ways that music teachers and researchers can begin to combat the aforementioned challenges currently facing music education. This study's research contributions reveal deeper understandings about how systems of tablet-mediated creative musical action:

- better connect the music classroom with students' informal music-making practices (11.1.1)
- champion inclusive musicking (11.1.2)
- are shaped by their situated context (i.e. community conventions) (11.1.3)
- compensate for the tablet computer's deficiencies (11.1.4)
- render the student's or teacher's technological, musical and pedagogical knowledge no more, or less important, than that knowledge forwarded by other system dimensions (11.1.5)
- mash-up disparate pedagogical approaches through time to provide instructive, emancipatory and dialogical opportunities for creative music development (11.1.6)

In addition to this direct understanding about how systems of digitally-mediated creative musical development emerge in different formal settings, this project has also furnished researchers and music teachers with additional tools and understandings too. This research has contributed:

- a new systemic framework, which subject to further testing and adaptation, is proposed as a useful conceptual tool for researching and facilitating digitally-mediated creative musical development in a broader range of classroom settings (11.1.7)
- a visual charting method to map out systemic creative musical development as it emerges overtime (11.1.8)
- a qualitative methodology to capture and understand the situated, transient and multimodal nature of creative musical development (11.1.9)
- A deeper understanding of creativity itself, one which emphasises the seminal role of cultural, local and personal constraints in creative musical action (11.1.10)

It is anticipated that any one of these contributions will form the basis of a journal article or a second post-doctoral research cycle to enhance research impact. Accepting the quantity and breadth of the contributions, it is also hoped that research colleagues will respond to the research contributions and undertake further research cycles. These will hopefully question or substantiate the understandings presented here. Finally, music teachers (and/or researchers) might concept their own classroom as per the new systemic framework (see Chapter ten) in order to question their own pedagogical approach to digitally-mediated creative musical development. Music teachers and researchers might also trial and/or develop the methodology presented in chapter six to undertake research in classrooms, as part of their professional development, for example.

The ten research contributions summarised in this concluding chapter have been already explored in some depth (see chapters 6-10). This said, the key contributions from this research are brought together here for the first time to propose research impact (11.1). Once these contributions have been summarised, 11.2 will comment upon research limitations (i.e. potential deficiencies in the selected theoretical, methodological and analytical processes). Finally, 11.3 will make recommendations for research going forward.

11.1 Research contribution

This research project has built upon existing theory and new research data to iteratively present and discuss six new understandings about how creative musical processes really work when young composers make music with a tablet workstation, as situated in their classroom. It has also yielded four additional understandings. These are especially useful for music teachers who wish to consider alternative approaches for musical development in their classroom. These four contributions are also useful for those music education researchers interested in capturing and understanding the situated, transient and multimodal nature of creative musical development. To conclude this thesis, these ten research contributions will now be presented and summarised as a way to measure the impact of this research project.

11.1.1 Formal and informal music-making practices are merged during classroom-situated, tablet-mediated CMD

Seminal to the research rationale was the intention to better connect the music classroom with students' informal music-making practices. Just like Burnard (2007a), I was preoccupied with how to 'close the gap' between technology use at home and school. This research project has yielded three primary ways which systemic CMD closed that gap.

Firstly, CMD systems (especially the tablet and teacher dimensions) picked up on students' personal forces and purposed them for action in a formal, classroom setting. Consequently, student composers were able to impose something of their own musical interests and compositional beliefs upon the system. This is a very different scenario to those played out in teacher-centred classrooms, where the student typically has little or no influence upon learning trajectory.

Secondly, some systemic pedagogical approaches connected classroom-based CMD with informal music-making practices. For instance, the dialogical pedagogical approach ensured that all human and material objects worked together in a natural way. Here, the motivation was largely intrinsic. That is, it was not extrinsically imposed by a matriarchal figure (as definitive for formal settings). Additionally, system dimensions (especially the tablet, teacher and peer dimensions) provided emancipating opportunities for student composers. This emancipatory conditioning encouraged students' intrinsic motivation. Formal evaluations or instructive direction were not required in these instances: Jaffurs (2004) argues that an absence of formalised instruction and feedback defines informal music-making practices.

Thirdly, cross-case analysis and discussion has revealed that the tablet computer's mediation of on-screen behaviour ensured that students could visualise, construct, listen to and edit their music in ways comparable with contemporary, digital technological composing practices. Student Mia constructed Dubstep music on-screen in ways comparable to her idol, for example.

Music lessons are still reliant upon large amounts of teacher talk (see Ofsted, 2011). This study has provided an account of classroom practice which minimises teacher talk 'about' music. The practices forwarded here invite students to *participate* in a musical setting which authentically recognises and develops their personally valued musical skills and knowledge.

11.1.2 Classroom-situated, tablet-mediated CMD champions inclusive musicking

As Mills (2005) makes clear, one of the great tragedies of school music education is that parents and students alike continue to believe they are 'not musical'. Fortunately, this study has found that the tablet computer and GBIOS can enhance student musical performance via an intellectual partnership. This mediational force ensures that all classroom students are equally included and have the opportunity to experience active music-making. For example, the tablet provided sounds; tools to assemble musical fragments; scales; notes; chords; ready-made creative ideas and dynamically linked all of these representations together to ensure that students achieved their creative musical goal.

There were some venerable examples of absolutist performance-enhancing partnerships presented in the case reports. Jackie and Mia's Loop-based phase evidenced how it is possible to create a professional sounding, complete Dubstep work in ten minutes (see 7.5.1.2). Scant musical knowledge was required from Jackie and Mia because musical content was presented to them preloaded into loops, which simply required triggering to develop textures and a structure. Community two members John and Botan quickly and seemingly effortlessly created a professional sounding drum track by dragging drum icons around a matrix interface (see 8.5.1.2). Neither student were competent drummers and yet they were able to vary rhythmic complexity and dynamics of the individual drum parts on-screen. As Comber et al. (1993) remark therefore, regardless of physical or mental ability, gender, ethnicity or cultural origin, student composers were able to develop performance partnerships with the tablet computer to achieve powerful musical outcomes. Please see 10.1.3.1 for an complete account of the performance-based intellectual partnerships which emerged through and around the tablet computer.

In addition to enhancing musical performance, the tablet device carried out lower-order tasks to reduce a student composer's cognitive burden (e.g. by providing a track-view, recording function, virtual instruments, editing tools and a range of timbres to choose from).

Consequently, students' mental faculties remained available for them to develop increasingly original ideas. These pedagogical partnerships necessitated students to impose their own cognitive strategy and musical/technological knowledge to work the tablet workstation. For instance, the Rehearse-Record-Listen strategy required student composers to contribute musical skills and knowledge *around* the tablet. In community one, Piper used her own musical knowledge of guitar playing to create a melodic hook outside of the GBIOS app; she used her own acoustic guitar. Here, the tablet was used as a technological (and not musical aid): merely as a recording device. Meanwhile, in community two, Owen created his own rap rhythms and lyrics, and Jenny recorded a melody using her own flute. Every student pair also made at least some use of the external keyboard (rather than the tablet) to find their creative ideas. The latter required musical knowledge of the piano, which was either provided by themselves and/or by me as music teacher. In these cases, the student acquired much of the cognitive burden to generate the musical knowledge necessary to achieve their goal. They were also free to impose their own musical interests upon the tablet during these pedagogical intellectual partnerships. Please see 10.1.3.2 for an complete account of the pedagogical intellectual partnerships which emerged through and around the tablet computer.

In addition to the tablet computer, other local forces enhanced musical performance to champion musical inclusion. Moment by moment, the music teacher musically and technologically supported CMD and provided feedback. The peer also helped to find ideas, develop shared goals, develop musical content and/or operate the tablet computer for the student. Agreeing with Hatch and Gardner (2001) therefore, student composers depended upon a wide variety of tools, people and other resources in order to inclusively participate in creative musical Activity.

11.1.3 Classroom musicking is the product of community convention

The decision to research two different classroom settings has defined the understandings developed throughout this project. The different curriculums, views of knowledge, behavioural and pedagogical characteristics of each Yorkshire secondary school were found to significantly explain creative musical behaviour. These cultural forces helped this study interpret situated meanings about the musical, technological and pedagogical behaviour of the music teacher, student and student partner at the local and personal level. This is because student behaviour, student expectations and overall systemic pedagogical approaches closely aligned with that community's cultural conditions and values. Unsurprisingly, situated cultural forces also manifested themselves in systemic products: the musical outcomes. For instance, those compositional products which emerged from the more regulated setting strongly embodied community-imposed constraint frameworks: most notably a blues-based scheme of work.

Observing, interviewing and participating in just one community could have ensured that claims of transferability were over-optimistic. Further, the finding that community conventions directly influence musical products reminds us to be cognisant of these powerful forces when researching or facilitating creative musical development.

11.1.4 CMD Systems compensate for the tablet computer's deficiencies

Despite the finding that tablet computers are inclusive musicking devices, this research has equally identified device deficiencies, which music teachers would do well to remain vigilant about. There were moments when the device appeared to, in Norman's (1998) words 'depersonalise the job'. Student composers became a servant of the system and could not adequately control what was happening (Norman, 1998). For example, experienced instrumentalists found it impossible to replicate their acoustic playing techniques beyond simplistic hitting or strumming.

This research study has revealed that systemic creative musical action pushed back those suppressive, dystopian and musically threatening characteristics of the tablet computer. In particular, when the tablet enticed students away from creating their own music, the music teacher or student partner typically intervened in the same moment. The music teacher also musically and technologically supported CMD through and around the tablet workstation in real-time (e.g. via modelling) and provided supportive and corrective feedback to students. This compensated for the tablet workstation's lack of technological guidance or corrective feedback, for example. Additionally, student peers imitated teacher roles by providing supportive, corrective and negotiated feedback, for instance.

This research contribution makes clear that when researchers concept CMD as a singular, systemic analytical unit, they develop understanding about how system dimensions compensate for, or neutralise, 'weaker' dimensions. Further research is needed to ascertain whether dimensions other than the tablet computer can be compensated for. For instance, if a music teacher is weak at instigating CMD, it might be hypothesized that the tablet computer or student peer would compensate for that deficiency. This new understanding underlines the necessity to widen the unit of analysis beyond a single personal, local or cultural force (e.g. teacher role) to understand CMD.

11.1.5 The technological, musical and pedagogical knowledge necessary to create music emerges from a culturally, locally and personally conditioned system of action, not from an individual person or material resource

This research has contributed new evidence that creative musical products are community products and not creditable to any specific individual, genius or otherwise. This is a radical statement but one grounded in an evidence-based discussion which concluded that:

- musical knowledge is a systemic and not individualistic phenomenon
- technological knowledge is a systemic and not individualistic phenomenon
- pedagogy is manifested in all things and people, not just the music teacher
- collaborative behaviour is not specific to students: the teacher and even digital resources partner with students in dialogical ways.

Taking the first point, musical and technological knowledge were not privileged to the music teacher. In fact, every system dimension forwarded musical and technological knowledge. Therefore, the music teacher is metaphorically repositioned in their own classroom. Music teachers become no more, or less, important than the student, peer or tablet computer, for example. For instance, students were observed developing their ‘how to’ musical knowledge because they requested new ideas from others, suggested their own musical ideas and merged their musical ideas with their partner’s ideas. The tablet too, passively taught students ‘how to’ music. The device necessitated students develop a Rehearse-Record-Listen strategy and this demanded musical rehearsal skills of them.

Technological knowledge also emerged across CMD systems. The tablet mediated on-screen behaviours which ensured students could listen to, visualise, construct and edit their music. At the same time, the teacher explained and demonstrated the tablet’s software-based tools and information sources in ways comparable with Kennewell’s (2001) account. The student partner also operated the tablet computer *for* the student. Partners setup the tablet for recordings and then edited the student composer’s musical material on their behalf.

With reference to the third point on pedagogy: even in this domain, the music teacher cannot expect special privileges. This study has evidenced how pedagogy is in fact, everywhere: a systemic phenomenon. Research contribution six (11.1.6) will propose a revised conceptualisation of pedagogy for CMD. This will perceive the tablet, the student peer and the music teacher as equal pedagogical chameleons. For now, it is sufficient to say that different dimensions were found to simultaneously impose different pedagogical approaches and this created tension in the system. For example, Jackie and Mia resolutely worked in a purely emancipatory fashion but their teacher desired dialogical and even dialectic approaches: this led to acute pedagogical tension.

To emphasise the final bullet point, students were not the only dialogical (collaborative) forces at work. Findings evidenced how the music teacher ‘got down’ alongside students and became a genuine partner, authentically committed to a shared goal. Perhaps most surprisingly, digital resources were found to behave dialogically because they distributed intelligence between students and vice versa to achieve a musical outcome. It is imperative therefore that teachers and researchers take heed of Kirkman’s (2016) plea to expand definitions of dialogue to include those modes of communication other than talk (e.g. sonic, visual, and gestural modes).

Collectively, these findings begin to describe CMD as an *egalitarian process*, one where no knowledge domain is privileged to any one material or human dimension. This lack of hierarchy is also evident at research contribution six, which will now assert that all system dimensions influenced action in pedagogical ways.

11.1.6 Systemic pedagogy is mashed-up because different system dimensions simultaneously draw upon once irreconcilable pedagogical approaches to condition creative musical action

It might be easy to define the music teacher as an instructor and the student as someone who wants to behave independently. It might also be assumed that these roles remain steadfast during CMD. This research has overwhelmingly evidenced this not to be the case. For instance, students can actually instruct themselves (dialectic), teachers can forward student habits and desires (emancipatory) and teachers can even work alongside students as a musical and technological collaborator (dialogic).

Data tables attached to visual charts have chronicled the speech and other multimodal behaviours which took place during systemic CMD. During data analysis, pedagogical labels were loosely attached to these data fragments. These indicated that pedagogical approach is immensely fluid during creative musical action. As Kirkman (2016) rightly suggests, those more dialectical teacher behaviours typically dominate at the outset. Soon however, these behaviours form tensions with the student's personal (emancipatory) ambitions. Consequently, the teacher works with the students and the students work with the teacher to accomplish a shared musical goal (dialogical working). While this 'classic' description of a creative idea's prevailing pedagogy was well evidenced in the data, pedagogy was also found to be unpredictable, mashed-up and situated. In reality, any system dimension had the potential to express techno-musical knowledge through any pedagogical approach. For instance, while the peer was (perhaps unsurprisingly) a musical and technological dialogical collaborator, they could also instruct students by demonstrating a rhythm or chord, for example.

The tablet was also a pedagogical chameleon. The device constrained action in dialectical ways to enhance the system's musical performance, emancipated students to develop their own compositional strategy and dialogically collaborated through intellectual partnerships. Dialogical collaboration became more prevalent when the tablet presented musical content and the student(s) adapted it for their own needs: a true partnership.

Ultimately, pedagogy was found to be diverse, fluid and all-pervading in the system. Just as Engeström and Miettinen (1999) describe, the disparate range of pedagogical conditioning evidenced by this study created internal tensions and contradictions in the system. These became primary forces for CMD (Engeström and Miettinen, 1999). Of course, there were additional developmental tensions beyond those concerning pedagogy. A seminal contribution of this project is its noble attempt to systemise (in a framework) that broad ensemble of personal, local and cultural tensions which catalysed CMD in two different classroom settings. This contribution will now be summarised.

11.1.7 A new systemic framework for facilitating effective, digitally-mediated creative musical development in classroom settings

When this research began as an idea some years ago, no widely accepted, easily accessible framework existed to help music teachers, such as myself, 'make a start' upon overcoming a range of relational challenges surrounding the music classroom. These challenges included the necessity to overcome:

- The outdated nature of existing classroom technology
- The complexity of initiating compositional behaviour
- Insufficient pedagogical models for digitally-mediated classroom creativity
- A disconnect between the classroom and informal music-making practices

To address all four points, the potential of tablet devices was considered. However, chapter one records just how little was known about how tablet computers might influence CMD. For instance, that chapter asked '*where* do creative ideas come from and *how* do they develop?'. This research study has proposed that creative ideas are initiated and developed as a result of the tensions which emerge between a classroom's local, personal and cultural forces. This study has also forwarded that local and personal forces (e.g. tablet computer and student) make musical and technological knowledge available in the system and this influences CMD. Such systemic knowledge is also pedagogically conditioned. This significantly extended understanding of tablet-mediated CMD is now embodied in a new framework.

The newly presented framework (see chapter ten) invites music teachers to pose a series of questions to ensure they develop effective creative musical development in their classroom. These questions are presented below:

- How will those cultural forces (e.g. school rules, geographical/political situation of the school) bearing down upon my classroom influence my student's CMD?
- What (e.g. tablet computer, poster on the wall, worksheet) and who (e.g. student and/or teacher) will provide the musical and technological knowledge necessary for effective CMD to emerge?
- How will those personal forces which my student brings with them into my classroom influence their CMD?
- How might the things in my classroom (local forces), school and government policy expectations (cultural forces) and my student's musical experience and interests (personal forces) pedagogically condition CMD in either dialectic, emancipatory or dialogical ways?
- How might the nature of the musical, technological and pedagogical knowledge available in my classroom change overtime as my student's musical and technological expertise develops?

This research suggests that effective creative music teaching with tablets requires every music teacher to be able to answer these questions during their planning process. In answering these questions, teachers are superimposing their proposed creative musical task onto the framework (chapter ten). If the Activity which emerges in the classroom evidences a balanced mashup of musical, technological and pedagogical approaches, the ultimate creative product will likely be of high quality. It must be concluded that this framework, while it requires further testing, represents a significant contribution for the improvement of tablet-mediated CMD in classroom settings.

11.1.8 A visual method to chart systemic creative musical development as it emerges over time

Arguably the most important contribution of this research is its resolve to spotlight the inherently transient nature of creative musical action, digitally mediated or otherwise. It is now clear that creative musical action is present one moment and gone the next. CMD systems emerge as if from nowhere to achieve a specific goal and then disappear, never to reappear in precisely the same configuration again. This research developed an ambitious charting method in an attempt to ‘freeze’ these systems in time and space and look inside them. The aim was to examine how their systemic dimensions symbiotically related and changed over time. When these inductively developed charts were used as an analytical tool, it was discovered that:

•creative ideas develop as a consequence of a symbiotic relationship between continuity of change
•musical, technological and pedagogical knowledge changes through time and between communities
•meanings emerge in consequence of the means, processes and goals used to construct the final musical product

With reference to the first point, it has been found that students’ creative musical products directly emerge from personal, local and cultural constraint frameworks. This is an important contribution in itself and it will be expanded as research contribution ten.

The second point further emphasises that CMD systems are fundamentally transient and this was evidenced by the charts. For instance, no creative idea developed in the same way. Even ideas developed by the same student pair were developed differently at different points in time. More dramatic behavioural differences were noted between different pairs and ultimately between different student communities. This study must ultimately align with Lave and Wenger (1991), Robson (2011), Engeström and Miettinen (1999), Jewitt (2006) and Davydov (1999) who collectively argue that truth, meaning and knowledge are tentative and emerge over time. Just as Burnard and Younker (2004) discovered in the field, there is a sequential aspect to composing: a pathway which emerges through time. Activity Systems share many of these perspectives. They pragmatically view ‘…current truth, meaning and knowledge as tentative and as changing over time’ (Robson, 2011, p.28). Consequently, Activity Systems align with Lagerlöf’s (2015) description of musical identity, namely that it is multifaceted, contextually dependent and constantly evolving.

The final bullet point reminds us that students must act to develop their musical creativity. By engaging with the local means, developing processes and agreeing goals, it can be said that ‘…knowledge is sought after, accessed, and situationally and purposefully constructed *ad hoc*’ over time’ (Salomon, 1998, p.5-6).

Given the understanding summarised here, the visual charting method developed for this research project transpired to be a powerful tool for understanding the multidimensional and transient nature of creative musical action. While music education researchers might wish to adapt charting to meet their own situated need, its use here has underlined the potentiality of studying digital musical creativity as a system of Activity.

11.1.9 A qualitative methodology to capture and understand the situated, transient and multimodal nature of creative musical development

To study digital musical creativity as a systemic, active phenomenon, a methodology was required which drew upon a wide range of theoretical understandings and methods. There were two broad stages to the design, which are themselves important research contributions. Stage one developed a research strategy whose philosophical underpinnings were expected to closely align with those theoretical assumptions which define Activity Systems. One influential theoretical assumption was that meanings are situated, emergent and constructed during action. Appropriately therefore, social cultural constructivism and symbolic interactionism became founding methodological principles. Simultaneously, the methodology also addressed the ways in which Activity Systems transcend the '…dualism between the individual subjective and objective societal circumstances' (Engeström and Miettinen, 1999, p.3). This was achieved by adapting a pragmatic view of the relationship between positivistic and interpretivist theories of knowledge. This was embodied by a fundamentally *iterative* approach to the relationship between historical knowledge and new research data. In the true spirit of the internalisation and externalisation process which Engeström and Miettinen (1999) cite as driving systemic development, Merriam's (2009) view, that all investigations (whatever their inductive intensions) are informed by discipline-specific theoretical frameworks, was made explicit.

Together the aforementioned research strategy, a research design was developed to:

1) observe *how* Activity Systems emerge and develop over time
2) understand *why* particular behaviours occur in particular situations

With reference to the first point, participant observation was found to be a naturally temporal method because as Bryman (2008) states, it is present in a local setting for a period of time. Case studies were also found to be inextricably linked with discourse because they deal with the production and organisation of meanings about the world (Kress, 2010, p.110). The literature on multimodal interaction (e.g. Jewitt, 2006; Kress and Van Leeuwen, 2001; Van Leeuwen, 2005) ensured that to deeply understand the 'how', the full ensemble of interactional modes (e.g. gestural, sonic, linguistic and visual) posed relevance to this investigation.

To better capture this multimodal interaction over time, this study replicated Burnard and Dragovic's (2015) use of a video camera to capture students and teacher during musical action.

Referencing the second point, case study methods were expanded to a multi-case study design to better understand how different settings might explain *why* particularistic creative behaviours emerge. To successfully achieve this aim, data was presented as two individual case reports. Each report prefaced their findings with important information about that community's conventions and the musical backgrounds of students. A cross-case analysis of these two reports did indeed reveal that by understanding personal, local and cultural (community) forces the *why* of emergent behaviour can be better understood.

Explaining 'why' was further enhanced by a qualitative, naturalistic approach influenced by Lincoln and Guba (1985). The forging of a natural teacher role, for instance, ensured that I came to understand much about both student's personal forces and their community's defining forces over time. Group interviewing put students at ease and consequently, they happily explained *why* they exhibited particular behaviours. This helped me construct meaning from their perspective. Even the sampling strategy was designed to create a naturalistic setting so that authentic meanings could be unearthed. Purposive, maximum variation sampling (to include negative cases) also ensured that a broad community narrative about the how and why of creative behaviour could be reconstructed for presentation via case report.

Subsequent to reconnecting this methodology to those research questions concerned with how tablet-mediated music creativity works in different classroom settings, a better understanding of creativity itself emerged. This will be summarised as research contribution ten.

11.1.10 A revised understanding of creativity which emphases pluralism and the seminal role of cultural, local and personal constraint during creative action

When a methodology, one designed specifically to observe and deeply understand creative musical Activity Systems, was applied in the field, a revised understanding of creativity itself emerged. This understanding can be introduced in one statement: *local, cultural and personal forces constrain creative musical action.* Vaggione is fundamentally right therefore, when he argues that there '…is no musical process without representational systems at work' (2001, p.60). After all, instances of Hugill's (2012) material, process-based and compositional constraints (representational systems) have been evidenced throughout this research. Analysis and discussion has learnt that:

> •the tablet computer and worksheets (material constraints) restricted the quantity and the nature of sonic materials
>
> •track-view design and student/teacher compositional strategies (process-based constraints) ensured that musical processes unfolded according to 'rules'
>
> •systemic musical and technological knowledge (especially a blues-based scheme of work) (compositional constraints) determined particular musical styles and compositional techniques (e.g. improvisation and chord progressions).

These bullet points firmly dispel those mythical accounts of an individualistic creative genius. In their place, this study has provided new evidence that composers actually create 'anew' from existing materials, processes and compositional conventions. Therein, constraint frameworks are not some negative aspect of creativity, things which dilute the invention process. Rather, *constraints are fundamental to the creative process, whether they are made explicit, or not*. Consequently, this research must deeply question any blue-sky, osmosis-based or completely hands-off approach to creative musicking in the classroom, digitally mediated or otherwise.

The seminal relationship between constraint and creative action proposed here aligns well with how Engeström and Miettinen (1999) describe development in Activity Systems. Action first strives to reproduce existing cultural conventions (internalization) but then transforms these known conventions and this is what makes the creation of new artifacts possible (externalization).

Creativity is not only driven by constraint frameworks but it is also inherently pluralistic. Consequently, discussions about how creativity is enhanced or constrained by material or human mediational means are ultimately found to be futile. This is because action must be somehow *constrained* in order for it to reap any *enhancing* fruits. In essence, these terms are completely interchangeable: they are the same word. At this moment therefore, any such argument about enhancements or constraints ceases to exist. To illustrate this point, it is concluded that classroom-based, digitally-mediated creativity is inherently pluralistic. This is because it brings together:

•absolute objective truths (e.g. community conventions) and the mental processes of human emotions

•cultural, social and cognitive theories of development

•deterministic (positivistic) and utopian (humanistic) philosophy for the role of digital technology

•dialectic (positivistic), emancipatory and dialogic (humanistic) pedagogical approaches

•musical, technological and pedagogical knowledge

•formal classroom conventions and students' informal music-making practices

Such a pluralistic account of creativity is well illustrated by its intellectual partnerships, which this study has found distribute intelligence to enhance students' musical performance. Intelligence is distributed between people and things during action (see Pea, 1984; Pea, 1985; Pea, 2001). These partnerships between situated people and things develop in consequence to wildly opposing philosophical underpinnings (see the bullet points above). These disparate perspectives collide during action to create the tension necessary to drive CMD. To best sum up this new understanding, Lave and Wenger (1991) are cited. Like them, this research project implores music teachers and researchers to concept creativity in ways which emphasize the relational interdependency of agent and world, activity, meaning, intelligence, development, and knowledge.

11.2 Research limitations

In the course of undertaking this research project, limitations around methodology and feasibility have emerged. These limitations will be identified to better inform music education researchers about those areas which require additional consideration going forward.

Firstly, those deeper understandings which have emerged about the pluralistic nature of creativity came to challenge the methodological design presented in this thesis. During a multimodal analysis of creative musical action, it was discovered that coding and retrieving data, as chronicled by Miles and Huberman (1994) (and many others), has limitations. For instance, labelling data fragments according to a specific pedagogy was fraught with challenge. Comparatively and despite presenting compelling definitions of musical and technological knowledge from the literature, separating musical and technological knowledge was found to be a challenging and wholly subjective task. Fortunately, this research has remained explicit about the limitations of traditional coding approaches. Such methodological difficulties provide further indication that creative action is an inherently pluralistic phenomenon. It is perhaps futile then to separate out dimensions; pedagogical, musical and technological knowledge and local, personal and cultural forces. This understanding informs another limitation concerning the use of frameworks to concept creative musical action. It is seldom possible to show the truly mashed-up nature of creative musical action via frameworks. Typically, frameworks have boxes and circles which do not sufficiently convey the fundamentally symbiotic, temporal and situated characteristics of musical creativity, as evidenced by this research. Perhaps a new method of data analysis could be developed: one which does not necessitate separating data into analytical containers. Such metaphorical boxes are found to further remove the researcher from those symbiotic relationships which promise to credibly explain creative musical action.

The scale of this project represents another research limitation. The combination of multiple research settings, an Activity Theory analysis and video-enhanced observation have quickly run up the scale of this research project. Of course, projects such as this threaten to become unfeasible for lone researchers.

To deeply understand the situated meanings which define just one community, case reports must contain a wide range of information about the cultural (e.g. conventions), local (e.g. schemes of work) and personal forces (student backgrounds). This data is largely text and image based and consequently, it is difficult to disseminate in any compact form: a common problem for qualitative researchers. Obviously the move to a multi-case design with its pair of case reports compounded the issue. Additionally, when reports are rightly presented as self-contained entities, a cross-case analysis of those reports must be undertaken before any theoretically-informed discussion takes place. An Activity System analysis also poses feasibility challenges. Instead of researching just one local force (e.g. the role of the teacher in creative musical action), that whole ensemble of local, personal and cultural forces must be understood and evidenced to describe each community. While this type of analysis has been proven here to reveal unparalleled understandings about how creative musical action really works, issues of scale and feasibility plague its application at every stage of the thesis.

Although the limitations of this research are now acknowledged, there are also opportunities to impact teaching practice and to undertake additional research cycles. These opportunities will now be summarised at 11.3 as research recommendations.

11.3 Research recommendations

The research contributions and limitations presented here bring with them opportunities to impact different target audiences. For instance, a revised definition of musical creativity (contribution ten) has relevance for examination boards to better inform their discussions about how creativity should be examined. At KS4 level in England, newly released GCSE specifications (e.g. AQA, 2019) now offer pathways for students to submit a composition and even a musical performance as created entirely through digital technology. While this is perhaps a positive step, this research has evidenced how inherently distributed the act of digitally-mediated musical creation is and consequently, how difficult it can be to empirically assign credit to any one individual for a creative product.

Research findings presented here also make for interesting comparison with the national framework for music education (see DfE, 2011). This seminal document accepts that music technology should be used to '…enable, deliver, support and extend the good teaching of music' (DfE, 2011, p.7). Rather than being central to the plan however, music technology is primarily addressed as an annex to the main four-part document. Here, there is insufficient emphasis upon the deployment of digital music technology to:

- amplify students' own informally acquired musical identities, performance-practices and creative strategies so that they can be recognised and developed in formal settings;
- ensure that *all* students can achieve a convincing musical outcome whatever their starting point (via digital technology's performance-enhancing partnerships).

These points should be central to a plan, which, instead of using DMTs to enhance the teaching of traditional musical aims, uses DMTs to amplify those musical conventions which are valued by our students' local/global, informal, emergent musical communities. Additionally the national framework provides little pedagogical advice pertaining to how to actually facilitate creative musical development through and around DMTs. A sensitising framework would be advantageous here and that presented at 10.4 might propose a promising starting point for fertile discussions at policy level.

In terms of disseminating the new framework (see 10.4), staffroom magazines aimed at classroom music teachers present a useful vehicle through which to introduce it in a no-nonsense, concise way. Music teachers could test this framework in their own setting and make changes as required. The framework might also pose use as part of a training package designed to help new and experienced music teachers facilitate effective tablet-mediated CMD in their classroom.

The methodological contributions and research limitations are recommended to the music education research community, who continue to grapple with credibly reporting musical development in a range of settings. This study's newfound analytical tool developed to 'look inside' Activity Systems using time-situated charts is a powerful new method to better understand the emergent nature of system-based action. The charts provide new ways to spot previously unseen trends in qualitative data which better explain the situated, goal-based and transient nature of creative musical development.

It is also recommended that some of the presented findings are investigated further. With reference to the school for girls in North Yorkshire (C1), university colleagues were surprised by the supreme technological and musical confidence exhibited by the female participants. This research explained that behaviour by referencing situated community conventions: namely a school ethos which encouraged students to behave and think independently. Colleagues have questioned this assumption on the basis of gender-based research (e.g. Comber et al., 1993; Essl, 2003; Mills and Murray, 2000), which chronicles how groups of girls can behave differently when they are expected to work with boys in co-educational settings. Although gender lay outside of this research project's research questions, a second research cycle is recommended, which addresses this influence via its rationale and research questions.

While this process-based research worked with participants over a number of weeks, it remains unknown what the longer term impacts of tablet composing really are. To better observe longitudinal impact, an investigation designed around a much smaller sample but tracked over a longer time frame might enhance understanding in this area.

Research contribution four (11.1.4) found that systems of CMD compensated for design deficiencies in the tablet workstation. For both community cases, the music teacher (me) was an experienced musician, teacher and digital music technologist. Would a CMD system compensate for a weak teacher, or student partner, for example? Perhaps trialling the tablet workstation with new teachers, or non-specialists, for example, might produce findings which develop further understandings about the compensatory nature of Activity Systems.

New technologies are emerging. iPad Pro devices are now available with much larger screens. When students collaborated on-screen as part of this research, the lack of glass area occasionally catalysed gestural and ultimately verbal friction between students. Further, fine-grain gestures were difficult to expedite with the regular screen size iPad purposed for this research. The variable of screen size therefore requires further investigation.

Finally, the question of where the motivation for creative musical action comes from also fell outside of research questions. Consequently, issues around motivation are not explicitly discussed by the new framework in chapter ten. Motivation in the less regulated community (C1) appeared to be more reliant upon a student's intrinsic habits and desires. Whereas, in the regulated setting (C2), students expected a range of routinely imposed, extrinsic motivators (e.g. targets, teacher interventions) during their musicking. The substantive literature on this topic (e.g. Bandura and Schunk, 1981; Hallam, 2006; van Loon et al., 2012) requires further review and its transferability to this research area assessed. For instance, De Lima et al. (2012) argue that models of creativity in music can be grouped according to their emphasis on intrinsic and extrinsic factors: an argument tentatively substantiated by this research.

These research recommendations and those methodological, feasibility and conceptual limitations of this research aside, the research contributions this study has made remain important. As statutory music education in England survives well into the twenty-first century, it is likely that tablet computers will become ever more ubiquitous in music classrooms. What this research has shown is that musical creativity through and around tablet computers is a pluralistic, systemic process, one defined by a range of situated constraints. Given this understanding, teacher training providers and practising music teachers would do well to deeply question how they should manage creative musicking with tablet computers in the classroom. Get it right and we can authentically connect our music classrooms with students' music interests and practices. By doing this, we will ensure that our next generation of amazing young composers develop the skills and knowledge they need to forge a distinctive musical identity in their wider community.

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Appendix A: The final, semi-structured interview guide

Interview Guide

Introduction

Overall, how did you think the GarageBand app influenced your composing process?
How has your out-of-school musical habits and interests shaped your decision making in this project?

[OQ] Can you tell me a little bit more about your musical interests?
- *Do you play a musical instrument?*
- *What music do you listen to?*
- *What music do you take part in at school?*
- *Have you got any musical ambitions or goals?*

Compositional strategies

[OQ] How did you compose your music? What steps did you work through?

- *Did you have a goal to start with or did your work develop randomly?*
- *How, if at all, did the images and videos stimulate musical ideas?*
- *How, if at all, did your strategy change as you began to use the software?*
- *Who decided how your piece should go together?*
- *Why do you think you composed in this way? Would you ever try different approaches?*
- *What was it like to be able to choose between lots of different resources and decide how you used them?*
- *Did you want to listen to other peoples' work, why?*

Tablet

[OQ] How, if at all, did the tablet help you to compose music?

- *Can you each name three features of the app which became important to you as your work developed?*
- *Which features, if any, do you think the tablet made easier to use than others?*
  - *Why were these features easier to use?*
- *Which features, if any, do you were harder to access and/or use?*
  - *Why were these features harder to use?*
- *How, if at all, did the tablet hold you back or limit your creative freedom?*
- *Can you name any musical benefits e.g. playing in time?*
- *Do you have to be musical to use this app. If yes, why?*
- *How, if at all, can the tablet enable anyone (regardless of musical background) to compose music?*
- *Was there a point where you 'really got into it'? Can you describe that experience?*
- *How, if at all, did the app make composing easier for you?*
- *Were there enough features for expert musicians?*
- *Did you find the simulation of musical processes authentic and motivating?*
- *There were a lot of sounds and resources to choose from. Was this a help or a hindrance?*

<u>Role of tablet for instructional guidance</u>

- *How, if at all, can the app 'teach' you how to write a 'good' composition?*
- *Should the app correct mistakes e.g. 'You're playing out of time'?*
  - *If yes, why?*
- *How did you know when your work was finished?*

How could the app have done to help you learn better? For example, to suggest a new composing strategy? Or to devise a different goal?

Effects *from the tablet partnership*

[OQ] How, if at all, has this project had a wider impact on your lives, musical or otherwise?

When you compose in future, how will you go about it?
What musical skills do you think you've now got that you didn't have before?
Will you approach musical tasks differently in the future?
Have you tried to compose at home or school since using the app?
If yes, when you now compose music, do you now know how make your music work?
What steps would you take if starting a new project now?
How fulfilled were you by the end of this project as compared to your normal music lessons?
Can you explain how, it at all, your ability to learn has developed after using the app?
How does the app compare to using manuscript paper or working at the piano?

Role of teacher

[OQ] What kind of role do you think teachers should have in the tablet composing process?

Did the teacher help define your goal?
How did the teacher help define your goal?
Can a teacher become too involved? Perhaps to the extent where they limit your creativity?
Why do you need a teacher working with you?
Should the teacher provide musical content e.g. chords for you to work with?
Should the teacher know about the styles of music you are trying to create?
Should the teacher provide musical material that links to music that you listen to, or not?
Should the teacher provide assessment criteria?

Role of peer

[OQ] What kind of roles do you think partners should have in the tablet composing process?

What did you learn from your peer?
How did you learn from them?
What roles did you peer have?
How, if at all, did you receive feedback from your partner?
Could you hear when your partner was making mistakes? Did you want to stop and help them?
Was it easy to sit back and let your partner undertake most of the work?
Do you still learn things when that happens? What do you learn?
Can an overenthusiastic or disinterested partner become a barrier to your own musical progress?

Finale

How could school make your lives as composers easier?
Do you have any final comments about the project or questions for me?

Thank you for your interest and assistance with this research project

Appendix B: Music Teacher Information Letter

UNIVERSITY OF LEEDS

Tablets for composing music in secondary school. A good idea?

Information for classroom music teachers

Pilot study students search through a range of included image and video stimuli with the aim of developing their musical ideas.

How would it work?

Pairs of students compose a piece of music of their choice using a provided iPad, connected piano keyboard and GarageBand for iOS. The iPad includes image and video stimuli which students browse through to develop their project goal.

The project aims to fun and exciting!

I take the role of teacher-observer, helping out where needed and supporting learning as any regular music teacher would.

The sample is small – maximum five pairs. Each pair works for a minimum of five thirty-minute sessions and subsequent interviews are group based.

A broad range of students is welcomed, such as you might find attend your KS3 classroom lessons e.g. those who have a very strong relationship with music (e.g. DJing or instrumental lessons) and those who don't believe music has a prominent role in their lives. This is to better understand how pedagogically valuable tablets might be for regular classroom use at KS3.

A fixed camera captures what students do on screen and what they say. Parents and students would need to sign an informed consent form should they wish to take part. Because the sample is so small, I would likely defer to you to recommend students who you thought a) would enjoy the project and b) met the sample criteria.

Students would most likely use the tablet during their regular music lesson in a nearby practice room. The aim would be to cause as little disruption as possible to your teaching timetable. The research project can also be tailored to your assessment processes and curriculum needs.

The project was piloted in a York secondary school January - April 2017. While students made use of the tablet in lots of different ways (e.g. loops to recording acoustic instruments), their feedback was positive and both students and school enjoyed becoming a part of the research process.

The project has received ethical clearance from the University of Leeds and it complies with their protocol in relation to data protection, storage and access. I hold QTS and have three years of teaching experience leading music in a secondary academy. For the pilot study, DBS clearance was sought and Child Protection Training attended. I've undertaken this type of research before and very much enjoy working with young people.

If each pair of students composed weekly, data collection would last no longer than six weeks.

About the researcher (CV)

Church Stretton School (2012-2015)
Secondary music teacher: sole specialist responsible for classroom music. The department required a new KS3 and KS4 curriculum. This constituted eighteen units at KS3 and at KS4, a new course tailored towards the AQA specification.

University of Oxford (2009-2011)
Master of Science in Education (Learning and Technology)

University of Cambridge (2008-2009)
Postgraduate Certificate in Secondary Education (Music)

University of York (2005-2008)
Bachelor of Arts (Hons.) Music (First Class Honours)

Birmingham Conservatoire Junior School (1996-2004)
Three Grade 8 music examinations in Voice, Pianoforte and Theory of Music

Musical Skills
Piano (pop/blues/songwriter)
Voice
Music Technology
Leading Choirs
African Music (Djembe)
Samba Bandmaster
GCSE and A level music specialist teaching assistant
KS3 music specialist teaching assistant

I know that school schedules are hectic to say the least (!) but it would be interesting to discuss the project further.

Ben Evans

Appendix C: Headteacher Information Letter

FACULTY OF EDUCATION, SOCIAL SCIENCES AND LAW
SCHOOL OF EDUCATION

Hillary Place, University of Leeds
Leeds, LS2 9JT Tel: 0113 343 4524
enquiries@education.leeds.ac.uk

UNIVERSITY OF LEEDS

'Tablets in Music Lessons' Research Project

Dear Headteacher,

As part of an ongoing process to ensure that school music education remains relevant to students, there is a need to carry out research exploring new ways of learning in music using digital technology. The most useful research involves trialing digital music technologies with those students who volunteer to use them.

I'm sure you're aware that tablet technologies are 'rolling out' to schools all over the country. However, there remains a lack of research that aims to find out from students just what the educational potential of tablets is.

Therefore, I am leading a research project which aims to discover how tablets can help young people produce powerful compositions, more independently from their teacher. It would be interesting to discover whether your students find tablets a useful companion during the creative musical process, or perhaps identify areas for improvement. The music-making is designed to be fun, exciting and beneficial for your students' musical education.

Please be assured that all research data will be processed lawfully. Data will be held securely in accordance with the Data Protection Act and University policy. The study is small-scale, based on no more than ten participant pairs. General findings may be published but students' identities and your institution will be protected.

As a qualified secondary school music teacher, I hope to offer your students a valuable musical experience, whilst also ensuring their safety and well-being. The project will have interesting outcomes for the nature of musical learning in schools. It is hoped that you would enjoy reviewing the findings and sharing them with your school community.

Providing you are supportive of this project, a parent information sheet is enclosed for your approval.

If you require additional information, contact me (edbde@leeds.ac.uk) or Research Supervisor, Dr. Aisha Walker (s.a.walker@education.leeds.ac.uk), in the first instance.

Yours faithfully,

Ben Evans.

Appendix D: Parental and child information letter

FACULTY OF EDUCATION, SOCIAL SCIENCES AND LAW
SCHOOL OF EDUCATION

Hillary Place, University of Leeds
Leeds, LS2 9JT Tel: 0113 343 4524
enquiries@education.leeds.ac.uk

UNIVERSITY OF LEEDS

In partnership with researchers at the University of Leeds, your child's school has agreed to take part in a study investigating how tablet computers might help young people develop their composing skills in music. We would like to invite your child to be part of this study. We very much hope that you would like to take part but before you decide, it is important that you understand why the study is being undertaken and also what it will involve.

What are we trying to find out?

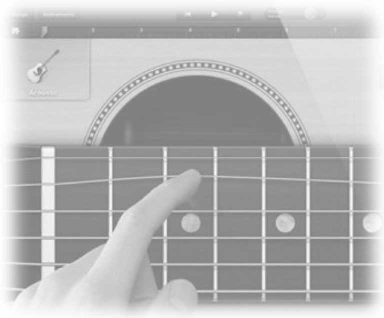
This project examines how young people use tablet apps. so that we can understand their educational potential for classroom use. The use of tablets during learning remains an under-researched area and yet findings could help teachers develop more authentic, powerful musical experiences for young people. Therefore, this project will investigate how tablet music making can enhance or restrict creative processes. Secondly, both the processes and products of learning will be observed. Thirdly, the necessity for feedback from teachers and peers will be investigated.

This study is designed to enhance your school's existing KS3 curriculum. The project offers a new and exciting opportunity to develop your child's ability to compose music with technology.

What will happen if my child takes part?

A researcher will informally observe your child and their partner during music composition activities that are organised around a tablet computer and piano keyboard. At the same time, these sessions may be video recorded to enable the researcher to add more detail to rough notes taken in the moment. Video footage will focus on the tablet screen only and capture dialogue between your child and their partner. No images of your child will be recorded.

Your child will be free to choose a musical activity that best relates to their musical ability: the activities are primarily fun and informal. The software used during the project is available to download at home. Your child will experience approximately seven 30-40 minute sessions with the software, although they are encouraged to try more if they so wish. Sessions will likely



take place during your child's regular music lesson. At the halfway stage and at the close of the project, groups of students will be informally interviewed in a quiet area near to their classroom. At these points, students can feedback their thoughts about composing on tablets.

What happens to the results of the study?

Research data remains confidential and stored in secure location authorised by the university. The data is managed in accordance with the Data Protection Act and the University's ethics committee guidelines. For instance, Children are identified by a code number only and at the close of research, only the text transcriptions will be preserved. Regular summaries of our findings will be given to your school and will be made available to parents. Findings may be published, although this will be in a journal specifically for music teachers. If your child chooses to withdraw from the project before it is complete, their data will not be analysed. However, once the school project is over, students, parents or school may not withdraw their data from the study.

Who is conducting this research?

The research project is organised by Ben Evans of the University of Leeds, who is a graduate student under the supervision of Dr. Aisha Walker and Dr. Ewan Stefani. This research has received ethics clearance through the University of Leeds ethical approval process for research involving human participants.

What should I do next?

Please fill in the enclosed form and return it to your Director of Music, if you would like your child to take part in this study.

Your Director of Music will happily answer any general questions but if you require additional information please contact Researcher Ben Evans (edbde@leeds.ac.uk) in the first instance, or Research Supervisor, Dr. Aisha Walker (s.a.walker@education.leeds.ac.uk).

Thank you for your supporting new research into technology-enhanced music making.

Appendix E: Parental informed consent letter

UNIVERSITY OF LEEDS

Tablet Composition Project

♫ Your child's school has agreed to participate in a study run by Leeds University, investigating how effective tablets can be for composing music in school.

♫ If your child participates, a researcher would visit school and provide some technology-enhanced experiences for them, which should be fun and exciting.

♫ If you are happy for your child to participate, please complete the form below and return it to the Director of Music, as soon as possible.

♫ To find out more about the project, please read the attached information sheet. If you have any questions, contact the Director of Music in the first instance. Further clarification can be obtained from Ben Evans (Researcher) (edbde@leeds.ac.uk) or Dr. Aisha Walker (s.a.walker@education.leeds.ac.uk) (Research Supervisor).

Name of Child: ______________________ ________________________ ____________

forename surname date of birth

Name of school: ____

I have read and understood the details of the above study and I've had the opportunity to ask questions and discuss the study with others. I understand that the project has received ethics clearance through the University of Leeds ethical approval process for research involving human participants. I understand who will have access to the data, how it will be stored and what will happen to the data at the end of the study. I understand that participation is voluntary and that both my child and I are free to withdraw at any time, without giving reasons. However, I know that once the study is complete, retrospective requests for data to be removed cannot be upheld.

I give permission for my child to participate in the above study.

Name of parent/guardian: ____

Signature: ____ date: ______________

I give permission for video recordings to be made which include my child working through a musical activity.

Name of parent/guardian: ____

Signature: ____ date: ______________

Appendix F: Child informed consent letter

UNIVERSITY OF LEEDS

Tablet Composition Project

♫ Your school has agreed to take part in a study run by Leeds University, which is interested in finding out whether tablet computers can develop your music composition skills.

♫ If you take part, a researcher will introduce you to a tablet connected to a music keyboard. They will also offer you a few tips about how to get started. We think this will be fun and exciting and we want you to create something amazing.

♫ To find out more about the project, please review the enclosed information sheet with an adult, to check that you agree with everything. Please discuss your participation in this project with your family. You can get more information from your Director of Music.

♫ If you are happy to take part, please fill in the form below and return it to your Director of Music, as soon as possible.

Name: ____________________ ____________________ ____________
forename surname date of birth

Name of school: ____________________________________

I have read and understood the details of the above study and have had the opportunity to ask questions and discuss the study with others. I understand who will have access to the data, how it will be stored and what will happen to the data at the end of the study. I understand that participation is voluntary and that I am free to withdraw at any point during the study.

I give my permission to take part in the above study.

Signature: ____________________________________ date: ____________

Appendix G: Analytical framework for understanding creative thinking in tablet-mediated musical activity

STAGE: Burnard and Younker (2004)	**FIND** (Preparation) *exploration, activates resources, discovery, clarification of purpose, defining goals* *The individual senses a problem or problems, and the overall scope and structure of the product.*	**TIME AWAY** (Incubation) *'mind writing', 'mind-playing', thinking about* *…divergent thinking plays a crucial role – the individual thinks about the problem, and generates and considers possible solutions.*	**FOCUS** (Illumination) *selection/rejection, aural testing and experiment* *…the light bulb stage – the individual arrives at various solutions while interacting with the musical materials.*	**FIX** (Verification) *evaluation, adjusting, refining* The individual hears externally what has been created, refines solutions, and welcomes opinions.
Webster (2003)	*Exploration, primitive gestures, planning*	*[enabled by]…Subconscious imagery, motivation, personality*	*Revising, editing, forming new ideas*	*Rehearsal, polishing*
Wallas (1926)	*Consciously accumulate knowledge…adopt a definite 'problem attitude'*	*…Consciously arrange, either to think on other subjects than the proposed problem, or to rest from any form of conscious.*	*…flash of illumination…*	*[Do the product(s) of illumination satisfy the need and the criteria defined in the preparation stage?]*
ROB Burnard and Younker (2004)	His talk about what he was doing included words like 'practising' (preparation)	Accounts of thinking about his composition between sessions (incubation) were in reference to 'the instruments' and improving the ending of his song; however, there was no indication of strategizing about or generating solutions (incubation) for either of these desires	rejecting specific timbres and eliminating material (illumination)	'listening' (verification)
LIA Burnard and Younker (2004)	Her accounts of composing emphasized the revisiting of 'made up pieces' (preparation)	Spent little or no time away from her instrument thinking about the emerging piece (absence of incubation)	Once she had recognized the musical starting point (illumination)	she continued by shifting to a verification phase where she played 'a quick piece'.
SHIRA Burnard and Younker (2004)	She selected pitches for each word in a linear, stepwise fashion with minimal exploration	When she did diverge to generate solutions (incubation)	While there was some movement between the incubation and illumination stages, there was no loop back to the preparation stage.	'And there we go' at the end of the final composing session signified the only indication of verification. While Shira did not verify this by performing her final composition.
KATIYA Burnard and Younker (2004)	'I start with a melodic idea' (defining the expressive purpose and framing the problem)	'and carry it in my head for a few days' (imagines possibilities – incubation)	then, at the piano, I devote all my time' (a phase of illumination which varied across four compositions from 10.5 to 24 hours and averaged 45–60 minutes a session) '… to working through it and finalizing it as I go' (a generative phase in which she identified musical possibilities, monitored changes and memorized choices).	Katiya offered a final played through version.
SARAH Burnard and Younker (2004)	'I normally would do [plays E♭ instead of D on piano while singing text] but I really like the effect of these [plays D, C on piano] of the major second there. I think it gives it a more "folksy" effect.	The importance of the incubation phase was made clear where 'musical mapping', 'imagining possibilities' from situated problems and 'mind-playing' and 'mind-writing' occurred. Both students demonstrated considerable meta-cognitive skills.	She continued until (aha), her vision for all four stanzas was constructed in terms of mood, form, style and harmony (illumination).	Verification was reflected in her talk and actions by performing her composition in whole sections before looping back to the other stages. Sarah made minimal notations and relied on the use of imagined sounds and audiotape to preserve and verify what was created

Appendix H: Blues Worksheet (community two)

12 Bar Blues & Ragtime

C 4 beats	C 4 beats	C 4 beats	C 4 beats
F 4 beats	F 4 beats	C 4 beats	C 4 beats
G 4 beats	F 4 beats	C 4 beats	C 4 beats

Tips for success

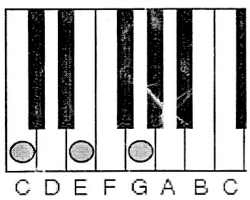
1. Play each note with your LH for 4 beats, try using: 5th 3rd & 1(thumb)
2. Try to create your own repeated rhythm for the chord pattern
3. Add in a backing beat on your keyboard.

Press Style > No **046,050,054,061,070** > Accompaniment on/Start/Stop

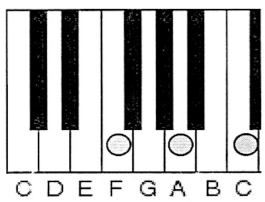
4. Challenge yourself by learning to play the notes of each chord yourself with the LH. (See keyboard pictures below)
5. OR, press ACCMP ON button and press each note (C/F/G) and the keyboard will add in a chord backing for you.

Piano Chords

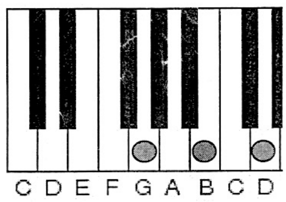
(I)C major = C-E-G



(IV) F major = F-A-C



(V) G major = G-B-D

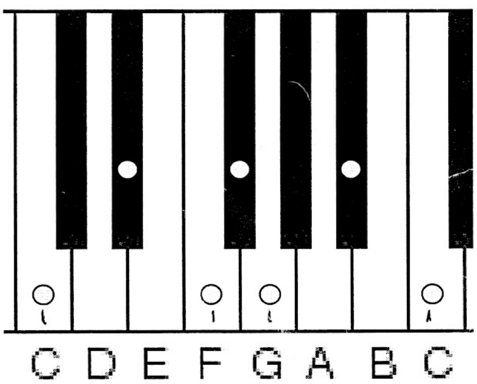


Once you have practiced the 12 Bar Blues chords, try **IMPROVISING** over the top with your **RIGHT** hand.

Start by using a few of the notes from the Blues scale below, then try and create a longer call & response tune

The notes in the C Blues scale are C, Eb, F, Gb, G, Bb , High C

THINK –BIG TRIANGLE, LITTLE TRIANGLE, BIG TRIANGLE.



Appendix I: Composing brief and assessment criteria (community two)

Create a piece of music:

a) To include musical features which link your work to the following classroom curricula:

	Music – Creating Music (Composing)
C1	Create music based on a **call and response** or **intro/verse/chorus** structure.
C2	Create at least one **catchy riff** (a short, repeated melody).
C3	Develop a repeating **chord pattern** e.g. C |F |C |G |F |C.
C4	Make effective use of at least two popular **blues instruments**.
C5	Select a **major or minor** tonality.
C6	Show an understanding of **graphic notation** by editing notes in the piano roll view.
C7	**Record, play, copy, paste, drag, crop** and **mix** together a number of tracks.
C8	**Improvise** a short melody based on the major, minor or blues scale.

b) To portray *your own musical interests*, be they playing an instrument or listening to music out-of-school.

Appendix J: Progress Tracker Jenny and Inder

Class 8Y. Jenny and Inder. SESSION THREE.

	Progress Tracker: Tablet Composing Project.
Facility Composition Attainment Criteria	C1 Create music which has a sense of form and structure. C2 Create and develop musical ideas. C3 Show an understanding of the chosen genre/tradition. C4 Make effective use of chosen instruments. C5 Demonstrate secure use of tonality and musical devices e.g. Major/Minor, ostinato pattern. C6 Show an understanding of staff and graphic notation. C7 Demonstrate an understanding of music technology software in composition and arrangements. C8 Show the ability to improvise.
Class	**8Y**
Student 1	Jenny
Current Assessment Data	C2 BLUE C3 BLUE C4 BLUE C7 RED C8 BLUE 5 Excelling 4 Confident 3 Secure 2 Emerging 1 Needs development
Student 2	Inder
Current Assessment Data	C2 BLUE C3 BLUE C4 BLUE C7 GREEN C8 BLUE 5 Excelling 4 Confident 3 Secure 2 Emerging 1 Needs development
Agreed Joint Composing Targets For Research Project	C2 Create at least one **catchy riff** (a short, repeated melody). C3 Develop a repeating **chord pattern** e.g. C |F |C |G |F |C. C4 Make effective use of at least two popular **blues instruments.** C7 **Record, play, copy, paste, drag, crop** and **mix** together a number of tracks. C8 **Improvise** a short melody based on the major, minor or blues scale.
Session 2 Date: 29/11/18 Time: 12pm Duration: 45 mins	**Jenny** **WWW:** Excellent use of the tablet to record, rewind and listen back to your work (C7). Collaborated with Inder to compose, perform and record a chord progression using Cm, F and G chords (C3). **EBI:** Learn track view to edit a track e.g. copy and paste or crop, for example (C7). Develop an improvisation based on the blues scale (C8). **Inder** **WWW:** Competent riff and improvisation work. The piano riff recorded near the end of the session was syncopated and made very good use of 'blue notes' e.g. Eb and Gb. Collaborated with Jenny to compose, perform and record a chord progression based on Cm, F and G chords (C3). **EBI:** Towards the end of the last session your improvisation skills began to develop very quickly. Continue to develop catchy improvisations and riffs and insert them into your music (C2/C8). Use the track view to determine exactly where they should be inserted (C7).